Deepwater Horizon Oil Spill Natural Resource Damage Assessment

Texas Trustee Implementation Group Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

January 2025

NEPA UIN EAXX-006-48-1HC-1729121448

Suggested citation: Texas Trustee Implementation Group (Texas TIG), 2025. Deepwater Horizon Oil Spill Texas Trustee Implementation Group. *Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats*.

Consistent with 40 C.F.R. § 1501.5(c)(4), this National Environmental Policy Act (NEPA) document has been assigned the NEPA Unique Identification Number (UIN) EAXX-006-48-1HC-1729121448.

Photo caption: A completed marsh restoration project that beneficially used dredged material in Pierce Marsh. Photo courtesy of Philip Smith, Galveston Bay Foundation.

Executive Summary

On April 20, 2010, the *Deepwater Horizon* (DWH) mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico (GOM), resulting in a massive release of oil and other substances from BP Exploration and Production's (BP's) Macondo well and causing loss of life and extensive natural resources injuries. Initial efforts to cap the well following the explosion were unsuccessful, and for 87 days after the explosion, the well continuously and uncontrollably discharged oil and natural gas into the northern GOM. Approximately 3.19 million barrels (134 million gallons) of oil were released into the ocean (U.S. Department of Justice 2016). Oil spread from the deep ocean to the ocean surface and nearshore environment from Texas to Florida. Extensive response actions, including cleanup activities and actions to prevent the oil from reaching sensitive resources, were undertaken to reduce harm to people and the environment. However, many of the response actions had collateral impacts on the environment and on natural resource services.

As part of a 2016 settlement, BP agreed to pay a total of $8.1 billion in natural resource damages (inclusive of Early Restoration funding) over a 15-year period and up to an additional $700 million for adaptive management and to address natural resources injuries that are presently unknown but may become apparent in the future. The settlement allocated a specific sum for restoration within specific Restoration Areas and across Restoration Types (described in more detail below).

The Texas Trustee Implementation Group (Texas TIG) is responsible for restoring natural resources and their services that were injured by the DWH oil spill within the Texas Restoration Area. The purpose of restoration, as discussed in the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; DWH NRDA Trustees 2016), is to make the environment and the public whole for injuries resulting from the spill. This will be achieved by implementing restoration actions that return injured natural resources and services to baseline conditions and compensate for interim losses in accordance with the Oil Pollution Act of 1990 and associated Natural Resources Damage Assessment (NRDA) regulations. The Final PDARP/PEIS and Record of Decision are available at www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

The Texas TIG has prepared this *Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats* (RP/EA #3) to address injury to natural resources and natural resource services in the Texas Restoration Area resulting from the DWH oil spill. This RP/EA #3 focuses on the beneficial use of dredged material (BUDM) to restore and conserve wetlands, coastal, and nearshore habitats. The Texas TIG proposes the allocation of $40 million in Wetland, Coastal and Nearshore Habitat Restoration Type funds toward the use of BUDM to construct habitat along the Texas coast through the projects included in this RP/EA #3. The $40 million will be divided among the selected projects to provide the incremental cost for the U.S. Army Corps of Engineers (USACE) or to fund other viable sources to beneficially use dredged sediments to construct preferred restoration alternatives. This RP/EA #3 includes a description and evaluation of eight restoration projects, also called restoration alternatives,[1] which compensate for the natural resource injury described in the Final PDARP/PEIS. Table ES-1 lists the reasonable range of alternatives evaluated by the Texas TIG, identifying those preferred for funding and implementation by the Texas TIG in this RP/EA #3.

[1] The terms "project" and "alternative" are used interchangeably throughout this RP/EA #3.

Table ES-1 Reasonable Range of Restoration Alternatives Proposed in RP/EA #3

Alternative	Potential Acres	Preferred or Not Preferred
Anahuac National Wildlife Refuge Roberts Mueller Tract Wetland Restoration	550	Preferred
Goose Island Wetland Restoration	40	Preferred
Guadalupe River Old Delta Wetland Restoration	1,140	Not preferred
Lower Neches Wildlife Management Area Old River Unit Wetland Restoration	224	Preferred
McFaddin National Wildlife Refuge Willow Lake Terraces	218	Preferred
San Bernard National Wildlife Refuge Sargent Oil Field Wetland Restoration	200	Preferred
Schicke Point Wetland Restoration	72	Preferred
Texas Point National Wildlife Refuge Wetland Restoration	623	Preferred

Many maintenance projects along the Texas coast involve dredging and disposing of sediment, which could be repurposed to ecologically benefit coastal habitats. These proposed projects would restore and conserve wetlands and coastal habitats by using suitable material dredged from nearby maintenance projects to create vegetated wetland habitat. The placement of dredged material, construction of containment levees, and associated plantings for the preferred alternatives would restore up to 1,927 acres of intertidal marsh as indicated in Table ES-1.

As opposed to identifying the cost of each alternative, the Texas TIG proposes to allocate $40 million to implement the alternatives selected in the *Final Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats* (Final RP/EA #3), as discussed in Section 3.2. This funding would be divided among the selected projects to provide the incremental cost for USACE or to fund other viable sources to beneficially use dredged sediments to construct the preferred restoration alternatives, as well as for Trustee implementation costs, planting, and monitoring.

Public Participation in the RP/EA #3

The Texas TIG prepared this RP/EA #3 to 1) inform the public about DWH NRDA restoration planning efforts in the Texas Restoration Area; 2) present analyses of the potential restoration benefits and environmental consequences of the reasonable range of restoration alternatives; and 3) seek public comment.

The public is encouraged to review and comment on this RP/EA #3 during the 30-day comment period following public notice. The deadline and other details for submitting written comments is specified in this section, the public notice published in the *Federal Register*, and on the National Park Service Planning, Environment & Public Comment website (see link in list below). Comment period information and other details can also be found on the Trustees' website.[2]

[2] The Trustees' website can be found at https://www.gulfspillrestoration.noaa.gov/restoration-areas/texas.

During the comment period, comments can be submitted by any of the following methods:

- **Online:** https://parkplanning.nps.gov/TXTIGRP3
- **By mail:** Hard copy addressed to U.S. Fish and Wildlife Service Gulf Restoration Office, 1875 Century Blvd., Atlanta, GA 30345. To be considered, mailed comments must be postmarked on or before the comment deadline.
- **During the public meeting:** The Texas TIG will hold a public meeting to facilitate the public review and comment process. The meeting will be held on January 28, 2025, at 5:00 p.m. CT at the Rosenburg Library in the Wortham Auditorium, 2310 Sealy Avenue, Galveston, TX 77550.

Please note that personal identifying information included in the submitted comments (such as name, address, phone number, and email address) may be made publicly available at any time. Personal information is not required to submit comments.

After the close of the comment period, the Texas TIG will consider all comments received and revise this RP/EA #3 as appropriate. A summary of comments received and the Texas TIG's responses, where applicable, will be included in the Final RP/EA #3.

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List of Abbreviations

BGEPA	Bald and Golden Eagle Protection Act
BP	BP Exploration and Production, Inc.
BUDM	beneficial use of dredged material
BUDM Project Fund	$40 million allocation to implement the preferred alternatives selected in the *Final Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats*
CBRA	Coastal Barrier Resources Act
C.F.R.	*Code of Federal Regulations*
CWA	Clean Water Act
cy	cubic yards
CZMA	Coastal Zone Management Act
DIVER	Data Integration Visualization Exploration and Reporting
DOI	U.S. Department of the Interior
DWH	*Deepwater Horizon*
E&D	Engineering and Design
EFH	Essential Fish Habitat
EJ	Environmental Justice
EO	Executive Order
ESA	Endangered Species Act
Final PDARP/PEIS	*Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*
GHG	greenhouse gas
GIWW	Gulf Intracoastal Waterway
GLO	Texas General Land Office
GOM	Gulf of Mexico
MAM	Monitoring and Adaptive Management
MBTA	Migratory Bird Treaty Act
MMPA	Marine Mammal Protection Act
MPRSA	Marine Protection, Research, and Sanctuaries Act
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act of 1966, as amended
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resources Damage Assessment
NWR	National Wildlife Refuge
OPA	Oil Pollution Act
RHA	Rivers and Harbors Act
ROD	Record of Decision

RP/EA #1	*Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters*
RP/EA #2	*Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final Restoration Plan/Environmental Assessment #2: Restoration of Wetlands, Coastal, and Nearshore Habitats; Nutrient Reduction; Oysters; Sea Turtles; and Birds*
RP/EA #3	*Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats*
RW RP/EA #1	*Deepwater Horizon Oil Spill Regionwide Trustee Implementation Group Final Restoration Plan/ Environmental Assessment 1: Birds, Marine Mammals, Oysters, and Sea Turtles*
SNWW	Sabine-Neches Waterway
SOP	standard operating procedure
TIG	Trustee Implementation Group
TNRC	Texas Natural Resources Code
TPWD	Texas Parks and Wildlife Department
Texas TIG	Texas Trustee Implementation Group
USACE	U.S. Army Corps of Engineers
U.S.C.	*United States Code*
USFWS	U.S. Fish and Wildlife Service
WMA	Wildlife Management Area

1 Introduction, Purpose and Need, and Public Participation

This *Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats* (RP/EA #3) has been prepared by the Texas Trustee Implementation Group (Texas TIG). The Texas TIG includes three Texas State Trustee agencies: the Texas Commission on Environmental Quality; Texas Parks and Wildlife Department (TPWD); Texas General Land Office (GLO); and four federal Trustee agencies: National Oceanic and Atmospheric Administration (NOAA), on behalf of the U.S. Department of Commerce, U.S. Department of the Interior (DOI), U.S. Department of Agriculture, and U.S. Environmental Protection Agency. The Texas TIG is responsible for restoring natural resources and their services that were injured or lost as a result of the *Deepwater Horizon* (DWH) oil spill within the Texas Restoration Area.

The Texas TIG prepared this RP/EA #3 to continue restoration of natural resources and their services that were injured or lost as a result of the DWH oil spill and to inform the public about the DWH Natural Resources Damage Assessment (NRDA) restoration planning efforts for wetlands, coastal, and nearshore habitats. This RP/EA #3 also seeks public comment on the identified reasonable range of alternatives for restoration of those injured resources. This RP/EA #3 was prepared in accordance with the Consent Decree[3] (E.D. La. 2016), *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; DWH NRDA Trustees 2016) and the Record of Decision (ROD)[4], Trustee Council's standard operating procedures (SOPs; DWH NRDA Trustees 2021a), Oil Pollution Act of 1990 (OPA), and National Environmental Policy Act (NEPA) and their implementing regulations. In this RP/EA #3, the Texas TIG identifies a reasonable range of project alternatives, which the Texas TIG believes would best compensate the public for part of the injuries caused to wetlands, coastal, and nearshore habitats.

1.1 Background and Summary of the Settlement

On April 20, 2010, the DWH mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico (GOM), resulting in a massive release of oil and other substances from BP Exploration and Production, Inc.'s (BP's) Macondo well and causing pervasive natural resource injuries across the northern GOM. Approximately 3.19 million barrels (134 million gallons) of oil were released (U.S. Department of Justice 2016) and spread from the deep ocean to the ocean surface and nearshore environment from Texas to Florida. Extensive response actions, including cleanup activities and actions to prevent the oil from reaching sensitive resources, were undertaken to reduce harm to people and the environment. However, many of these response actions had collateral impacts on the environment and natural resource services. The breadth of injuries incurred from the incident are described in Chapter 4 of the Final PDARP/PEIS.

Under the authority of OPA, a council of federal and state trustees (DWH Trustees[5]) was established to assess natural resource injuries resulting from the incident and to work towards making the environment and public whole for those injuries. In accordance with OPA and the OPA NRDA regulations (15 C.F.R. § 990), in February 2016, the DWH Trustees issued a Final PDARP/PEIS and subsequent ROD

[3] Consent Decree, United States v. BPXP et al., Civ. No. 10-4536, (E.D. La. Apr. 4, 2016), centralized in MDL 2179, In re Oil Spill by the Oil Rig "Deepwater Horizon" in the Gulf of Mexico, on April 20, 2010 (E.D. La.).

[4] The Consent Decree, PDARP/PEIS, and ROD can be found on the DWH Trustee website www.gulfspillrestoration.noaa.gov/.

[5] The Trustees are the entities authorized under OPA to act on behalf of the public to assess the natural resource injuries resulting from the DWH oil spill and to develop and implement project-specific restoration plans to compensate for those injuries. Together with the members of the Texas TIG, state Trustees authorized by the governors of Alabama, Florida, Mississippi, and Louisiana compose, as a whole, the Trustee Council.

detailing a specific, proposed plan to fund and implement restoration projects across the GOM with available restoration funds. The Final PDARP/PEIS sets forth the process for selecting specific projects for implementation by outlining programmatic Restoration Goals and Restoration Types (*see* Figure 5.4-1 of the Final PDARP/PEIS). The Final PDARP/PEIS also establishes a distributed governance structure that assigns a Trustee Implementation Group (TIG) for each of the eight Restoration Areas.[6] The Texas TIG makes all restoration decisions for the use of funds allocated to the Texas Restoration Area. Chapter 7 of the Final PDARP/PEIS provides detailed information on the Trustees and the TIG governance structure. In April 2016, the U.S. District Court for the Eastern District of Louisiana entered a Consent Decree resolving civil claims by the Trustees against BP arising from the DWH oil spill.

1.2 Restoration Planning

Restoration planning from the DWH oil spill began in Texas in 2011 as part of the *Framework for Early Restoration Addressing Injuries Resulting from the Deepwater Horizon Oil Spill* (DWH NRDA Trustees 2011). Restoration planning continued in Texas with the release of two post-settlement restoration plans: 1) *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters*[7] (RP/EA #1; Texas TIG 2017); and 2) *Deepwater Horizon Oil Spill Natural Resource Damage Assessment*, *Texas Trustee Implementation Group, Final Restoration Plan/Environmental Assessment #2: Restoration of Wetlands, Coastal, and Nearshore Habitats; Nutrient Reduction; Oysters; Sea Turtles; and Birds*[8] (RP/EA #2; Texas TIG 2022a).

In RP/EA #1, the Texas TIG selected, in addition to others, a project to address injury to wetlands, coastal, and nearshore habitats called Dredged Material Planning for Wetland Restoration.[9] The project, further described in Section 2.2, involved the identification of priority locations, development of 60% design, and preparation of permit application packages for the beneficial use of dredged material (BUDM) for marsh restoration at eight sites along the Texas coast. The Texas TIG noted that "implementation of the BUDM to construct intertidal wetlands would take place in subsequent phases of the project" (Texas TIG 2017). The Texas Dredged Material for Wetland Restoration – Final Report was completed in 2022 (Texas TIG 2022b). This RP/EA #3 evaluates the sites identified in that report under OPA and NEPA for the next phase of planning and implementation.

Table 1-1 shows the total Texas TIG settlement funds allocated within the *Deepwater Horizon Oil Spill: Programmatic and Phase III Early Restoration Plan and Early Restoration Programmatic Environmental Impact Statement,*[10] the *Deepwater Horizon Oil Spill Final Phase IV Early Restoration Plan and Environmental Assessments*,[11] RP/EA #1, RP/EA #2, and funds proposed for allocation in this RP/EA #3. For current information on the projects, see the NOAA's Gulf Spill Restoration website about the Texas Restoration Area.[12]

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[6] The restoration areas are Alabama, Florida, Louisiana, Mississippi, Texas, Regionwide, Open Ocean, and Adaptive Management and Unknown Conditions.

[7] RP/EA #1 is available at https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf.

[8] RP/EA #2 is available at https://www.gulfspillrestoration.noaa.gov/media/document/2022-07-txrpeafinalcombined508pdf.

[9] The OPA evaluation of the project is in RP/EA #1, pages 61 through 63.

[10] Phase III Early Restoration Plan is available at https://www.gulfspillrestoration.noaa.gov/restoration/early-restoration/phase-iii.

[11] Phase IV Early Restoration Plan is available at https://www.gulfspillrestoration.noaa.gov/media/document/final-phase-iv-erp-eapdf.

[12] The Texas Restoration Area portion of the Gulf Spill Restoration website is available at https://www.gulfspillrestoration.noaa.gov/restoration-areas/texas.

Table 1-1 Texas TIG Funds by Restoration Goal and Restoration Type

Final PDARP/PEIS Programmatic Restoration Goal	Restoration Type	Total Texas Settlement Funds	Funds Allocated in Early Restoration	Funds Allocated in RP/EA #1	Funds Allocated in RP/EA #2	Funds Proposed for Allocation in RP/EA #3
Restore and conserve habitat	Wetlands, coastal, and nearshore habitats	$100,000,000	$0	$45,452,000	$10,920,000	$40,000,000
Restore water quality	Nutrient reduction (nonpoint source)	$22,500,000	$0	$0	$4,750,000	$0
Replenish and protect living coastal and marine resources	Sea turtles	$27,465,000	$19,965,000	$0	$4,720,000	$0
Replenish and protect living coastal and marine resources	Birds	$40,603,770	$20,603,770	$0	$9,300,000	$0
Replenish and protect living coastal and marine resources	Oysters	$22,500,000	$0	$309,000	$9,500,000	$0
Provide and enhance recreational opportunities	Provide and enhance recreational opportunities	$18,582,688	$18,582,688	$0	$0	$0
Monitoring and adaptive management and administrative oversight to support restoration implementation		$6,500,000	$0	$0	$0	$0

1.3 OPA and NEPA Compliance

As an oil pollution incident, the DWH oil spill is subject to the provisions of OPA (33 U.S.C. § 2701 *et seq*.). A primary goal of OPA is to make the environment and public whole for injuries to natural resources and services resulting from an incident involving an oil discharge or substantial threat of an oil discharge. OPA identifies factors the Texas TIG must consider in evaluating restoration projects. Under 15 C.F.R. §§ 990.54-55, the Texas TIG must consider a reasonable number of restoration alternatives when selecting a restoration project for implementation.

In addition, the federal trustees must comply with NEPA (42 U.S.C. § 4321 *et seq.*), its regulations (40 C.F.R. §§ 1500–08), and agency-specific NEPA procedures when proposing restoration projects. The NEPA analysis in this integrated OPA/NEPA document is being prepared in accordance with NEPA, its amendments under the Fiscal Responsibility Act of 2023 (Pub. L. No. 118-5, 137 Stat. 10), and the Bipartisan Permitting Reform Implementation Rule (89 Fed. Reg. 35,442 (May 1, 2024)). The 2016 Final PDARP/PEIS was intended to be used to tier the NEPA analysis in subsequent restoration plans prepared by the TIGs (40 C.F.R. § 1501.11; *see* Chapter 6 of the Final PDARP/PEIS). A tiered environmental analysis focuses on project-specific issues and summarizes or references (rather than repeats) the broader issues discussed in a programmatic NEPA analysis—in this case, the 2016 Final PDARP/PEIS. The NEPA analysis in this RP/EA #3 tiers from the 2016 Final PDARP/PEIS, where applicable. Additionally, the Texas TIG relies on incorporation by reference of existing NEPA analyses, management plans, studies, or other relevant material (40 C.F.R. § 1501.12), and adoption of existing NEPA analyses (40 C.F.R. § 1506.3), where applicable, in the analysis of impacts in this RP/EA #3 (Chapter 4; Appendix A).

The Fiscal Responsibility Act of 2023 (Pub. L. No. 118-5, 137 Stat. 10) amended NEPA to require that when a federal agency relies on a programmatic environmental document more than five years old, the federal agency must re-evaluate the analysis and any underlying assumptions in the programmatic environmental document to ensure the analysis remains valid. The DWH Federal Trustees reviewed the framework of the Final PDARP/PEIS for continued relevance, and in a memorandum dated June 28, 2024, affirmed the continued validity of the Final PDARP/PEIS to the overall program. The Federal Trustees will evaluate whether new information or changed circumstances may affect the continued validity of relevant portions of the Final PDARP/PEIS at the project level during the preparation of each tiered RP/EA. Consistent with the Fiscal Responsibility Act amendment to NEPA, and with 40 C.F.R. § 1501.11, the DWH Federal Trustees of the Texas TIG determined that the analysis and the underlying assumptions in the Final PDARP/PEIS (DWH NRDA Trustees 2016) remain valid in the context of the projects proposed in this RP/EA #3 and continue to be applicable as a programmatic evaluation for DWH restoration planning.

NOAA is the lead federal Trustee for preparing this RP/EA #3 pursuant to NEPA (40 C.F.R. § 1501.7). The other Texas TIG federal and state Trustees are acting as cooperating agencies for the purposes of NEPA compliance in the development of this RP/EA #3 (40 C.F.R. § 1501.8). Each federal cooperating agency on the Texas TIG will review the analysis for adequacy in meeting the standards set forth in its own NEPA-implementing procedures and subsequently adopt the NEPA analysis if appropriate (40 C.F.R. § 1506.3). Adoption of the environmental assessment would be completed via signature on a NEPA decision.

NOAA is aware of the November 12, 2024 decision in Marin Audubon Society v. Federal Aviation Administration, No. 23-1067 (D.C. Cir. Nov. 12, 2024). To the extent that a court may conclude that the Council on Environmental Quality (CEQ) regulations implementing NEPA are not judicially enforceable or binding on this agency action, NOAA has nonetheless elected to follow those regulations at 40 C.F.R. Parts 1500–1508, in addition to NOAA's procedures/regulations implementing NEPA to meet the agency's obligations under NEPA, 42 U.S.C. §§ 4321 et seq.

1.4 Purpose and Need

The Texas TIG has undertaken this restoration planning effort to meet the purpose of contributing to the compensation for and restoration of natural resources and their services injured in the Texas Restoration Area resulting from the DWH spill. This RP/EA #3 is consistent with the Final PDARP/PEIS, which identified extensive and complex injuries to natural resources and their services across the GOM and a need to plan for comprehensive restoration consistent with OPA. This RP/EA #3 falls within the scope of the purpose and need identified in the Final PDARP/PEIS. As described in Section 5.3 of the Final PDARP/PEIS, the Restoration Goals work independently and together to benefit injured resources and services. The reasonable range of restoration alternatives in this RP/EA #3 address one of the programmatic Restoration Goals: Restore and Conserve Habitat. Additional information about the purpose and need for DWH NRDA restoration can be found in Section 5.3.2 of the Final PDARP/PEIS.

1.5 Proposed Action and Alternatives

1.5.1 Proposed Action

The Texas TIG proposes to implement the restoration alternatives identified as preferred in this RP/EA #3 to provide compensatory restoration toward meeting the Restore and Conserve Habitats restoration goal identified in the Final PDARP/PEIS (Section 1.5.3) under the Wetlands, Coastal, and Nearshore Habitats Restoration Type.

1.5.2 Proposed Alternatives

Table 1-2 identifies the reasonable range of restoration alternatives evaluated in this RP/EA #3, including those identified as "preferred" by the Texas TIG for implementation following approval of the *Final Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats* (Final RP/EA #3). The preferred alternatives would be implemented over approximately the next five to ten years. Figure 1-1 provides the approximate location of each restoration alternative.

This RP/EA #3 proposes seven preferred alternatives for implementation. Table 1-2 identifies the projects evaluated and projects preferred for implementation. The Texas TIG proposes to allocate $40 million of Texas TIG Wetlands, Coastal, and Nearshore Habitat Restoration Type funds in this RP/EA #3 (i.e., the estimated cost of the preferred restoration alternatives) to restore wetland habitat along the Texas coast. This funding would be divided among the selected projects to provide the incremental cost to the U.S. Army Corps of Engineers (USACE) or to fund other viable sources to beneficially use dredged sediments to construct preferred restoration alternatives, as well as for Trustee implementation costs, planting, and monitoring. Detailed information on all alternatives can be found in Section 2.3.

Table 1-2 Reasonable Range of Restoration Alternatives Proposed in this RP/EA #3 (Listed Alphabetically)

Alternative	Potential Acres	Preferred or Not Preferred
Anahuac National Wildlife Refuge Roberts Mueller Tract Wetland Restoration	550	Preferred
Goose Island Wetland Restoration	40	Preferred
Guadalupe River Old Delta Wetland Restoration	1,140	Not preferred
Lower Neches Wildlife Management Area Old River Unit Wetland Restoration	224	Preferred
McFaddin National Wildlife Refuge Willow Lake Terraces Wetland Restoration	218	Preferred
San Bernard National Wildlife Refuge Sargent Oil Field Wetland Restoration	200	Preferred
Schicke Point Wetland Restoration	72	Preferred
Texas Point National Wildlife Refuge Wetland Restoration	623	Preferred

1.5.3 Natural Recovery/No Action Alternative

Under the Natural Recovery/No Action Alternative, the Texas TIG would not select and implement any of the restoration alternatives proposed in this RP/EA #3 (Section 3.5). In the Final PDARP/PEIS, the Trustees analyzed the Natural Recovery/No Action Alternative programmatically and found that it would not meet the purpose and need for restoring lost natural resources and their services. A No Action Alternative is included in this RP/EA #3 analysis pursuant to NEPA (40 C.F.R. § 1502.14(c)) as a "benchmark, enabling decision-makers to compare the magnitude of environmental effects of the action alternatives" (CEQ 1981). The No Action Alternative is analyzed in Appendix A.

1.5.4 Severability of Projects

Restoration alternatives identified in this RP/EA #3 are independent of each other and may be selected independently by the Texas TIG. A decision not to select one or more of the alternatives does not affect the Texas TIG's selection of any remaining alternatives in future restoration planning.

1.6 Public Involvement

The Texas TIG prepared this RP/EA #3 to 1) inform the public about DWH NRDA restoration planning efforts in the Texas Restoration Area; 2) present analyses of the potential restoration benefits and environmental consequence of the reasonable range of restoration alternatives; and 3) seek public comment.

The public is encouraged to review and comment on this RP/EA #3 during the 30-day comment period following public notice. The deadline and other details for submitting written comments is specified in this section, in the public notice published in the *Federal Register*, and on the National Park Service Planning, Environment & Public Comment website (see link in list below). The timeframe for providing comments, along with other information can also be found on the Trustees' website.[13] During the comment period, comments can be submitted by any of the following methods:

- **Online:** https://parkplanning.nps.gov/TXTIGRP3
- **By mail:** Hard copy addressed to U.S. Fish and Wildlife Service Gulf Restoration Office, 1875 Century Blvd., Atlanta, GA 30345. To be considered, mailed comments must be postmarked on or before the comment deadline.
- **During the public meeting:** The Texas TIG will hold a public meeting to facilitate the public review and comment process. The meeting will be held on January 28, 2025, at 5:00 p.m. CT at the Rosenburg Library in the Wortham Auditorium, 2310 Sealy Avenue, Galveston, TX 77550.

After the close of the comment period, the Texas TIG will consider all comments received and revise this RP/EA #3, as appropriate. A summary of comments received and the Texas TIG's responses, where applicable, will be included in the Final RP/EA #3. Please note that personal identifying information included in the submitted comments (such as name, address, phone number, and email address) may be made publicly available at any time. Personal information is not required to submit comments.

1.7 Administrative Record

The DWH Trustees opened a publicly available Administrative Record for the DWH NRDA[14] concurrently with publication of the 2010 Notice of Intent (pursuant to 15 C.F.R. § 990.45). DOI is the lead federal Trustee for maintaining the Administrative Record. Information about restoration project implementation is provided to the public through the Administrative Record and other outreach efforts including the Texas Restoration Area portion of the DWH Trustee website.[13]

1.8 Coordination with Other DWH Restoration Programs

As discussed in Section 1.5.6 of the Final PDARP/PEIS, coordination with other DWH restoration planning efforts promotes successful implementation of restoration projects and optimizes ecosystem recovery. The Texas TIG has committed to coordinating with other DWH restoration programs (e.g., the Resources and Ecosystem Sustainability, Tourist Opportunity, and Revived Economies of the Gulf Coast States Act and the National Fish and Wildlife Foundation's Gulf Environmental Benefit Fund) to maximize the overall ecosystem impact of restoration efforts and ensure effective use of funds by identifying synergies and reducing potential redundancies in project selection. This coordination ensures that all funds are allocated for critical restoration projects in Texas.

1.9 Next Steps

This RP/EA #3 is intended to provide the public and decision-makers with information and analysis on the Texas TIG's proposal to implement the proposed actions described in this RP/EA #3, which includes restoration alternatives to restore wetlands, coastal, and nearshore habitats. To help inform the Texas TIG's decision on which alternatives to propose for implementation, the environmental impacts of the alternatives are assessed in Appendix A and summarized in Chapter 4. This RP/EA #3, together with public review and comment, is intended to guide the Texas TIG's selection of projects that best meet the purpose and need, as described in Section 1.4, for implementation in the Final RP/EA #3.

[13] The Texas Restoration Area section of the Trustees' website can be found at https://www.gulfspillrestoration.noaa.gov/restoration-areas/texas.

[14] The DWH Administrative Record can be found at www.doi.gov/deepwaterhorizon/adminrecord/.

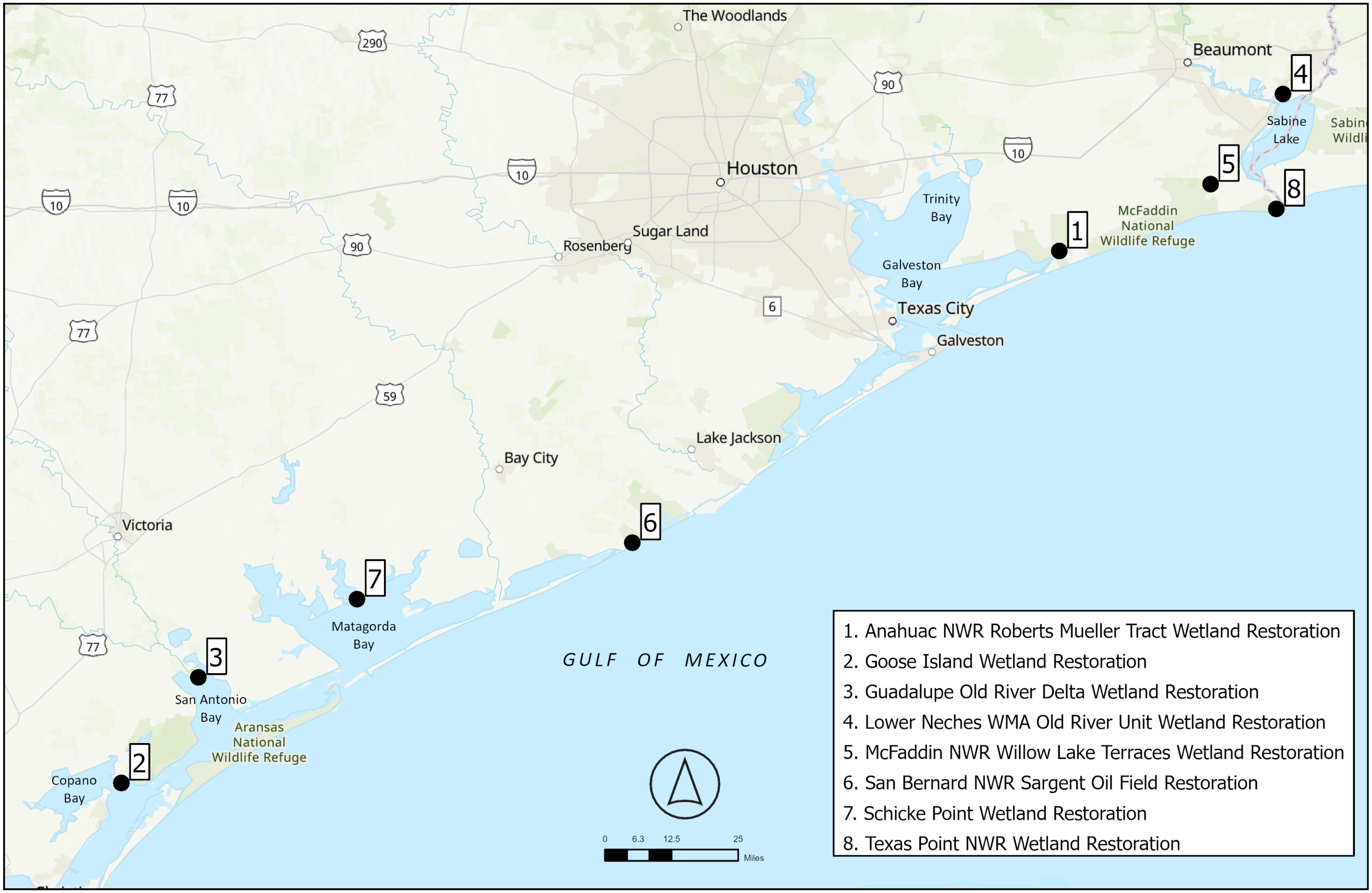

Figure 1-1 Approximate Locations of the Reasonable Range of Alternatives Proposed

2 Restoration Planning Process

NRDA restoration under OPA is a process that includes evaluating injuries to natural resources and the services they provide to determine the types and extent of restoration needed to address the injuries. Restoration activities need to produce benefits that are related to or have a connection to natural resource injuries and service losses resulting from a spill. As part of the NRDA process, the Trustees must consider a reasonable range of restoration alternatives[15] before selecting their preferred alternative(s) (15 C.F.R. § 990.53(a)(2)). The OPA NRDA regulations (15 C.F.R. § 990.54) provide evaluation standards to be used by Trustees to evaluate projects designed to compensate the public for injuries caused by oil spills.

The Texas TIG developed a screening process, described in this chapter, based on the OPA NRDA regulations to help identify the reasonable range of alternatives evaluated in this RP/EA #3. The reasonable range of alternatives is consistent with the DWH Trustees' selected programmatic alternative and the goals identified in the Final PDARP/PEIS. This chapter summarizes the injuries addressed by this RP/EA #3 and the projects considered in the reasonable range of alternatives.

2.1 Summary of Wetlands, Coastal, and Nearshore Injuries Addressed in the RP/EA #3

Chapter 4 of the Final PDARP/PEIS summarizes the injury assessment, which documents the nature, degree, and extent of injuries from the DWH oil spill to both natural resources and the services they provide. Restoration projects identified in this RP/EA #3 are designed to address injuries to resources resulting from the spill. This RP/EA #3 proposes alternatives for the Wetlands, Coastal, and Nearshore Habitats Restoration Type described in the Final PDARP/PEIS. This section summarizes the most relevant information from Chapter 4 of the Final PDARP/PEIS injury assessment and establishes the basis for restoration planning for this Restoration Type.

Injury to the coastal wetlands was observed across wide swaths of the northern GOM. Injury occurred in all oiling exposure categories, with more severe and varied injuries documented along more heavily oiled shorelines. Multiple model species were affected, including mainland salt marsh plants (reduced plant cover and aboveground biomass), periwinkles (reduced abundance), shrimp (reduced growth and biomass), amphipods (reduced survival and biomass), *Fundulus* spp. (reduced hatch success and biomass), juvenile southern flounder (*Paralichthys lethostigma*; reduced growth and biomass), red drum (*Sciaenops ocellatus*; reduced growth and biomass), fiddler crab (reduced burrow density), insects (reduced abundance), and nearshore oysters (reduced cover and biomass). Marsh edge habitat also suffered increased erosion.

Animals using the edge of the marsh for refuge and forage were exposed to oil through contact with oiled plants, soil, sediment, and detritus on the marsh surface as it flooded with the tide, as well as through ingestion or contact with oil entrained in submerged sediments near the edge. Toxicity testing conducted using marsh soil containing oil from the spill demonstrates that polycyclic aromatic hydrocarbon concentrations found in oiled marsh areas are toxic to many marsh species (Morris et al. 2015). Cleanup and oil removal activities at the edge of marshes smothered, crushed, or removed animals and vegetation in oiled areas (Nixon and Michel 2015). The release of river water as part of spill

[15] For the purposes of this RP/EA #3, each project evaluated in the reasonable range is considered a separate alternative; therefore, the terms "project" and "alternative" are used interchangeably.

response actions also reduced growth of juvenile brown shrimp (*Farfantepenaeus aztecus*; Powers and Scyphers 2016).

As discussed in the Final PDARP/PEIS, oiling has been documented to adversely affect coastal wetland vegetation and associated fauna. Oil can wash up at the marsh edge, oiling soil and coating vegetation. It can also penetrate the marsh through tidal creeks and wash-over events and become stranded in the marsh interior, where it can coat plant stems and soil (Final PDARP/PEIS, Section 4.6.4.1). Furthermore, marsh plants help stabilize shorelines by holding, retaining, and accumulating marsh sediments. They also contribute to coastal flood protection by reducing storm surge and waves and provide critical structural habitat (as refuge and forage) for a wide variety of organisms (Final PDARP/PEIS Section 4.11.4).

2.2 Identification and Consideration of Reasonable Range of Alternatives

In developing a reasonable range of alternatives suitable for addressing the injuries caused by the DWH oil spill, the Texas TIG considered the programmatic Restoration Goals and Restoration Types specified in the Final PDARP/PEIS, the screening factors in the OPA NRDA regulations (15 C.F.R. § 990.54), the availability of funds under the DWH NRDA settlement, and projects previously funded by the Texas TIG or proposed to be funded by other sources.

The Dredged Material Planning for Wetland Restoration project was selected for implementation in RP/EA #1 (Texas TIG 2017).[16] To implement the project, the Texas TIG engaged in a process of site identification and evaluation that included input from coastal stakeholders, nongovernmental organizations, experts, and members of the public. With assistance from its project team, led by Ducks Unlimited, the Texas TIG engaged in an iterative process to create a list of potentially suitable sites and refine a shortlist for consideration and preliminary planning and development.

The initial survey of the Texas coastal restoration community identified 163 potential sites. Utilizing initial screening criteria (e.g., suitability for estuarine marsh habitat, protection from erosive forces, and proximity to a sediment borrow source), these were narrowed to 40 viable sites. The project team applied a second set of criteria to further reduce the list of sites to 15. These criteria included sites identified in the *Texas Coastal Resiliency Master Plan* (GLO 2019), technically viable distance to a sediment source, long-term sustainability, and minimum regulatory restraints. From this group of sites, the Texas TIG identified eight sites that would provide the highest restoration benefit for surveying, development of 60% restoration design, and development of permit application packages. The Texas Dredged Material for Wetland Restoration – Final Report (Texas TIG 2022b) contains the biological, engineering, and site-specific details on the identification and evaluation of the eight project sites and restoration cell footprints.

These eight project ideas were also submitted to the Texas TIG for consideration in the development of RP/EA #2 (2022). As these projects were still in development, the Texas TIG decided not to consider these projects in RP/EA #2, but to consider BUDM in a later restoration plan.

2.3 Reasonable Range of Restoration Alternatives Considered

Using the process described in Section 2.2, the Texas TIG identified a reasonable range of alternatives for further consideration and evaluation in this RP/EA #3 (Table 2-1). Summaries of each of these alternatives are provided in the subsequent subsections of this chapter. OPA NRDA and NEPA

[16] See RP/EA #1 available at https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf.

evaluations of these alternatives are provided in Chapters 3 and 4 of this RP/EA #3, respectively. The total estimated cost to implement all preferred alternatives is discussed in Section 3.2. A No Action Alternative is also included in this RP/EA #3 pursuant to NEPA (40 C.F.R. § 1501.5(C)(2)(ii).

Table 2-1 Reasonable Range of Alternatives Considered in RP/EA #3

Alternative
Anahuac National Wildlife Refuge Roberts Mueller Tract Wetland Restoration
Goose Island Wetland Restoration
Guadalupe River Old Delta Wetland Restoration
Lower Neches Wildlife Management Area Old River Unit Wetland Restoration
McFaddin National Wildlife Refuge Willow Lake Terraces Wetland Restoration
San Bernard National Wildlife Refuge Sargent Oil Field Wetland Restoration
Schicke Point Wetland Restoration
Texas Point National Wildlife Refuge Wetland Restoration

2.3.1 Anahuac NWR Roberts Mueller Tract Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS, Section 5.5.2.2).

Restoration Technique

Create or enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 550 acres of coastal intertidal wetlands through BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The project is located in the Roberts Mueller Tract of the Anahuac National Wildlife Refuge (NWR) in Chambers County, Texas, on the north side of the Gulf Intracoastal Waterway (GIWW), northwest of High Island, Texas (Figure 2-1).

Project Summary

The project site is within the Anahuac NWR managed by the U.S. Fish and Wildlife Service (USFWS). Dredged material would provide fill for four dredge placement cells, using containment levees built from material collected on site to restore up to 550 acres of intertidal marsh.

The predominant wetland habitats in the project area are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the project area. Subsidence and sea level rise are rapidly converting emergent marsh to open water. This project is consistent with regional efforts to counteract land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching project goal is to restore and conserve wetlands and coastal habitats in the Anahuac NWR by beneficially using dredged material to create a viable, vegetated wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to return current submerged shallow open water habitat in the Anahuac NWR to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass (*Sporobolus alterniflorus*) and saltmeadow cordgrass (*Sporobolus pumilus*). This project would place up to 650,000 cubic yards (cy) of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredged material would be placed in the levees to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 550 acres of marsh habitat, including the conversion of approximately 380 acres of existing open water to intertidal marsh habitat.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of engineering and design (E&D), permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to their target elevations. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

Emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the Monitoring and Adaptive Management (MAM) Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

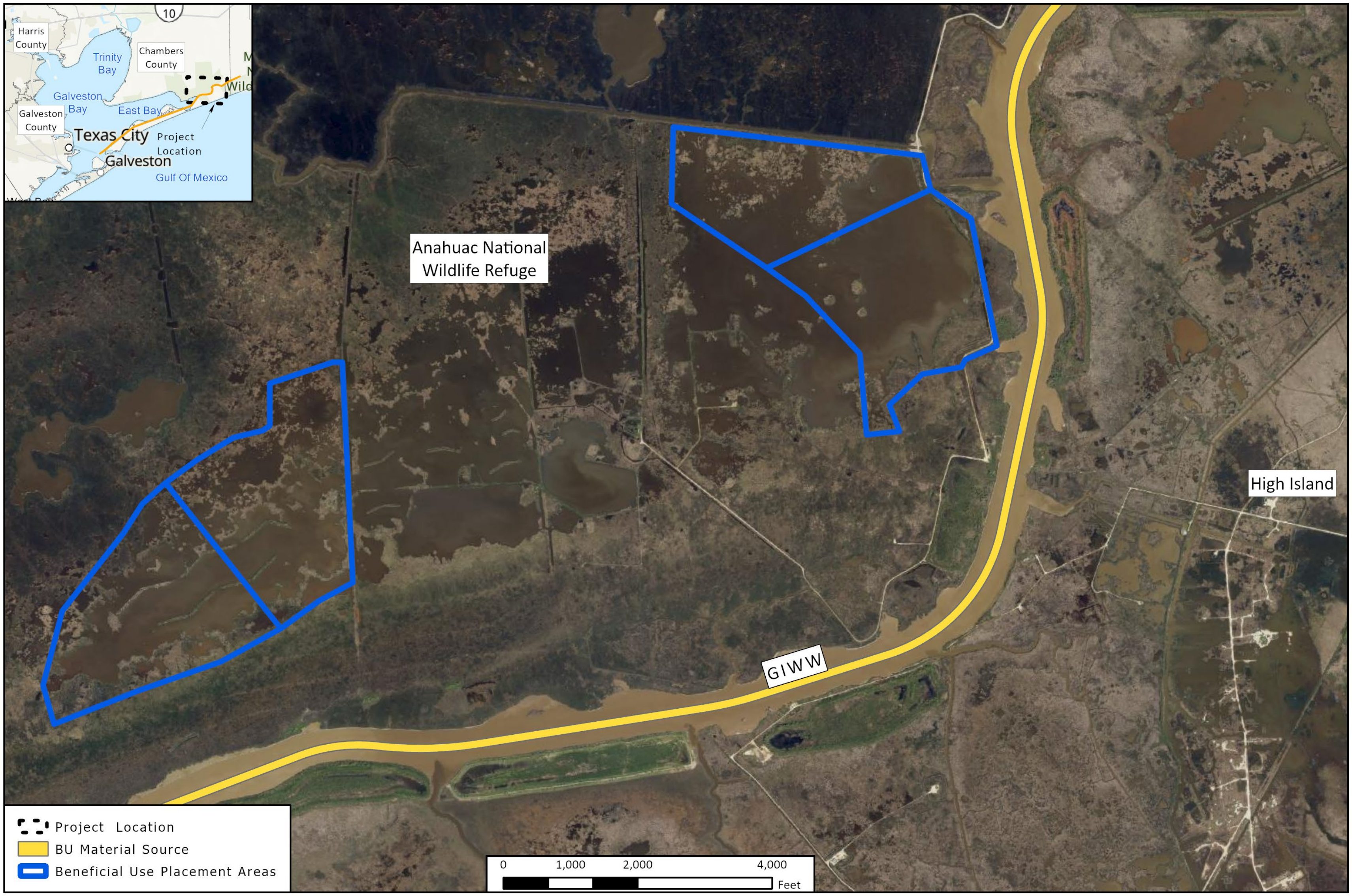

Figure 2-1 Anahuac NWR Roberts Mueller Tract Wetland Restoration General Location Map

2.3.2 Goose Island Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS Section 5.5.2.2).

Restoration Technique

Create or enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1)

Project Goal

This project would restore up to 40 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The project is located in Aransas County, Texas, at the end of Lamar Peninsula north of Rockport, Texas, between St. Charles and Aransas bays (Figure 2-2).

Project Summary

The project area is within Aransas Bay on or adjacent to Goose Island State Park. Dredged material would provide fill for two containment cells constructed at the site of an earlier marsh restoration project on Goose Island as well as two new cells on the northern side of the existing cells. The containment levees will be constructed and rehabilitated using on-site sediments.

The predominant wetland habitats near the project site are characterized as salt marsh, seagrasses, and estuarine open water. The combination of rising sea levels, erosion, subsidence, and reduced sediment supplies have resulted in loss of wetlands and other coastal habitats on Goose Island. This project is consistent with regional efforts to counteract land and habitat loss through estuarine marsh restoration.

The overarching goal of the Texas TIG for this project is to restore and conserve wetlands and coastal habitats by beneficially using dredged material to create a viable, vegetated wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage.

The primary objective of this project is to return current shallow open water habitat within the project site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 195,000 cy of suitable hydraulically dredged material within containment levees. As part of the project, existing levees would be rehabilitated and additional levees constructed. Sediment would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 40 acres of marsh habitat, including the conversion of approximately 34 acres of existing open water to intertidal and high marsh habitat.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged

material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

Emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-2 **Goose Island Wetland Restoration General Location Map**

2.3.3 Guadalupe River Old Delta Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 1,140 acres of coastal intertidal wetlands through BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The Guadalupe River Old Delta Wetland Restoration project area is located in Refugio County, Texas, at the northern portion of San Antonio Bay and forms a peninsula between Hynes Bay to the west and Guadalupe Bay to the east (Figure 2-3).

Project Summary

The project site is at the northern portion of San Antonio Bay and forms a peninsula between Hynes Bay to the west and Guadalupe Bay to the east. Dredged material would provide fill for four dredge placement cells, using containment levees built from material collected on site to restore up to 1,140 acres of intertidal marsh in degraded portions of the delta.

Over the past several decades, the vegetated marsh of the site has undergone physical deterioration through erosion of portions of the marshes encompassing the site as well as the expansion of interior open water areas. This change is particularly noticeable along the southern boundary of the delta where it is exposed to San Antonio Bay.

The predominant wetland habitat in the Guadalupe River Old Delta site is characterized as a mosaic of brackish marsh and estuarine open water. The combination of rising sea levels, erosion, storm impacts, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the project area. This project is consistent with regional efforts to counteract land and habitat loss through hydrology enhancements and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in the Guadalupe River Old Delta by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to return current submerged open water in the project site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 1.91 million cy of suitable hydraulically dredged material within levees constructed from on-site sediments. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 1,140 acres of marsh habitat, including the conversion of up to 480 acres of existing open water to intertidal marsh.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the Victoria Barge Canal, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

Emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-3 Guadalupe River Old Delta Wetland Restoration General Location Map

2.3.4 Lower Neches WMA Old River Unit Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS, Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 224 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The Lower Neches Wildlife Management Area (WMA) Old River Unit Wetland Restoration project is located in Orange County, Texas, south of Bridge City and north of Sabine Lake (Figure 2-4).

Project Summary

The project area is within the Old River Unit of the Lower Neches WMA managed by TPWD. The Old River Unit of the WMA consists of 4,386 acres on the north shore of Old River Cove of Sabine Lake and near the GIWW. Dredged material would provide fill for six marsh restoration placement cells, using containment levees built from material collected on site to restore up to 224 acres of intertidal marsh.

The site is composed primarily of intertidal marsh and shallow open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant, rapid loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands at the project site by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in Lower Neches WMA Old River Unit to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 400,000 cy of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredged material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation would consider sediment compaction and expected sea level rise. Project actions would restore up to 224 acres of intertidal marsh, including the conversion of 96 acres of existing open water to intertidal marsh.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the Sabine Neches Waterway (SNWW), private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

The emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

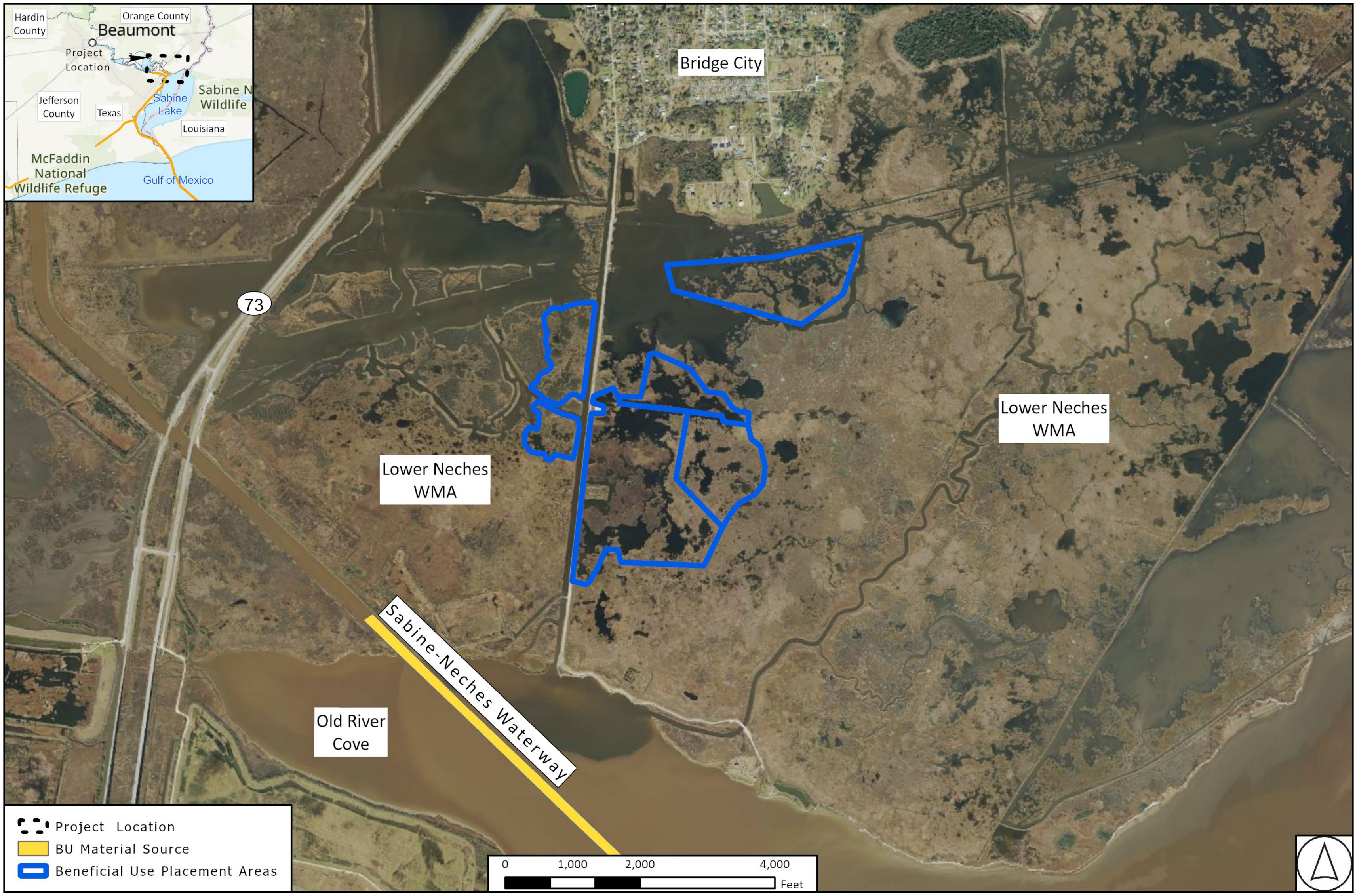

Figure 2-4 Lower Neches WMA Old River Unit Wetland Restoration General Location Map

2.3.5 McFaddin NWR Willow Lake Terraces Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS, Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1.)

Project Goal

This project would restore up to 218 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The McFaddin NWR Willow Lake Marsh Restoration project is in Jefferson County, Texas, south of the GIWW, about 7 miles southwest of Port Arthur, Texas (Figure 2-5).

Project Summary

The project site is located in the McFaddin NWR managed by the USFWS. The restoration site boundaries were based on a previous effort to regenerate marsh using terraces within subtidal open water areas surrounding Willow Lake. The addition of dredge material to the terraced area would restore up to 218 acres of intertidal marsh habitat.

The predominant wetland habitats near the McFaddin NWR are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands by rapidly converting emergent marsh to open water. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in Willow Lake by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in Willow Lake to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 475,000 cy of suitable hydraulically dredged material within levees constructed from on-site material. Sediment would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 218 acres of marsh habitat, including the conversion of up to 140 acres of existing open water to low marsh.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW and SNWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

The emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-5 McFaddin NWR Willow Lake Terraces Wetland Restoration General Location Map

2.3.6 San Bernard NWR Sargent Oil Field Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS, Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 200 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The San Bernard NWR Wetland Restoration project is located in Matagorda County, Texas, on the north side of the GIWW, southeast of Sargent, Texas (Figure 2-6).

Project Summary

The project site is located on the San Bernard NWR managed by USFWS. Dredged material would provide fill for a contained placement area within the abandoned oil field adjacent to the GIWW to restore up to 200 acres of intertidal marsh.

The predominant wetland habitats in the San Bernard NWR Sargent Oil Field project area are characterized as salt and brackish marsh and estuarine open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through beach renourishment, dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in the San Bernard NWR Sargent Oil Field area by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in the San Bernard NWR Sargent Oil Field site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 120,000 cy of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredged material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 200 acres of marsh habitat, including the conversion of up to 119 acres of existing open water to low marsh.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged

material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

The emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-6 San Bernard NWR Sargent Oil Field Wetland Restoration General Location Map

2.3.7 Schicke Point Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS, Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS, Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 72 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The Schicke Point Wetland Restoration project is in Calhoun County, Texas, along the northern rim of Matagorda Bay at the mouth of Carancahua Bay (Figure 2-7).

Project Summary

The project site is located adjacent to the peninsula separating Matagorda Bay and Caranchua Bay. A segmented, rubble-mound breakwater was constructed along the shoreline facing Matagorda Bay in 2017. Dredged material would provide sediment to restore up to 72 acres of intertidal marsh behind the existing breakwater.

Over the past several decades, the marsh portion of the site has undergone physical deterioration through erosion of its bayward boundary as well as the expansion of interior open water areas. The predominant wetland habitats at Schicke Point are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, erosion, reduced sediment supplies, wind-wave erosion, and storm impacts have resulted in significant loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through hydrology enhancements, oyster reef, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in Schicke Point by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in Schicke Point to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 182,000 cy of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredged material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 72 acres of marsh habitat.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the Matagorda Ship Channel, private dredging sources, and material mined from dredged material placement areas. As part of the completion of E&D for the BUDM site, the specific sources of dredged material would be determined during project implementation. Any dredged material used would pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each project cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

Emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-7 Schicke Point Wetland Restoration General Location Map

2.3.8 Texas Point NWR Wetland Restoration

Restoration Approach

Create, restore, and enhance coastal wetlands (Final PDARP/PEIS Section 5.5.2.2).

Restoration Technique

Create, restore, and enhance coastal wetlands through placement of dredged material (Final PDARP/PEIS Chapter 5, Appendix D.1.1).

Project Goal

This project would restore up to 623 acres of coastal intertidal wetlands through the placement of BUDM, which is consistent with the Restore and Conserve Habitat and the Wetlands, Coastal, and Nearshore Habitats Restoration Type goals in the Final PDARP/PEIS (DWH NRDA Trustees 2016). To accomplish the Restoration Type goals, the project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands; and 2) establish estuarine marsh vegetation.

Project Location

The Texas Point NWR project area is located within Jefferson County, Texas, at the extreme southeastern portion of Texas along the Gulf Coast and the west bank of Sabine Pass, which forms the boundary between Texas and Louisiana (Figure 2-8).

Project Summary

The project site is within the Texas Point NWR managed by the USFWS. Dredged material would provide fill for three marsh restoration cells, using containment levees built from sediments collected on site to restore up to 623 acres of intertidal marsh.

The predominant wetland habitats near the Texas Point NWR are characterized as salt and brackish marsh and estuarine open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, erosion, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the region and project site. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats by beneficially using dredged material to create viable, vegetated, wetland habitat for a variety fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage.

The primary objective of this project is to restore shallow submerged open water habitat in the Texas Point NWR to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 1.6 million cy of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredged material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 623 acres of marsh habitat, including the conversion of up to 239 acres of existing open water to intertidal marsh.

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the SNWW, private dredging sources, or material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source.

General Project Activities and Implementation Timing

Project activities will include completion of E&D, permit acquisition, coordination with dredge material sources, construction, and monitoring.

The total amount of time to complete the project would depend on the timing of sediment availability and quantity of sediment available in each dredging cycle. Generally, the Trustees would coordinate with USACE or other project partners regarding dredging schedules and would complete engineering, design, and permitting in years 1 and 2. Sediment placement may require more than one dredge cycle to fill the restoration cells to target elevation. Once construction is complete, post-construction monitoring would be conducted to assess project outcomes and determine if any corrective actions or adaptive management are needed.

Maintenance

The emergent wetlands promoted by the BUDM project should be self-sustaining and would not require maintenance unless conditions change. The project may need to be modified during construction or adaptively managed post-construction as described in the MAM Plan in Appendix E.

Monitoring

Project monitoring details are provided in the project MAM Plan in Appendix E.

Figure 2-8 Texas Point NWR Wetland Restoration General Location Map

3 OPA NRDA Evaluation of Alternatives

The Texas TIG developed a reasonable range of restoration alternatives for consideration and evaluation in this RP/EA #3. The screening process to identify the alternatives and project descriptions are provided in Chapter 2. This chapter includes an OPA NRDA analysis of alternatives considered in this RP/EA #3. There are six sections in this chapter. Section 3.1 summarizes the evaluation standards of OPA NRDA; Section 3.2 estimates project costs; Section 3.3 discusses the use of best practices; Section 3.4 uses the OPA NRDA standards to evaluate each project in the reasonable range of alternatives and identifies those alternatives that the Texas TIG prefers for implementation; Section 3.5 discusses a Natural Recovery/No Action alternative; and lastly, Section 3.6 uses the OPA NRDA standards to evaluate each project in the reasonable range of alternatives and identifies those alternatives that the Texas TIG prefers for implementation.

3.1 Summary of OPA NRDA Evaluation Criteria

Trustees are required, pursuant to the OPA NRDA regulations, to determine a reasonable range of alternatives (15 C.F.R. § 990.53(a)(2)) that can be evaluated in accordance with the OPA NRDA evaluation standards (15 C.F.R. § 990.54(a)). Once a reasonable range of alternatives has been developed, the OPA NRDA regulations require trustees to evaluate the reasonable range of alternatives and identify preferred restoration alternatives based on, at minimum, the following standards:

- Cost-Effectiveness: the cost to carry out the alternative
- Goals and Objectives: the extent to which each alternative is expected to meet the Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses
- Feasibility: the likelihood of success of each alternative
- Avoid Collateral Injury: the extent to which each alternative will prevent future injury from the DWH oil spill and avoid collateral injury from implementing the alternative
- Benefits: the extent to which each alternative benefits more than one natural resource and/or service
- Health and Safety: the effect of each alternative on public health and safety

If the Trustees conclude that two or more alternatives are equally preferable, the OPA NRDA regulations provide that the most cost-effective alternative must be chosen (15 C.F.R. § 990.54(b)).

When developing a restoration plan under the OPA NRDA regulations, Trustees are to establish restoration objectives that are specific to the natural resources that were injured (15 C.F.R. § 990.55(b)(2)). The desired project outcome is to be clearly specified in these objectives, as well as the performance criteria by which successful restoration under OPA will be determined, including criteria that would necessitate corrective actions (15 C.F.R. § 990.55(b)(2)). Should a corrective action become necessary from unanticipated conditions, the Implementing Trustee would evaluate the necessary corrective action for consistency with the OPA NRDA and NEPA analyses conducted in this RP/EA #3 in accordance with Section 9.5.2 of the Trustee Council's SOPs (DWH NRDA Trustees 2021a). Requirements for the monitoring component of a restoration plan can be found in 15 C.F.R. § 990.55(b)(3).

One of the programmatic Restoration Goals in the Final PDARP/PEIS that DWH Trustees identified is Monitoring, Adaptive Management, and Administrative Oversight. Chapter 5, Appendix E of the Final PDARP/PEIS provides detail on how the Trustees committed to a MAM framework that integrates the best available science into planning and design of each alternative, identifies and reduces key uncertainties, tracks and evaluates progress toward restoration goals, determines the need for corrective actions, and supports compliance monitoring. The DWH NRDA MAM framework provides a flexible, science-based approach to effectively and efficiently implement and monitor restoration to provide long-term benefits to the natural resources and services injured by the DWH oil spill.

The Texas TIG developed a draft MAM plan for each of the preferred alternatives identified in this RP/EA #3, which can be found in Appendix E. The MAM plans include descriptive information regarding monitoring goals, objectives, parameter details, potential corrective actions, and monitoring schedules. The plans are consistent with the OPA, the Final PDARP/PEIS (DWH NRDA Trustees 2016), the Trustee Council's SOPs (DWH NRDA Trustees 2021a), and the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (DWH NRDA Trustees 2021b). The MAM plans are intended to be living documents and will be updated as needed to reflect any changing conditions and/or to incorporate new information. For example, MAM plans may need to be revised if the project design changes, initial data analysis indicates that the sampling design is inadequate, if uncertainties are resolved, or new uncertainties are identified during project implementation and monitoring. Updates to MAM plans and any additional details concerning the status of monitoring activities will be made publicly available through the Data Integration Visualization Exploration and Reporting (DIVER) website.

3.2 Estimated Costs

The approach to identifying a total allocation for this RP/EA #3 is uniquely structured compared to other DWH restoration plans. Rather than including individual total project budgets, this RP/EA #3 identifies the total allocation the Texas TIG anticipates is needed to fund the implementation of the suite of preferred alternatives. As beneficial dredged material becomes available through channel maintenance and other similar projects are carried out by other project sponsors or agencies, the alternatives in this RP/EA #3, if selected, would be implemented. These projects would be implemented during multiple dredge cycles that may occur over a decade or more. This approach intends to apply more fiscal flexibility to accommodate real-time costs and opportunities as each project becomes ripe for implementation.

As opposed to identifying the cost of each alternative, the Texas TIG would allocate $40 million (BUDM Project Fund) to implement the seven preferred alternatives, if selected in the Final RP/EA #3. In RP/EA #1, the Texas TIG funded the initial site identification, project design, and USACE permit application packages for the eight restoration alternatives further evaluated in this RP/EA #3. As part of the initial project design effort, "upper end" fully funded cost estimates were developed for each alternative using information available at the time. These estimates reflected all costs for each project, including the full costs to dredge and transport material (i.e., costs beyond the Texas TIG's responsibility for the projects proposed in this RP/EA #3). The initial fully funded cost estimates ranged from approximately $2 million to more than $19 million across the eight projects considered in the reasonable range of alternatives. The Texas TIG considered these initial individual cost estimates when formulating the proposed allocation of funds for the seven preferred alternatives identified in this RP/EA #3 and determined $40 million would be reasonable and appropriate, given the information available.

Project implementation would include final design, remaining permitting needs, incremental construction costs, site planting, project monitoring, and oversight. Incremental costs are defined as the difference in the cost between sediment disposal methods employed by USACE and other viable sources (e.g., open water or upland), and the cost to beneficially use sediments to restore intertidal marsh habitats. These incremental costs often include levee construction, increased sediment pumping distance, additional pipeline, project management, and equipment mobilization. Due to the Texas TIG's intention to fund the incremental costs associated with the construction of the selected alternatives over an extended time frame—potentially spanning up to 10 years or more—accurately forecasting the incremental costs for each project poses challenges. Nevertheless, the Texas TIG anticipates that leveraging BUDM will ultimately result in a reduction of the overall costs required to implement these marsh projects. The potential incremental cost for each project will vary over time and would depend on the number of dredging events needed to complete site restoration and on external factors beyond the Texas TIG's control, such as USACE-funding levels and sedimentation rates in federally-maintained channels. In addition, some sources of dredge material may become available before USACE dredging activities or can be used if USACE dredge activities are neither available nor cost effective. Estimating the cost of those other types of dredging activity is difficult given the unknown possible future availability of those dredge sources, the location of those sources and the resulting costs of using those sources in the future. Therefore, the Texas TIG does not include cost estimates for each project site in this RP/EA #3. Instead, the OPA evaluation in Section 3.4 considers the level of restoration benefits that would be provided using the restoration technique “create or enhance coastal wetlands through placement of dredge material” at each of the sites identified in the Texas Dredged Material for Wetland Restoration – Final Report (Texas TIG 2022b). Additionally, the Texas TIG evaluates which sites included in that report would provide the highest restoration benefit. Conditional upon selection of project alternatives in the Final RP/EA #3, when the Texas TIG authorizes a project or portion of a project via a Trustee Resolution, the Texas TIG will ensure the project continues to provide restoration benefits within current site conditions, is cost-effective and will document the project budget. The Texas TIG will also inform the public via a web story that will document the project budget and the remaining balance in the BUDM Project Fund.

BUDM has become an increasingly important tool and a cost-effective approach in coastal restoration and resiliency. The impact of sea level rise, erosion, and subsidence is resulting in significant and unprecedented land loss, particularly in ecologically important habitats. The demand for sediment to mitigate this loss is high, as is the cost of transporting and placing fill material for habitat restoration. Navigational dredging on the Texas coast produces millions of cy of material annually. These dredged sediments are often placed in closed placement areas and inshore open waters or deposited offshore and removed from natural sediment budgets, rather than being beneficially used to restore coastal habitats. USACE has acknowledged the potential benefits to BUDM and, in a January 2023 Beneficial Use of Dredged Material Command Philosophy Notice (USACE 2023), outlined the USACE’s goal to beneficially use at least 70% of dredged sediments by 2030, and identified the need for partnerships to meet this goal. For typical USACE dredging projects using BUDM, project partner expenses are limited to the incremental costs to beneficially use the sediments, while USACE incurs dredging and traditional, planned sediment placement costs. This partnership arrangement typically results in highly cost-efficient marsh restoration projects because project partners do not bear the full cost of sediment procurement, characterization, and equipment mobilization.

The Texas TIG would work with USACE to increase further cost-effectiveness by taking advantage of programs, such as the USACE Continuing Authorities Programs and Section 204—Aquatic Ecosystem Restoration. The Texas TIG would also seek additional opportunities to leverage project costs, including other NRDA case funds and state and federal funding sources. Before entering into an agreement with USACE or other viable sources, the Texas TIG would evaluate each incremental cost analysis USACE or other viable sources provides to ensure restoration costs are reasonable.

Due to the cost efficiency of BUDM as described above and past and ongoing leveraging efforts, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is a cost-effective approach for restoring injured resources through the Wetlands, Coastal and Nearshore Restoration Type funds.

If these projects are selected for implementation, there would be $3,628,000 remaining the Texas TIG's Wetlands, Coastal and Nearshore Habitat. The Texas TIG intends to hold these funds in reserve to use for potential cost overruns in projects authorized in all three Texas TIG restoration plans. Therefore, this plan is likely to be the last Texas TIG plan for wetlands, coastal, and nearshore habitats.

3.3 Best Practices

The federal regulatory agencies provide guidance on best practices as part of the environmental compliance process. Best practices generally include design criteria, lessons learned, and expert advice. Trustees incorporate appropriate best practices to avoid or minimize impacts to natural resources, including protected and listed species and their habitats. Specific project designs shall consider the potential impacts on these resources and integrate best practices and other mitigation measures to avoid adversely affecting resources. Best practices required in permits, consultations, and environmental reviews would be followed. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.

3.4 OPA NRDA Evaluation of Reasonable Range of Alternatives

Each project in the reasonable range of alternatives is evaluated against the OPA NRDA standards. Project summaries are provided in Section 2.3.

3.4.1 Anahuac NWR Roberts Mueller Tract Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would include restoring intertidal wetland elevations, restoring native coastal wetland vegetation, providing habitat for fish, invertebrates, and resident and migratory birds. This project would restore up to 550 acres of wetland complex, a habitat type that was injured as a result of the DWH oil spill.
Likelihood of success	This project would build on strategic planning and design of past marsh restoration actions in nearby locations. Based on documented experience and successful completion of previous projects, the Texas TIG anticipates this project has a high likelihood of success. The project is technically feasible and uses proven techniques with established methods and documented results.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.

OPA NRDA Evaluation Standard	Evaluation
Benefits	Beyond restoring wetlands and coastal habitat, this restoration project would increase ecological functionality for the range of resources injured by the DWH oil spill. The project would provide habitat for various ecologically and economically important species, including birds, fish, and crabs.
Health and safety	The Texas TIG does not anticipate impacts to public health and safety. The creation of marshes can benefit the public's safety by improving water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.2 Goose Island Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, incremental costs, site planting, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would combat land and habitat loss through estuarine marsh restorations that would include returning the area to reference marsh elevations to support habitat restoration and revegetation. This project would restore up to 40 acres of wetlands complex, a habitat injured as a result of the DWH oil spill.
Likelihood of success	This project would be modeled on past marsh restoration projects from nearby locations. Based on documented experience and successful completion of previous projects, the Texas TIG anticipates this project would have a high likelihood of success.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	This project would restore and conserve wetlands, coastal, and nearshore habitat while also maximizing ecological functions for a range of resources injured by the DWH oil spill. The project would provide habitat for various ecologically and economically important species, including birds, fish, and crabs.
Health and safety	The Texas TIG does not anticipate impacts to public health and safety. The wetland restoration in this project creates buffers to storm surge and damage to adjacent natural areas and improves water quality in the area.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.3 Guadalupe River Old Delta Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds. However, there is a prior dispute over ownership of portions of the site. It is unclear what the costs would be to determine ownership, gain access to the site, and obtain approval to perform the project.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would restore and conserve wetlands and coastal habitats and restore current low elevation, open-water habitat to reference marsh elevations. This project would restore up to 1,140 acres of wetland complex, including intertidal wetland elevations, a habitat injured by the DWH oil spill.
Likelihood of success	Texas Trustee agencies have successfully implemented marsh restoration projects in nearby locations using BUDM as a marsh restoration technique. However, as there is a prior dispute over the ownership of portions of this site, it is uncertain whether the Trustees would be able to implement this project as described, in a timely fashion.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	The project would restore and conserve wetland habitat and maximize ecological functions for a range of resources injured by the DWH oil spill. The wetland habitat would be beneficial to important fauna such as birds, fish, crabs, and many other benthic species.
Health and safety	The Texas TIG does not anticipate adverse impacts because measures will be taken to avoid impacting public health and safety. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation, this project was identified as a non-preferred restoration alternative due to a prior dispute over the ownership of portions of the property. As a result, the cost-effectiveness and likelihood of success are uncertain.	

3.4.4 Lower Neches WMA Old River Unit Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would create vegetated wetland habitat. This project would restore up to 224 acres of intertidal marsh, a habitat that was injured as a result of the DWH oil spill.
Likelihood of success	The Texas TIG anticipates this project would have a high likelihood of success because the Texas TIG agencies have successfully implemented marsh restoration projects in nearby locations using similar techniques.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	The intertidal wetland elevations would be restored, increasing wetland vegetation and habitat for fish, invertebrates, and birds. The project's benefits would be provided for many resources injured by the DWH oil spill.
Health and safety	The Texas TIG does not anticipate adverse impacts because measures will be taken to avoid impacts to public health and safety. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.5 McFaddin NWR Willow Lake Terraces Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would restore and conserve wetlands and coastal habitats. This project would restore up to 218 acres of intertidal marsh, a resource that was injured in the DWH oil spill.

OPA NRDA Evaluation Standard	Evaluation
Likelihood of success	The Texas TIG anticipates this project would have a high likelihood of success because the Texas TIG agencies have successfully implemented similar marsh restoration projects in nearby locations.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	Benefits among multiple resources, such as wetlands habitat that provides for birds, fish, and crabs, would be increased through this project. This restoration project would maximize ecological functions for a range of resources injured by the DWH oil spill.
Health and Safety	Measures in the final design would be taken to avoid adversely impacting public health and safety, and the Texas TIG does not anticipate adverse impacts. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.6 San Bernard NWR Sargent Oil Field Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would allow the marshes to return to a sustainable and productive estuarine wetland. This project would restore up to 200 acres of intertidal marsh, a resource that was injured in the DWH oil spill.
Likelihood of success	The Texas TIG anticipates this project would have a high likelihood of success due to the successful implementation of marsh restoration projects using similar techniques.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	Beyond restoring and conserving wetlands, coastal, and nearshore habitat, this restoration project would maximize ecological functions for the range of resources injured by the DWH oil spill. The project would provide habitat for various ecologically and economically important birds, fish, and crabs.

OPA NRDA Evaluation Standard	Evaluation
Health and safety	The Texas TIG does not anticipate impacts on public health and safety because the final design plan of this project would include specifications to avoid negative impacts. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.7 Schicke Point Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project would restore intertidal wetland elevations; increase native coastal wetland vegetation; and provide habitat for fish, invertebrates, and resident and migratory birds. This project would restore up to 72 acres of intertidal marsh, a resource that was injured from the DWH oil spill.
Likelihood of success	The Texas TIG anticipates this project would have a high likelihood of success. This project would be modeled on the efforts used in past restoration projects in nearby locations.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	The project would restore and conserve wetland habitat and maximize ecological functions for a range of resources injured by the DWH oil spill. The wetland habitat would be beneficial to important fauna such as birds, fish, crabs, and many other benthic species.
Health and safety	The Texas TIG does not anticipate impacts to public health and safety. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.4.8 Texas Point NWR Wetland Restoration

OPA NRDA Evaluation Standard	Evaluation
Cost-effectiveness	The BUDM Project Fund would be used for project implementation, including final design, remaining permitting needs, site planting, incremental costs, project monitoring, and oversight. Due to the cost efficiency of BUDM described in Section 3.2, the Texas TIG concludes that for the eight evaluated alternatives, BUDM is cost-effective to restore injured resources through the Wetlands, Coastal, and Nearshore Restoration Type funds.
Goals and objectives	This project is consistent with the Texas TIG goals and objectives and meets the Trustee programmatic restoration goals and restoration-type-specific goals as described in the Final PDARP/PEIS. This project aims to restore intertidal wetland elevations; increase native coastal wetland vegetation; and provide habitat for fish, invertebrates, and resident and migratory birds. This project would restore up to 623 acres of intertidal marsh, a resource that was injured from the DWH oil spill.
Likelihood of success	The Texas TIG anticipates this project would have a high likelihood of success due to the successful implementation of marsh restoration projects using similar techniques.
Avoid collateral injury	Best practices, conservation measures, and design modifications to avoid and minimize impacts identified during the permitting process or during consultations and reviews with natural resource agencies would be implemented. Also, best practices described in Appendix 6.A of the Final PDARP/PEIS would be followed, as appropriate, to reduce or eliminate environmental impacts.
Benefits	Beyond restoring and conserving wetlands, coastal, and nearshore habitat, this restoration project would maximize ecological functions for the range of resources injured by the DWH oil spill. The project would provide habitat for various ecologically and economically important birds, fish, and crabs.
Health and safety	The Texas TIG does not anticipate impacts to public health and safety. The creation of marsh can benefit public safety by promoting water quality and buffering storm surges.
Summary: Based on the OPA evaluation of the cost-effectiveness, goals/objectives, likelihood of success, benefits, and health and safety standards, this project was identified as a preferred restoration alternative.	

3.5 Natural Recovery/No Action

Pursuant to the OPA NRDA regulations, the Final PDARP/PEIS considered “a natural recovery alternative in which no human intervention would be taken to directly restore injured natural resources and services to baseline” (15 C.F.R. § 990.53(b)(2)). Under a Natural Recovery alternative, no additional restoration would be implemented by the Texas TIG to accelerate the recovery of Wetlands, Coastal, and Nearshore Habitat in the Texas Restoration Area using DWH NRDA funding.

Given that technically feasible restoration approaches are available to compensate for natural resource and service losses, the DWH Trustees rejected the Natural Recovery alternative under the OPA evaluation within the Final PDARP/PEIS. Based on this determination, tiering this RP/EA #3 from the Final PDARP/PEIS and incorporating that analysis by reference, the Texas TIG did not further evaluate Natural Recovery as a viable alternative under OPA, and it is not considered a reasonable alternative. Natural Recovery is not considered further in this RP/EA #3.

A No Action Alternative is evaluated in Appendix A of this document as a basis for comparison of potential environmental consequences in the NEPA context.

3.6 OPA NRDA Evaluation Conclusions

As described in Section 3.4, the Texas TIG conducted an OPA NRDA evaluation for each project included in the reasonable range of alternatives for this RP/EA #3. All of the projects evaluated in this RP/EA #3 would use proven techniques that have a high likelihood of success, and their cost effectiveness would be optimized by reliance on BUDM. The proposed restoration approach is consistent with the goals and objectives for the Wetlands, Coastal, and Nearshore Habitats Restoration Type as described in the Final PDARP/PEIS. These projects would provide benefits to multiple species by creating or restoring habitat, and collateral injury would be reduced or eliminated through adherence to relevant best practices, conservation measures, and design modifications. The Texas TIG does not anticipate that any of these projects would have adverse impacts to public health and safety; rather, the projects would provide benefits through improving water quality and buffering storm surges. However, one project, Guadalupe River Old Delta Wetland Restoration, has less certainty of success and cost-effectiveness owing to the prior dispute over the ownership of portions of the property necessary to implement the project. For that reason, that project is not preferred for implementation at this time. The Texas TIG's identification of preferred alternatives is based on this evaluation and informed by the NEPA analysis presented in Appendix A and summarized in Chapter 4.

4 Environmental Assessment

4.1 Overview of NEPA Approach

Under NEPA (42 U.S.C. § 4321 et seq.) and its implementing regulations (40 C.F.R. §§ 1500 through 1508), federal agencies must consider the reasonably foreseeable effects that a proposed action may have on the physical and biological environment and related social and economic effects before funding, authorizing, or implementing an action. This integrated OPA/NEPA document was prepared in accordance with NEPA and its amendments under the Fiscal Responsibility Act of 2023 and the Phase 2 Regulation Revisions to NEPA that became effective July 1, 2024. As such, NEPA conclusions presented herein are informed by the NEPA Supporting Documentation Report in Appendix A.

The NEPA analysis describes the affected environment and associated environmental consequences for each project in the reasonable range of alternatives. A No Action Alternative is also analyzed as a benchmark. The NEPA Supporting Documentation Report (Appendix A) is consistent with the PDARP/PEIS, which is incorporated by reference, and tiers where applicable. Resources analyzed and impact definitions (minor, moderate, and major) in Appendix D align with those described in the Final PDARP/PEIS (DWH NRDA 2016).

To determine whether an action has the potential to result in significant impacts, the context and intensity of the proposed action are considered. Context refers to the area of impacts (i.e., local or statewide) and duration (i.e., whether they are short or long term). Intensity refers to the severity of impact and could include the timing of the action (e.g., more intense impacts would occur during critical periods like high visitation or wildlife breeding/rearing). Intensity is also described in terms of whether the impact would be beneficial or adverse. “Adverse” is used in Appendix A and this chapter only to describe the Texas TIG’s evaluation under NEPA. This term is defined and applied differently in consultations pursuant to the Endangered Species Act of 1973 (ESA) and other protected resource statutes. The analysis in this RP/EA #3 characterizes adverse impacts as short- or long-term and minor, moderate, or major. The analysis of beneficial impacts focuses on the duration (short- or long-term) and does not attempt to specify the intensity of the benefit (Appendix D).

The NEPA Supporting Documentation Report provided in Appendix A and the conclusions provided in this chapter address indirect, direct, and cumulative impacts for each alternative. The analysis in this RP/EA #3 incorporates by reference relevant evaluations of the environmental consequences from Section 6.4.1.1 (Create, Restore, and Enhance Coastal Wetlands) of the Final PDARP/PEIS. Section 2.3 provides project descriptions for each alternative. Further, brief project descriptions focusing on activities that would result in environmental impacts are provided in Appendix A.

To streamline the NEPA evaluation process and present a concise document that provides sufficient evidence and analysis for determining whether to prepare an environmental impact statement or a Finding of No Significant Impact, and to aid the Texas TIG’s compliance with NEPA and its implementing regulations (40 C.F.R. §§ 1506.3, 1508.9), relevant information from previous environmental analyses, existing plans and studies, and the Final PDARP/PEIS have been incorporated by reference. Agencies should “focus on significant environmental issues” and, for issues that are not significant, there should be “only enough discussion to show why more study is not warranted” (40 C.F.R. §§ 1502.1(b), 1502.2(b)). All documents used to conduct the NEPA analyses are incorporated by reference and available in the administrative record, and links are provided in the environmental consequences discussion, where applicable.

4.2 Consistency with the Final PDARP/PEIS

The NEPA analysis in this RP/EA #3 tiers from the Final PDARP/PEIS, where applicable (40 C.F.R. § 1501.11). To ensure compliance with the Fiscal Responsibility Act of 2023 (42 U.S.C. Sec. 108 § 4336(b)(1)(2), Public Law 118-5 (2023)) and 40 C.F.R. § 1501.11 in the preparation of this RP/EA #3, the DWH Federal Trustees of the Texas TIG re-evaluated the Final PDARP/PEIS analysis and its underlying assumptions and confirmed its continued validity. Specifically, the Federal Trustees of the Texas TIG compared their assessment of each project's anticipated impacts on each resource analyzed with the impact intensity definitions (short- or long-term, and minor, moderate, or major) found in Table 6.3-2 of the Final PDARP/PEIS (and in this RP/EA #3 as Appendix D), the impacts that the Final PDARP/PEIS forecasted for preliminary phases of restoration planning (Section 6.4.14), and the restoration approaches and techniques to create, enhance, or restore coastal wetlands (Section 6.4.1.1) proposed in this RP/EA #3.

The Final PDARP/PEIS found that the types of activities proposed in this RP/EA #3, which utilizes approaches and techniques to create, enhance, or restore coastal wetlands, would be likely to cause environmental consequences, as discussed in the sections below.

4.2.1 Physical Resources

Short-term, minor adverse impacts on geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise could occur during the construction phase. For example, short-term impacts could result from the use of staging areas (e.g., causing water turbidity from sediment disturbance) and construction equipment (e.g., releasing emissions causing adverse air quality and noise impacts from the operation of machinery). Short-term adverse impacts would be minimized by implementing best practices. Long-term, minor adverse indirect impacts on the physical environment could occur from the construction of sediment containment levees, and the placement of dredged material in shallow water areas, which may affect sediment dynamics. Placement of materials (e.g., dredged material or riprap) would result in long-term, but localized, adverse impacts to the existing substrate. Hydrology also may be affected where tidal connectivity is modified per project design. However, projects would typically require implementation of best practices to minimize or avoid adverse impacts. Best practices, such as silt curtains, buffer zones, and water quality monitoring, would be used to minimize such effects. This approach will benefit wetlands and other shoreline habitats by raising substrate elevations affected by subsidence and sea level rise and re-establishing natural hydrology needed to restore the function of coastal wetland communities. Reconnecting coastal wetlands to freshwater sources and/or tidal flooding will restore the natural hydrology of these habitats. This would re-establish natural estuarine salinity gradients and could maintain and improve coastal water quality, benefiting other coastal habitats and resources. This approach also helps stabilize substrates, which increases the resilience of coastal wetlands to sea level rise and reduces coastal erosion. This approach supports linkages within the broader coastal and nearshore ecosystem by restoring the natural movement of water, sediments, energy, and nutrients among habitats. Long-term benefits to hydrology and coastal resilience are anticipated as a result of increasing upland areas and providing buffer for storm surges.

4.2.2 Biological Resources

Depending on the techniques implemented, short-term, minor to moderate adverse impacts to the biological environment could occur during construction activities related to 1) disturbance to wetland vegetation during construction and 2) displacement of land-based or aquatic faunal species resulting from staging equipment and materials, as well as entrapment of marine mammals. Long-term, minor to moderate impacts could include conversion of one wetland vegetation type to another (e.g., saline vegetation to more freshwater vegetation) with changes in the distribution of fauna communities. Some applications of this approach could also result in localized, permanent, adverse impacts to shallow intertidal or subtidal habitat—such as that for submerged aquatic vegetation or oysters, for instance, if fill is placed in areas to create marsh. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts. This approach would provide long-term benefits for many ecologically and economically important animals, including fish, shrimp, shellfish, birds, sea turtles, marine mammals, and terrestrial mammals in the form of food, shelter, breeding, and nursery habitat. Many of the species that directly use coastal marshes and mangroves as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open ocean ecosystems through the movement of animals that use wetlands during their life cycle to grow and reproduce. Projects implementing these techniques would be designed to maximize ecological benefits to animals that depend on coastal wetland habitats.

4.2.3 Socioeconomic Resources

Indirect adverse impacts in the immediate area could occur during construction through 1) limits on recreational activities near the construction area to protect public safety; 2) temporary increases in road traffic due to movement of construction vehicles; and 3) adverse effects on aesthetics due to the presence of construction equipment, sediment containment levees, or other changes to the surrounding environment. Implementation of this approach at national, state, and local parks; wildlife refuges; and WMAs could result in short-term, minor adverse impacts to land and marine management due to temporary partial or full closure of areas, public access restrictions, and/or interruption of interpretive programs. Long-term benefits for the public are anticipated as a result of the restoration approach. This approach may provide long-term benefits to recreationists through increased opportunities for wildlife viewing, kayaking, canoeing, hunting, fishing, and other recreational activities. Additional indirect benefits could include increased fishing opportunities (both commercial and recreational), from restoring coastal habitats that benefit fish. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures. This approach may increase property values adjacent to a project site if aesthetics are improved. Improvements in water quality resulting from increased water filtration from these activities could also contribute long-term benefits to public health. Construction of wetland restoration and enhancement activities could provide benefits to coastal populations and infrastructure through improved flood and shoreline protection. This benefit is particularly effective for low-energy storm events. Creating, enhancing, or restoring coastal wetlands could result in minor (i.e., temporary disturbance) to moderate (i.e., disturbance without loss of cultural information) impacts on cultural and historic resources due to construction activities such as dredging, addition of sediments or borrow materials, and/or removal of sediments, depending on the scale of the action and site-specific characteristics. Adverse impacts could include physical destruction or alteration of resources and may alter, damage, or destroy resources such as historic shipwrecks, engineering structures or landscapes, or connectivity with related sites. The Office of Coast Survey's Automated Wreck and Obstruction Information System database and other relevant studies are available for identification of submersed resources for individual projects. Discovery or recovery of cultural or historic resources would allow their future protection. The DWH Federal Trustees of the Texas TIG found that the resource impacts as forecasted in the Final PDARP/PEIS are consistent with the impacts anticipated from the projects analyzed in this RP/EA #3, and thus, the Texas

TIG affirms the applicability of the Final PDARP/PEIS's NEPA analysis to this RP/EA #3. Additional analysis regarding the specific activities proposed in this RP/EA #3 is found in Appendix A.

4.3 Overview of Affected Texas Coastal Environments

As displayed in Figure 1-1, this RP/EA #3 analyzes eight alternatives, spanning from Jefferson County (east of Houston) to Aransas County (just north of Corpus Christi), and in coastal waters. These alternatives are part of the Gulf Prairies and Marshes Ecoregion, which is characterized by barrier islands, salt grass marshes surrounding bays and estuaries, remnant tallgrass prairies, oak parklands and oak mottes scattered along the coast, and tall woodlands in the river bottomlands (TPWD 2024a). Marshes in the affected area provide habitat for a variety of wildlife (e.g., migratory birds and fish), serve as buffers against storm surge, and filter pollutants from freshwater runoff (TPWD 2024b). Additionally, these ecosystems support local economies through tourism and benefit commercial fisheries and commerce. The impact of sea level rise, erosion, subsidence, and reduced sediment supplies have resulted in significant and unprecedented land loss in these ecologically important habitats. Further details on resources specific to each particular project are described in the Affected Environment sections of Appendix A.

Additionally, the Texas TIG previously described areas included in the affected environment for the eight alternatives in this restoration plan and incorporates by reference the affected environment information from the Final PDARP/PEIS (DWH NRDA Trustees 2016), *Deepwater Horizon Oil Spill Regionwide Trustee Implementation Group Final Restoration Plan/ Environmental Assessment 1: Birds, Marine Mammals, Oysters, and Sea Turtles* (RW RP/EA #1; Regionwide Trustee Implementation Group 2021), and RP/EA #2, as well as the Coastal Texas Protection and Ecosystem Restoration Feasibility Study: Final Environmental Impact Statement (USACE and GLO 2021). The Texas TIG reviewed and determined that this information remains relevant to the current NEPA analysis.

4.4 Summary of Environmental Consequences

Analysis of environmental consequences for each alternative in this RP/EA #3 is included in Appendix A. Table 4-1 summarizes direct and indirect impacts of each alternative and the No Action Alternative. The environmental analysis demonstrated that there would primarily be minor, but some moderate, short- and long-term adverse impacts and environmental benefits from implementation of the RP/EA #3 alternatives.

In general, implementation of the RP/EA #3 alternatives would result in short-term, minor adverse impacts to physical resources, including geology and substrates and hydrology and water quality associated with increased turbidity during sediment removal and placement of dredged material. There would also be short-term, minor adverse impact to air quality and GHG emissions and noise from the operation of construction machinery and activities.

There would be minor long-term adverse effects to geology and substrates and hydrology and water quality associated with the placement of dredged sediment for implementation. All the alternatives in this RP/EA #3 would benefit wetlands and coastal habitats by beneficially using dredged material to create viable, vegetated wetland habitat for a variety of local wildlife and would contribute to coastal resiliency by rebuilding wetlands to create buffers against storm surge damage to adjacent natural areas.

Biological resources would primarily experience short-term, minor-to-moderate adverse impacts from human- and construction-related disturbance (e.g., foot traffic or human presence) associated with project construction. Overall, biological resources would also experience long-term benefits from wetland restoration and creation.

The Texas TIG has not fully completed environmental compliance reviews with relevant regulatory agencies regarding potential adverse impacts to protected species and habitats for each preferred alternative. However, as shown in Table 5-1, all consultations are in progress and anticipated to be completed before this plan is finalized. Implementing Trustees would conduct due diligence to ensure that no unanticipated effects to listed species and habitats would occur. Adverse impacts would be minimized by following mitigation measures and other guidance developed during environmental reviews, consultation and permitting processes, and other relevant regulatory requirements. The Texas TIG would also consider best practices referenced in Section 3.3 of this RP/EA #3 and Appendix 6.A of the Final PDARP/PEIS (DWH NRDA Trustees 2016).

For socioeconomic resources, the RP/EA #3 alternatives would result in short-term, minor adverse impacts to tourism and recreation, fisheries and aquaculture, and public health and safety. Short--term, minor-to-moderate adverse impacts to aesthetics and visual resources could occur. Minor short-term adverse impacts to tourism and recreation may be attributed to temporary inaccessibility during construction for activities such as birding, hiking, and fishing. Temporary turbidity during dredged material placement may have short-term, minor adverse impacts to fisheries and, therefore, displace subsistence fishers, and short-term minor-to-moderate adverse impacts during construction to visual scenery and aesthetics. Machinery present during construction, as well as active construction sites, may cause short-term, minor adverse impacts to public health and safety. No long-term adverse impacts are anticipated. Furthermore, most projects in this RP/EA #3 would result in short- and long-term benefits to socioeconomic resources (in particular, socioeconomics, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety) as a result of restoration of coastal and wetland habitats. Enhancing wetlands increases appeal to tourists and creates a more desirable destination for activities such as birding, hiking, and wildlife viewing. RP/EA #3 alternatives are not expected to result in impact to populations with special vulnerabilities (e.g., preexisting health conditions that exceed norms among the general population) or unique routes of exposure (e.g., use of surface water or well water in rural communities).

Initial review of Texas Historical Commission cultural and historical resources database (Texas Historical Commission 2024) indicates that no known historic sites or significant cultural, scientific, or historic resources exist within the boundaries of the project areas. No adverse impacts to cultural resources are anticipated as a result of the projects. For each project selected for implementation under the Final RP/EA #3, a comprehensive review under Section 106 of the National Historic Preservation Act (NHPA) would be completed before any project activities began, to develop practices that avoid, minimize, or mitigate adverse effects on historic properties within the project area. The projects would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

The No Action Alternative is anticipated to result in long-term, moderate-to-major adverse impacts to physical and biological resources from continued erosion and coastal flooding, continued wetland habitat degradation and fragmentation, and conversion of wetlands to open water. Continued wetland degradation, erosion, and land loss would also result in long-term, minor impacts to socioeconomic resources including infrastructure, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety

Table 4-1 Summary of the Direct and Indirect Impacts of the Reasonable Range of Restoration Alternatives

Project	Geology and Substrates	Hydrology and Water Quality	Air Quality and GHG Emissions	Noise	Habitats	Wildlife Species	Marine and Estuarine Resources	Protected Species	Socioeconomics and EJ	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Land and Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety
No Action	L	L	NE	NE	L	L	L	L	NE	NE	l	l	l	l	NE	l	l
Anahuac NWR Roberts Mueller Tract Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Goose Island Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Guadalupe River Old Delta Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Lower Neches WMA Old River Unit Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
McFaddin NWR Willow Lake Terraces Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
San Bernard NWR Sargent Oil Field Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Schicke Point Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Texas Point NWR Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE

Notes:
+: beneficial effect
l: long-term, minor adverse effect
L: long-term, moderate-to-major adverse effect
NE: no adverse effect
s: short-term, minor adverse effect
s*: short-term, minor-to-moderate effect
S: short-term, moderate-to-major adverse effect

5 Compliance with Other Environmental Laws and Regulations

In addition to the requirements of the OPA and NEPA, other federal laws may apply to the preferred alternatives considered in this RP/EA #3. Legal authorities applicable to restoration alternative development were fully described in the context of the DWH restoration planning in the Final PDARP/PEIS, Section 6.9 Compliance with Other Applicable Authorities and Appendix 6.D Other Laws and Executive Orders. That material is incorporated by reference here.

The Texas TIG will ensure compliance with all applicable federal, state, and local laws and regulations relevant to the proposed restoration alternatives. Compliance for protected species and their habitats under the ESA, Magnuson-Stevens Act, which defines Essential Fish Habitat, and the Marine Mammal Protection Act, will be completed prior to project implementation. In addition, compliance with Section 404 of the Clean Water Act (CWA), Section 10 of the Rivers and Harbors Act (RHA), and Section 103 of the Marine Protection, Research, and Sanctuaries Act (MPRSA), where applicable, as well as technical assistance reviews for cultural resources under the NHPA, and compliance with the Coastal Zone Management Act (CZMA), will also be completed prior to project implementation for the preferred alternatives.

The current compliance status for each preferred alternative at the time of this RP/EA #3 is provided in Table 5-1. The status of each statute by project is sorted into the following categories:

- Complete (C): indicates that the requirements have been met and a response was received from the appropriate agency(ies)
- In Progress (IP): indicates that the compliance reviews have been requested or are in the process of being requested, but an answer has not yet been received from the regulatory agency(ies)
- Not Applicable (N/A): indicates that the statute is not applicable to a preferred alternative, often due to the scope and/or location of the activities to be carried out under the alternative

Projects involving in-water work may require authorization pursuant to Section 404 of the CWA, Section 10 of the RHA, and Section 103 of the MPRSA, where applicable. Any work in waters of the United States, including wetlands, associated with the preferred alternatives will be coordinated with USACE, and final authorization pursuant to Section 404 of the CWA, Section 10 of the RHA, and Section 103 of the MPRSA, where applicable, will be completed prior to construction.

Wherever existing consultations or permits are present, they will be reviewed prior to construction to determine if the consultations/permits are still valid or if re-initiation of any consultations or permits are necessary. Implementing Trustees will implement alternative-specific implementation measures (i.e., best practices) identified in this RP/EA #3, biological evaluation form requirements, and completed consultations/permits. Oversight, provided by the Implementing Trustees, would include due diligence to ensure that no unanticipated effects to listed species and habitat occur, including ensuring that best practices are implemented and continue to function as intended. Pursuant to the CZMA, federal activities must be consistent with the federally approved coastal management programs for states where the activities would affect a coastal use or resource. The lead Federal Trustee is submitting consistency determinations for state review coincident with public review of this document.

Federal environmental compliance responsibilities and procedures will follow the Trustee Council's SOPs, specifically Section 9.4.6 (DWH NRDA Trustees 2021a). The Implementing Trustee for each preferred alternative will ensure the status of environmental compliance is tracked through DIVER. The Implementing Trustee will keep a record of compliance documents and ensure the documents are submitted for inclusion in the Administrative Record. Additional information specific to each preferred alternative regarding environmental compliance requirements and their status is provided in Table 5-1.

5.1 Additional Federal Laws and Executive Orders

Additional laws or federal executive orders (EO) that may be applicable include, but are not limited to, the following:

- Endangered Species Act (16 U.S.C. § 1531 *et seq.*)
- Magnuson-Stevens Fishery Conservation and Management Act, as amended (16 U.S.C. § 1801 *et seq.*)
- Marine Mammal Protection Act (16 U.S.C. § 1361 *et seq.*)
- Coastal Zone Management Act (16 U.S.C. § 1451 *et seq.*)
- National Historic Preservation Act (16 U.S.C. § 470 *et seq.*)
- Coastal Barrier Resources Act (16 U.S.C. § 3501 *et seq.*)
- Migratory Bird Treaty Act (16 U.S.C. § 703 *et seq.*)
- Bald and Golden Eagle Protection Act (16 U.S.C. § 668 *et seq.*)
- Clean Air Act (42 U.S.C. § 7401 *et seq.*)
- Federal Water Pollution Control Act (33 U.S.C. § 1251 *et seq.*)
- Rivers and Harbors Act (33 U.S.C. § 401 *et seq.*)
- Marine Protection, Research, and Sanctuaries Act (16 U.S.C. § 1431 *et seq.,* 33 U.S.C. § 1401 *et seq.*)
- Estuary Protection Act (16 U.S.C. §§ 1221–26)
- Archaeological Resource Protection Act (16 U.S.C. §§ 470aa–470mm)
- National Marine Sanctuaries Act (16 U.S.C. § 1431 *et seq.*)
- Farmland Protection Policy Act (7 U.S.C. §§ 4201–09)
- EO 11988: Floodplain Management (as augmented by EO 13690), as amended
- EO 11990: Protection of Wetlands, as amended
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, as amended
- EO 12962: Recreational Fisheries, as amended
- EO 13112: Safeguarding the Nation from the Impacts of Invasive Species, as amended
- EO 13175: Consultation and Coordination with Indian Tribal Governments
- EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- EO 13693: Planning for Federal Sustainability in the Next Decade
- EO 13985: Advancing Racial Equity and Support for Underserved Communities Through the Federal Government

- EO 13990: Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis
- EO 14008: Tackling the Climate Crisis at Home and Abroad
- EO 14072: Strengthening the Nation's Forests, Communities, and Local Economies
- EO 14096: Revitalizing Our Nation's Commitment to Environmental Justice for All

5.2 State Laws

State laws may apply to the proposed preferred alternatives considered in this RP/EA #3. The Texas TIG will ensure compliance with all applicable state laws and regulations relevant to the proposed restoration alternatives. Potentially applicable state laws may include, but are not limited to, the following:

- Texas Natural Resources Code (TNRC)
- Coastal Public Lands Management Act (TNRC § 33.001 *et seq.*)
- Dune Protection Act (TNRC § 63.001 *et seq.*)
- Open Beaches Act (TNRC § 61.001 *et seq.*)
- Texas Parks and Wildlife Code
- Texas Water Code
- Texas Health and Safety Code

Table 5-1 Current Status of Federal Regulatory Compliance Reviews and Approvals of Preferred Alternatives at Release of This RP/EA #3

Preferred Alternative	Coastal Zone Management Act (CZMA)	Endangered Species Act – Section 7 (ESA; NMFS)	Endangered Species Act – Section 7 (ESA; USFWS)	Magnuson-Stevens Act (EFH; NMFS)	Marine Mammal Protection Act (MMPA; NMFS)	Marine Mammal Protection Act (MMPA; USFWS)	National Historic Preservation Act (NHPA)	River and Harbors Act (RHA) /Clean Water Act (CWA)	Bald and Golden Eagle Protection Act (BGEPA; USWFS)	Migratory Bird Treaty Act (MBTA; USFWS)	Coastal Barrier Resources Act (CBRA; USFWS)
Anahuac NWR Roberts Mueller Tract Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP
Goose Island Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP
Lower Neches WMA Old River Unit Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP
McFaddin NWR Willow Lake Terraces Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP
San Bernard NWR Sargent Oil Field Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP
Schicke Point Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	N/A
Texas Point NWR Wetland Restoration	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP	IP

Notes:
C: complete
IP: in progress
N/A: not applicable

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Appendix A National Environmental Policy Act Supporting Documentation

This appendix contains the National Environmental Policy Act (NEPA) supporting documentation for the reasonable range of alternatives and informs the NEPA summary presented in Chapter 4. This environmental analysis includes evaluation of a No Action alternative for comparative purposes. The following analysis provides the site-specific affected environment for each project (alternative) evaluated, including the No Action alternative, and a discussion of environmental consequences. The appendix is organized as follows.

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A.1 Incorporation by Reference of Previous NEPA Analyses

This section summarizes existing environmental analyses that relate to the proposed actions in this *Draft Restoration Plan/Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats* (RP/EA #3). These summaries provide supplemental information on resources of the affected environments and environmental consequences associated with actions related to the activities proposed in this RP/EA #3, such as beneficial use of dredged material (BUDM) in coastal restoration projects.

The projects in this plan rely on BUDM, and the analyses of material placement in sections A.3.1 through A.3.8 focus solely on the sites where material would be placed. The U.S. Army Corps of Engineers (USACE) has prepared environmental analyses of the anticipated impacts of the dredging of the material proposed for placement at the sites considered in this plan. This section summarizes the pertinent environmental analyses of those dredging activities connected to the BUDM projects proposed in this plan.

USACE is responsible for maintaining the Gulf Intracoastal Waterway (GIWW) from Sabine Pass (Texas-Louisiana border) south to the Brownsville Ship Channel (Texas-Mexico border). In addition, there are multiple deep-draft and shallow-draft navigation channels maintained by USACE within the study area, including the Sabine-Neches Water Way (SNWW), the Houston Ship Channel (HSC), the Galveston Ship Channel, and the Matagorda Ship Channel (MSC). Shallow-draft channels in the study area include the GIWW from Port Arthur to High Island, GIWW from High Island to Matagorda Bay, GIWW from Corpus Christi to Matagorda Bay, Palacios Channel, tributaries to the HSC, and the San Bernard River Channel. The following are summaries of existing NEPA Analyses for USACE navigation dredge projects related to the eight alternatives included within this RP/EA #3.

A.1.1 Final EIS for SNWW Channel Improvement Project Southeast Texas and Southern Louisiana

The SNWW is an approximately 64-mile federally authorized and maintained waterway located in Jefferson and Orange counties in southeast Texas and Cameron Parish, Louisiana. The deep-draft portion of the authorized federal project generally provides for a channel 42 feet deep and 800 feet wide at the entrance to the Gulf of Mexico, a channel 40 feet deep and 500 feet wide to Port Arthur, and a channel depth of 40 feet Mean Lower Low Water (MLLW) and 400 feet wide to Beaumont by way of the Neches River. Authorization for deepening the SNWW to 48 feet MLLW was included in the Water Resources and Reform Development Act of 2014.

The Final Environmental Impact Statement (EIS) for SNWW Channel Improvement Project (CIP) Southeast Texas and Southwest Louisiana (USACE 2011) was prepared as required by NEPA to present an evaluation of potential impacts of the proposed SNWW CIP. The proposed SNWW CIP is intended to improve the efficiency of the deep-draft navigation system to a depth of 48 feet MLLW while protecting the area’s environmental resources. The Final EIS addressed the potential direct, indirect, and cumulative impacts of the proposed project on the human environment, as identified during the public interest review, including placement of dredged material. All factors that may be relevant to the proposed project were considered, including plans for construction and operations; dredged material management and opportunities for beneficial uses; hydrology, salinity, and storm surges; terrestrial and aquatic habitats; endangered species; essential fish habitat (EFH); hazardous materials; air quality; shoreline erosion; cultural resources; socioeconomic considerations; safety; and economic effects.

A.1.2 MSC Improvement Project Feasibility Report and Final EIS

The 26-mile existing Federal MSC is located 125 miles southwest of Galveston, Texas, and 80 miles northeast of Corpus Christi, Texas. The channel extends from offshore in the Gulf through Matagorda Bay and Lavaca Bay to the Port. The MSC CIP would deepen the main channel to -47 feet MLLW, deepen the entrance channel to -49 feet MLLW, widen the main channel bottom width to 300 feet, and widen the entrance channel bottom width to 550 feet.

The purpose of the MSC Improvement Project Feasibility Report and Final EIS (USACE 2019) was to evaluate federal interest in alternative plans (including the No Action Plan) for reducing transportation costs while providing for safe, reliable navigation of the MSC. The study also assessed the effects of the alternatives on the natural system and human environment, including the economic development effects of existing inefficiencies. The MSC dredged material management plan (DMMP) addressed the dredging needs, disposal capabilities, capacities of placement areas, environmental compliance requirements, potential for BUDM, and indicators of continued economic justification. The MSC DMMP will be updated periodically to identify any potentially changed conditions. The MSC DMMP identifies specific measures necessary to manage the volume of material likely to be dredged over a 50-year period from both construction and maintenance dredging.

A.1.3 Final EIS Coastal Texas Protection and Restoration Feasibility Study

The Coastal Texas Protection and Ecosystem Restoration Feasibility Study was completed to determine the feasibility of constructing coastal storm risk management and ecosystem restoration features using a multiple lines of defense strategy along the Texas coast. The project feature selection process resulted in six coastal storm risk management options and nine large-scale ecosystem restoration features that were evaluated for engineering, economic, and environmental viability and reviewed under NEPA to determine feasibility for Congressional consideration. The Final EIS Coastal Texas Protection and Restoration Feasibility Study (USACE 2021) employs a tiered-NEPA approach in which full environmental compliance with NEPA and environmental laws has been demonstrated for “actionable measures,” which primarily consist of ecosystem restoration actions where the impacts and designs are well understood and minimal changes are anticipated during the preconstruction engineering and design phase.

A.1.4 GIWW Coastal Resiliency Study-Draft Integrated Feasibility Report and Environmental Assessment

The project area encompassed 85 miles of the Texas portion of the GIWW in Brazoria and Matagorda counties, which was divided into 20 zones for detailed analysis according to geography and ecology. The Gulf Intracoastal Waterway Coastal Resiliency Study – Draft Integrated Feasibility Report and Environmental Assessment (USACE 2022) addressed three main issues within the navigation channel: 1) the chronic and episodic coastal storm erosion of the shorelines and barrier islands that have historically protected vessels on the GIWW; 2) sea level rise and continued hurricanes and tropical storms that will likely exacerbate the loss of barriers around the channel; and 3) sediment carried by coastal storms from eroded shorelines and shoals in the channel leading to light-loading and unintentional groundings of vessels resulting in navigation safety risks.

The purpose of the study was to investigate and determine modifications that would: increase system resilience, improve navigability and navigation safety, reduce overall dredging and structure maintenance, reduce commercial transit delays and accidents; and enhance regional sediment management practices along the GIWW. The study evaluated alternatives that would benefit the GIWW navigation system by reducing ongoing shoreline erosion and shoaling in the channel and mitigating impacts of periodic coastal storms. Considerations of ecosystem restoration or damage reduction benefits are incidental to the primary navigation purpose of the GIWW. Analyses focused on identifying causes of transportation service interruptions or capacity reductions; reaches most vulnerable to effects of erosion, shoaling, storm damages; changes due to relative sea level rise; local sediment resources that have the potential for BUDM (e.g., used to restore degraded sandbars, islands, and wetlands); methods to reduce impacts of currents and wind fetch on navigation through restoration of coastal features; and high shoaling areas that require significant expenditures for operations and maintenance (O&M), such as dredging.

A.1.5 GIWW BUDM – Aquatic Ecosystem Restoration for Gulf Intracoastal Waterway – Beneficial Use of Dredged Material, Aransas County, Texas, Detailed Project Report and Environmental Assessment Continuing Authorities Program Section 204A

The tentatively selected plan (project) in the Aquatic Ecosystem Restoration for Gulf Intracoastal Waterway – Beneficial Use of Dredged Material, Aransas County, Texas, Detailed Project Report and Environmental Assessment Continuing Authorities Program Section 204 (USACE 2024a) aligns with the objectives and scope of the Goose Island Wetland Restoration project described in this RP/EA #3. This project seeks to beneficially use material dredged from the nearby GIWW to restore habitat and capture ecological output through beneficially placing O&M material in areas degraded from coastal and navigational forces over time. The focus of this study is to investigate the options around placing O&M material at Goose Island to build up marsh and create future capacity for the surrounding O&M placement areas for the GIWW and other federally maintained channels surrounding Goose Island. A tentatively selected plan for implementation of this project has been evaluated in the Aquatic Ecosystem Restoration for Gulf Intracoastal Waterway – Beneficial Use of Dredged Material, Aransas County, Texas, Detailed Project Report and Environmental Assessment Continuing Authorities Program Section 204 (USACE 2024a). The document focused on the expected impacts of restoration activities on the environment and related social and economic activities and analyzed the transportation and placement of material to the Federal Standard location (No Action) or to Goose Island State Park.

The USACE tentatively selected plan builds the existing cells 1 and 2 to a target elevation between 0.6 and 0.8 foot NAVD88 but may reach up to 1 foot NAVD88. Two new parcels (cells 3 and 4) are built to the north of the existing cells to add 9.5 and 6.5 acres, respectively. Within cells 3 and 4, along the southern area, fill material would be constructed to target between 1.5 and 2.0 feet NAVD88 to create a 3.7- and 2.5-acre higher elevation marsh, respectively. The remaining area in cells 3 and 4 (9.5 and 6.5 acres, respectively) would be filled to target elevations of 0.6 and 0.8 foot NAVD88.

A.1.6 Final Environmental Statement Maintenance Dredging GIWW Texas Section—Main Channel and Tributary Channels—Volume 3 Supplements

The Maintenance Dredging GIWW Texas section includes the maintenance dredging for the GIWW, including the following main channels and tributaries: Colorado River Channel, Tributary Channel to Port Mansfield, Galveston Bay to Matagorda Bay, Port Isabel to Mud Flats, Tributary Channel to Harlingen, High Island to Galveston Bay, Corpus Christi Bay to Mud Flats, San Bernard River Channel, Port Arthur to High Island, Channel to Palacios, Channel to Victoria, Matagorda Bay to San Antonio Bay, San Antonio Bay to Corpus Christi Bay, and Tributary Channel to Aransas Pass. The federal action continued periodic maintenance dredging of the channels and tributaries required to prevent shoaling from halting or restricting navigation on the GIWW.

A.2 Project-level Evaluation Tiered from the Final PDARP/PEIS

The *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon (DWH) Natural Resource Damage Assessment (NRDA) Trustees 2016) established a framework for restoration of resources injured by the DWH oil spill and programmatically evaluated environmental consequences on the physical, biological, and socioeconomic resources of the Gulf of Mexico associated with implementing a range of restoration approaches. The proposed alternatives in this RP/EA #3 use the Final PDARP/PEIS restoration approach "create, restore, and enhance coastal wetlands." The relevant portions of the Final PDARP/PEIS that evaluated that approach programmatically are incorporated by reference and summarized in Section 4.2 of this RP/EA #3.

Consistent with the criteria described and applied in the Final PDARP/PEIS, criteria for addressing environmental consequences were applied to each project evaluated. Applicable definitions for context and intensity per each resource category are provided in Appendix D, Guidelines for NEPA Impact Determination in the Final PDARP/PEIS.

The projects proposed in this RP/EA #3 are located across the Texas coast from Copano Bay to Sabine Lake (Figure A-1). The environments associated in each of the project areas are generally similar; however, each project setting also includes location-specific environments. Descriptions of each affected environment and analysis of the environmental consequences are presented for each project considered within the reasonable range of alternatives. Each project is evaluated for impacts to those resource categories addressed in the Final PDARP/PEIS:

Physical Resources
Geology and Substrates, Hydrology and Water Quality, Air Quality, Noise
Biological Resources
Habitats, Wildlife Species (including Birds), Marine and Estuarine Resources (Fish, Shellfish, Benthic Organisms), Protected Species
Socioeconomic Resources
Socioeconomics and Environmental Justice (EJ), Cultural Resources, Infrastructure, Land and Marine Management, Tourism and Recreational Use, Fisheries and Aquaculture, Land and Marine Transportation, Aesthetics and Visual Resources, Public Health and Safety

The descriptions and analyses of the projects are based on the 60% basis of design concepts developed under the Texas Dredged Material for Wetland Restoration – Final Report (Texas TIG 2022b) authorized in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Texas Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (RP/EA #1; Texas TIG 2017), except for the Goose Island Wetland Restoration analysis. The Goose Island Wetland Restoration analysis is based upon the tentatively selected plan in Aquatic Ecosystem Restoration for Gulf Intracoastal Waterway – Beneficial Use of Dredged Material, Aransas County, Texas, Detailed Project Report and Environmental Assessment Continuing Authorities Program Section 204 (USACE 2024a). The descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects.

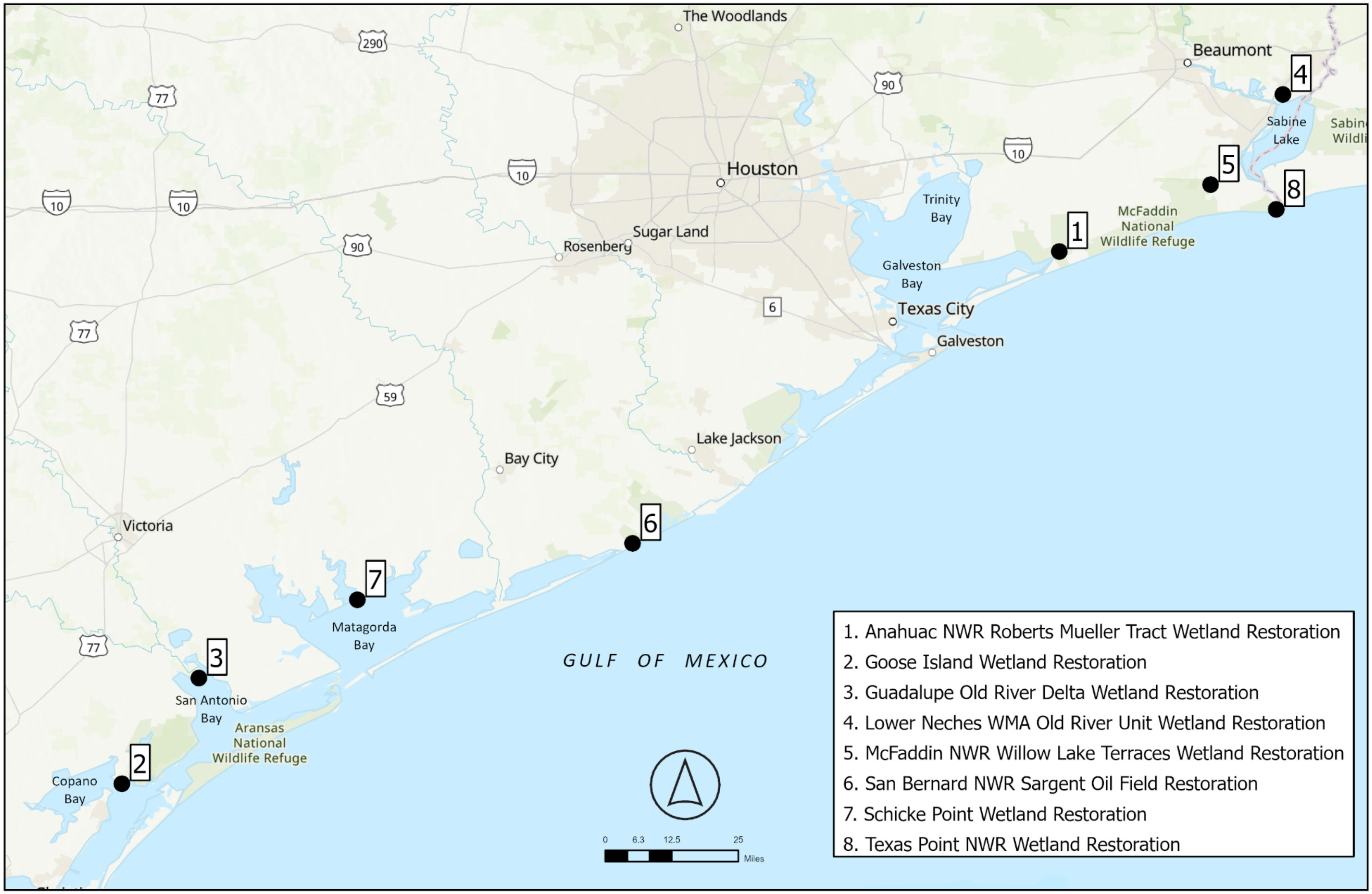

Figure A-1 Approximate Project Alternative Locations Along the Texas Coast

Throughout the completion of the 100% designs, which is an activity incorporated into all the proposed action alternatives, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. Although the Texas Trustee Implementation Group (Texas TIG) does not consider it likely, it is possible that the 100% Engineering and Design (E&D) processes could generate planned implementation actions that may result in adverse environmental impacts different in type or magnitude from those discussed in this document. Should differences in level of impacts occur, the Texas TIG would, consistent with each Monitoring and Adaptive Management plan, determine whether further environmental impacts analysis would be necessary and prepare supplemental analysis if needed. Any additional environmental analysis would be included in the Administrative Record and Data Integration Visualization Exploration and Reporting (DIVER) once completed.

The Texas TIG has not fully completed environmental compliance reviews with relevant regulatory agencies regarding potential adverse impacts to protected species and habitats for each preferred alternative for which implementation is proposed. The Texas TIG would coordinate and complete consultation with relevant regulatory agencies, if necessary, regarding potential adverse impacts to protected species and habitats before project implementation. Implementing Trustees would conduct due diligence to ensure that no unanticipated effects to listed species and habitats would occur. Adverse impacts would be minimized by following mitigation measures, best practices, and other guidance developed during the permitting processes, environmental reviews, consultation processes, and other relevant regulatory requirements. The Texas TIG would also consider best practices referenced in Section 3.3 of this RP/EA #3 and Appendix 6.A of the Final PDARP/PEIS (DWH NRDA Trustees 2016).

The sections below provide additional information concerning those resource categories common to all projects and associated regulatory responsibilities for the analysis of environmental consequences.

A.2.1 Physical Resources

A.2.1.1 Hydrology and Water Quality

In accordance with 40 C.F.R. § 130.8 and 33 U.S.C. §§ 305(b) and 303(d) of the Clean Water Act, the Texas Commission on Environmental Quality (TCEQ) is responsible for developing and enforcing the Texas Surface Water Quality Standards (TCEQ 2022) to ensure that both freshwater and marine surface waters in the state support their designated uses (i.e., aquatic life, contact and noncontact recreation, drinking water, and oyster waters). Impairment criteria include dissolved oxygen, temperature, pH, dissolved minerals, toxic substances, and bacteria. Surface waters that do not meet the standards necessary to allow their designated uses must be included in the biennial 303(d) list of impaired waters, and TCEQ must calculate a Total Maximum Daily Load (TMDL) for each impaired water. The TMDL establishes the maximum amount of a pollutant allowed in a waterbody and serves as the starting point or planning tool for restoring water quality. TCEQ manages point and nonpoint source discharges of pollutants to these waters by issuing permits under the Texas Pollutant Discharge Elimination System (USACE and GLO 2021). Any activity that would result in discharges of pollutants to impaired water would be subject to review and permitting under the Texas Pollutant Discharge Elimination System.

A.2.1.2 Air Quality and Greenhouse Gas emissions

Pursuant to the Clean Air Act, as last amended in 1990, the U.S. Environmental Protection Agency (EPA) has set National Ambient Air Quality Standards (NAAQS) for six principal criteria air pollutants (i.e., ground-level ozone, lead, carbon monoxide, nitrogen dioxide, sulfur dioxide, and particulate matter) that are known to be harmful to public health, especially to sensitive populations such as children, the elderly, and individuals with certain health conditions (USEPA 2024a). Areas that do not meet these standards for one or more criteria pollutants are designated as nonattainment areas. The Clean Air Act requires states to submit state implementation plans for all nonattainment areas to outline the measures to be taken to improve air quality and to demonstrate progress toward meeting the NAAQS. Federal actions that take place within nonattainment areas may be subject to general conformity requirements to ensure that the action conforms with the state implementation plan and would not cause or contribute to exceedances of the NAAQS. However, projects that are expected to result in de minimis levels of emissions (40 C.F.R. § 93.153) are generally exempt from conformity requirements (TCEQ 2024). Brazoria and Chambers counties are within the Houston-Galveston-Brazoria area, which has been designated as a serious nonattainment area for ozone (USEPA 2024b). Ozone is generated primarily from emissions of volatile organic compounds and nitrous oxides from nonpoint sources (i.e., vehicles, area sources, and agriculture) and stationary or point sources (e.g., power plants and industrial activities). No other nonattainment or maintenance areas for any criteria pollutants are present within the seven-county region containing the considered alternatives (USEPA 2024b).

In addition to the six criteria pollutants in the NAAQS, greenhouse gases (GHGs) are chemical compounds found in the Earth's atmosphere that absorb and trap infrared radiation as heat. The principal GHGs emitted to the atmosphere through human activities are carbon dioxide; methane; nitrous oxide; and fluorinated gases, such as hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride. Carbon dioxide accounts for the largest quantity of GHGs emitted. Criteria air pollutants and GHG emissions are largely generated by electricity production, vehicular movements, and commercial and residential buildings using electricity.

A.2.1.3 Climate Change

Consistent with Executive Order (EO) 13990, Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis, and *NEPA Guidance on Consideration of Greenhouse Gas Emissions and Climate Change*[1] federal agencies should consider effects of climate change in developing projects that are resilient in nature and able to adapt to changes in the existing environmental conditions over time. Therefore, design of the proposed alternatives described herein have taken into account the following information described by Kloesel and others (2018):

> Along the Texas coastline, sea levels have risen 5–17 inches over the last 100 years, depending on local topography and subsidence. Sea level rise along the western Gulf of Mexico during the remainder of the 21st century is likely to be greater than the projected global average of 1-4 feet or more. Such a change, along with the related retreat of the Gulf coastline, will exacerbate risks and impacts from storm surges.

A.2.2 Biological Resources

A.2.2.1 Wildlife Species

The Migratory Bird Treaty Act (MBTA) is the primary legislation in the United States that protects migratory birds. The statute makes it unlawful without a waiver to pursue, hunt, take, capture, kill, or sell the parts, nests, or eggs of migratory birds. Nonnative bird species, such as European starling (*Sturnus vulgaris*) and house sparrow (*Passer domesticus*) are not covered under the MBTA. Another statute, the Bald and Golden Eagle Protection Act of 1940 (BGEPA), further protects bald eagles (*Haliaeetus leucocephalus*) and golden eagles (*Aquila chrysaetos*) within the United States. In addition to

[1] The NEPA guidance can be found here: https://www.govinfo.gov/content/pkg/FR-2023-01-09/pdf/2023-00158.pdf

similar protections afforded migratory birds, the BGEPA protects eagles from disturbance and human-induced alterations that may impact nesting areas.

A.2.2.2 Marine and Estuarine Resources

Marine and estuarine fauna and fishery resources are protected under the Fish and Wildlife Coordination Act of 1958, as amended; the Endangered Species Act (ESA); the Magnuson-Stevens Fishery Conservation and Management Act of 1976, as amended (MSA); the Magnuson-Stevens Act Reauthorization of 2006; the Coastal Zone Management Act; and the Estuary Protection Act. Additionally, the National Marine Fisheries Service (NMFS) manages highly migratory species (e.g., sharks) for which EFH is identified by geographical area, rather than habitat type (Regionwide Trustee Implementation Group 2021).

A.2.2.3 Protected Species

Protected species consist of designated wildlife and plant species protected from harm or harassment by law. The ESA of 1973 protects all federally listed wildlife and plant species, and the designated critical habitat of these species, in the United States. The ESA requires that federal agencies ensure any action authorized, funded, or carried out by an agency is not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. Other protected species include marine mammals such as the common bottlenose dolphin (*Tursiops truncatus*), protected by the Marine Mammal Protection Act of 1972 (MMPA), and migratory birds, protected by the MBTA and BGEPA. The primary regulatory agencies responsible for ESA compliance are U.S. Fish and Wildlife Service (USFWS) and NMFS. Critical habitat is defined as an area containing the physical or biological features essential to a listed species' conservation. Any action authorized, funded, or carried out by a federal agency is prohibited from destroying or adversely modifying designated critical habitat.

A.2.3 Socioeconomic Resources

A.2.3.1 Cultural Resources

NEPA recognizes that a unique characteristic of an environment is its relation to historic or cultural resources. However, under NEPA, no definition is provided for "cultural resources." The National Register of Historic Places, which was established under the National Historic Preservation Act of 1966, as amended (NHPA) (54 U.S.C. § 3001 et seq.), identifies historic properties based on their relationship to significant historic events or individuals; important stylistic or engineering trends; or in their potential to provide information about the local, regional, or national past (36 CFR § 60.1). Historic properties may include archaeological sites, historic structures, historic districts, landscapes, battlefields, or shipwrecks. Also included are Traditional Cultural Properties, which may be defined as locations that are eligible for the National Register of Historic Places due to their association with practices or beliefs of a modern community that are tied to a community's sense of history, place, or identity (Parker and King 1998).

Under Section 106 of the NHPA, agencies are required to attempt to identify, in coordination with other interested parties, including State Historic Preservation Officers and federally recognized Native American tribal groups, whether historic properties are present within the area of effect of an undertaking and whether they would be significantly impacted by that undertaking. Projects which are directed, overseen, funded, partially funded, or permitted by a federal agency are considered undertakings.

A.2.3.2 Socioeconomics and EJ

EO 12898 (1994), Federal Actions to Address EJ in Minority Populations and Low-Income Populations, which was augmented by EO 14008 (2021), Tackling the Climate Crisis at Home and Abroad, and EO 14096 (2023), Revitalizing Our Nation's Commitment to Environmental Justice for All, requires that federal agencies advance EJ by pursuing fair treatment and meaningful involvement of minority and low-income populations. Fair treatment means such groups should not bear a disproportionate share of negative environmental consequences from federal programs, policies, decisions, or operations. Meaningful involvement means that federal officials actively promote opportunities for public participation and that federal decisions can be materially affected by participating groups and individuals.

Communities with EJ concerns were identified using methods outlined in the EPA's Promising Practices for EJ Methodologies in NEPA Reviews (USEPA, 2016). Minority populations were identified using the Fifty-Percent analysis to initially identify the extent to which minority populations reside within the analysis area. Based on Table A-1, four counties have minority populations that meet or exceed 50% of the total population. These four counties were then evaluated using the Meaningfully Greater analysis to determine whether that minority population exceeds a reference threshold. For the purposes of this analysis, any county containing a minority population percentage at least 10% higher than the state average was identified as containing a minority population. None of the counties met the threshold based on the Meaningfully Greater analysis. Low-income populations were identified using the Low-Income Threshold Criteria analysis. This analysis compared the proportion of individuals below the poverty level in project counties to state poverty level percentages. Counties with percentages equal to or greater than the state poverty level percentages were carried forward as containing low-income populations.

This RP/EA #3 analyzes alternatives spanning seven Texas Gulf Coast counties from Jefferson County (east of Houston) to Aransas County (just north of Corpus Christi). The demographic and economic characteristics of each county and the state of Texas is shown in Table A-1.

Table A-1 Demographics and Economic Characteristics

Area	Population Estimate (2023)	Percentage of Minority Population (2023)	Percentage of Persons in Poverty	Percentage of Population Age 16 or Older in Civilian Labor Force (2018-2022)	Median Household Income in 2022 Dollars (2018-2022)
Texas	30,503,301	60.4%	13.7%	64.6%	$73,035
Aransas	25,374	32.9%	17.4%	47.8%	$58,168
Calhoun	19,696	58.3%	15.9%	62.7%	$62,267
Chambers	53,876	39.2%	8.3%	66.7%	$106,103
Jefferson	251,496	63.5%	18.8%	55.5%	$57,294
Matagorda	36,359	57.6%	19.9%	56.9%	$56,412
Orange	85,722	22.3%	13.8%	61.4%	$71,910

Area	Population Estimate (2023)	Percentage of Minority Population (2023)	Percentage of Persons in Poverty	Percentage of Population Age 16 or Older in Civilian Labor Force (2018-2022)	Median Household Income in 2022 Dollars (2018-2022)
Refugio	6,666	59.3%	17.5%	51.2%	$54,304

Notes:
Shading indicates presence of low-income populations based on the Low-Income Threshold Criteria analysis. None of the counties met the threshold for minority populations based on the Meaningfully Greater analysis. The State of Texas was used as the reference site for the analyses.
Source: U.S. Census Bureau (USCB 2024a, USCB 2024b, USCB 2024c, USCB 2024d, USCB 2024e, USCB 2024f, USCB 2024g, USCB 2024h)

The EPA's EJScreen: EJ Screening and Mapping Tool (USEPA 2024c) was reviewed to determine environmental and socioeconomic indicators in each project area. EJScreen is EPA's EJ mapping and screening tool that provides EPA with a nationally consistent dataset and approach for combining environmental and socioeconomic indicators. This screening tool and data can be used to identify EJ issues, consider EJ in projects, and assist stakeholders in making informed decisions about pursuing EJ. For this RP/EA #3, socioeconomic and EJ indicators were assessed for each project site at the county level, with indicators above the 50th state percentile identified.

Socioeconomics indicators used to measure a community's potential susceptibility to environmental factors include people of color (i.e., percentage of individuals who list their racial status as a race other than white alone and/or list their ethnicity as Hispanic or Latino), low-income (i.e., percentage of the population in households where the household income is less than or equal to twice the federal poverty level), unemployment rate (i.e., percentage of the population that did not have a job during the reporting period, made at least one specific active effort to find a job during the prior four weeks, and were available for work unless temporarily ill), limited English-speaking households (i.e., percentage of people living in households in which all members aged 14 years and over speak a non-English language and speak English less than "very well"), less than high school education (i.e., percentage of people aged 25 or older whose education is short of a high school diploma), under age 5 (i.e., percentage of people under the age of 5), and over age 64 (i.e., percentage of people over the age of 64). These indicators form the basis for the demographic index (i.e., average of two socioeconomic indicators: low-income and people of color) and the supplemental demographic index (i.e., average of five socioeconomic indicators: low-income, unemployment, limited English-speaking households, less than high school education, and low life expectancy).

Environmental indicators include particulate matter 2.5 (i.e., potential exposure to inhalable particles 2.5 microns or smaller), ozone (i.e., potential exposure to ground-level ozone), nitrogen dioxide (i.e., potential exposure to surface level nitrogen dioxide), diesel particulate matter (i.e., potential exposure to a mixture of particles from diesel exhaust), toxic releases to air (i.e., potential exposure to the average annual chemical concentrations in air weighted by the toxicity of each chemical) traffic proximity (i.e., proximity to major roadways and high traffic areas), lead paint (i.e., percentage of housing units built before 1960, where the potential for exposure to lead-based paint is more likely), superfund site proximity (i.e., residential proximity to sites listed on the National Priorities List), risk management plan facility proximity (i.e., residential proximity to an active facility with a required potential chemical accident management plan), hazardous waste facility proximity (i.e., residential proximity to a facility that handles hazardous waste), underground storage tanks (i.e., residential proximity to underground storage tanks and to underground storage tank release sites), wastewater discharge (i.e., relative risk of exposure to pollutants from wastewater that flows into rivers or other bodies of water downstream), and drinking water non-compliance (i.e., populations served by community water systems that have challenges complying with Safe Drinking Water Act requirements).

Communities with EJ concerns cannot always be identified by statistical data sources. Inclusion of these counties for analysis does not mean that communities with EJ concerns will necessarily be impacted by any given alternative evaluated in this RP/EA #3. Often, low-income or minority populations may be unevenly distributed across the analysis area. Further, there may be sensitive populations not captured statistically that could be uniquely susceptible due to the following reasons: 1) special vulnerabilities (e.g., preexisting health conditions that exceed norms among the general population); 2) unique routes of exposure (e.g., use of surface water or well water in rural communities); or 3) cultural practices (e.g., subsistence fishing, hunting or gathering, or access to sacred sites).

A.3 Affected Environment and Resource Impacts Specific to Each Alternative

This section includes a summary of the project, a description of the relevant affected environment, and an analysis of the environmental consequences according to resource category for each alternative in this RP/EA #3. Figure A-1 shows approximate locations of the eight project alternatives along the Texas coast.

A.3.1 Anahuac NWR Roberts Mueller Tract Wetland Restoration

The project site is within the Anahuac National Wildlife Refuge (NWR) managed by the USFWS. Dredged material would provide fill for four dredge placement cells, using containment levees built from material collected on site to restore up to 550 acres of intertidal marsh.

The predominant wetland habitats in the project area are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the project area. Subsidence and sea level rise are rapidly converting emergent marsh to open water. This project is consistent with regional efforts to counteract land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching project goal is to restore and conserve wetlands and coastal habitats in the Anahuac NWR by beneficially using dredged material to create a viable, vegetated wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to return current submerged shallow open water habitat in the Anahuac NWR to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass (*Sporobolus alterniflorus*) and saltmeadow cordgrass (*Sporobolus pumilus*). This project would place up to 650,000 cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredge material would be placed in the levees to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 550 acres of marsh habitat, including the conversion of approximately 380 acres of existing open water to intertidal marsh habitat (Figure A-2).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged

material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.1.1; project-level environmental consequences are summarized in Table A-2 and described in Section A.3.1.2.

This section presents the affected resources of the Anahuac NWR Roberts Mueller Tract Wetland Restoration project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

Table A-2 Summary of Adverse and Beneficial Impacts from Implementation of the Anahuac NWR Roberts Mueller Tract Wetland Restoration Project

Resource Category	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: provides benefits

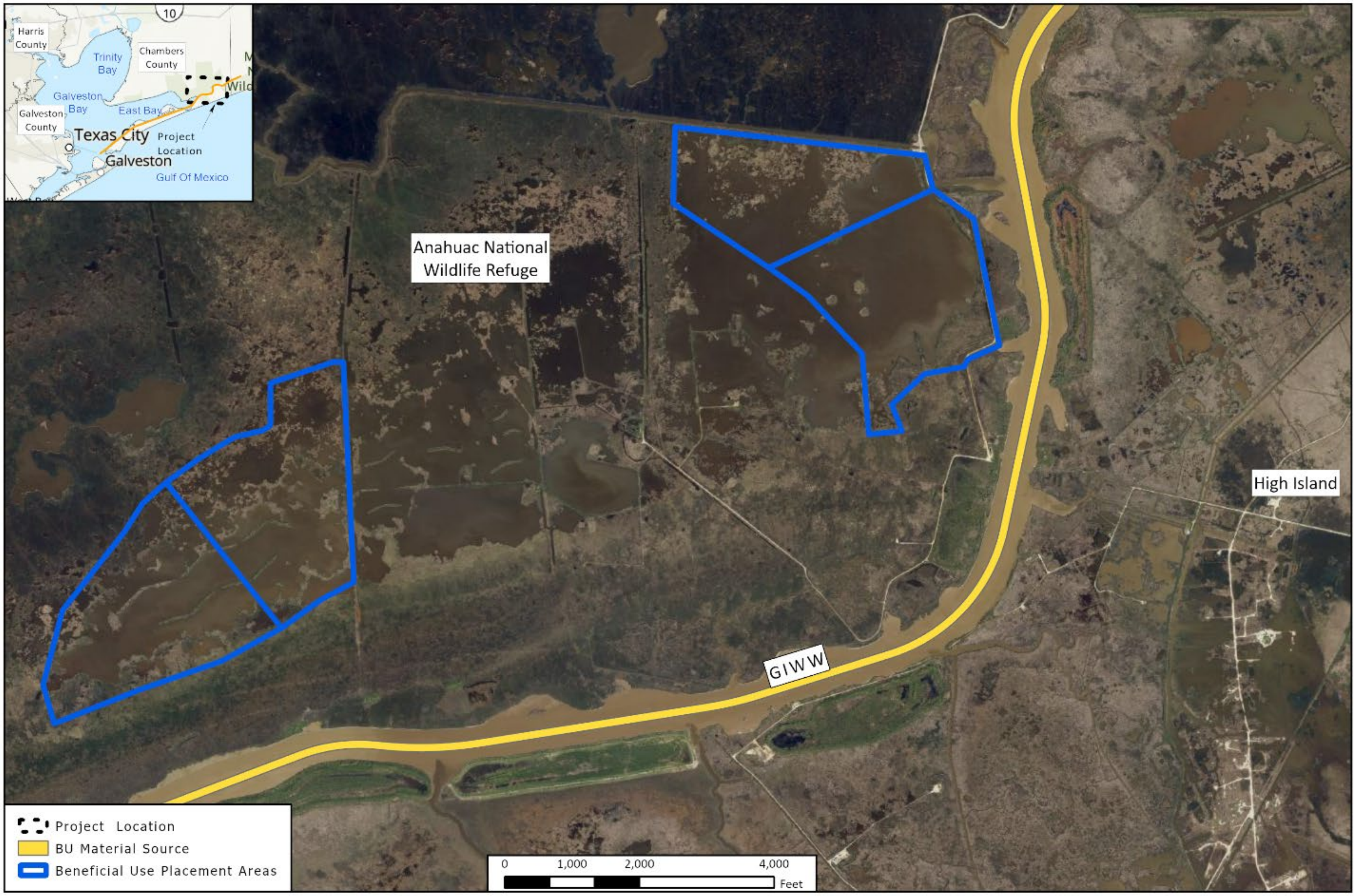

Figure A-2 Location of Proposed Restoration Areas within the Anahuac NWR Roberts Mueller Tract Wetland Restoration Area

The description and analysis of the project are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. The descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts are anticipated to be short-term and minor (Table A-2). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project were implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS (DWH NRDA Trustees 2016) would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.1.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.1.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The Anahuac NWR Roberts Mueller Tract Wetland Restoration project area is located in the Chenier Plain, which was formed by the reworking of riverine sediments with the Mississippi River being the main source of sediments. The geologic substrate of the Chenier Plain region is primarily composed of Holocene sediments with some subsurface Pleistocene outcroppings. According to the Salt Bayou Watershed Restoration Plan (Salt Bayou Marsh Workgroup 2013):

> The Chenier plain was developed by lateral oscillations of the Mississippi River over long periods of time and the reworking of sediments that were deposited during these shifts. Mudflats were formed along the shoreline by the fine-grained sediments from the Mississippi River. These sediments were pushed west by longshore transport and were ultimately deposited along the shoreline through nearshore currents (Britsch and Dunbar 1993). Eastward shifts in the course of the Mississippi River resulted in a decline of the westward sediment transport. This decline in sediments resulted in coastal processes reworking and eroding the sediments along the shore. These coastal processes concentrated the coarse, large-grained sediments forming higher ridges or cheniers (Britsch and Dunbar 1993). When the Mississippi River oscillated westward again, new sediments were deposited along the existing shoreline, and the cycle of ridge and mudflat formation began again. Repetition of sediment accretion and erosion from coastal processes over time created the alternating ridges separated by marshlands, which is now called the Chenier plain (Britsch and Dunbar 1993).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Anahuac NWR Roberts Mueller Tract Wetland Restoration project area is within the East Galveston Bay watershed (Hydrologic Unit Code 12010202). The 34,339-acre Anahuac NWR is dissected by four estuarine bayous which drain into East Galveston Bay or the GIWW. Most of the NWR is subject to frequent tidal and freshwater flooding. Marsh habitats on Anahuac NWR include fresh, intermediate, brackish, and saline marshes, with intermediate marsh being the predominant marsh type (USFWS 2008).

Surface water quality in the region and the Texas Chenier Refuge Complex is influenced by industrial and agricultural practices, flood management practices, and various human alterations to its hydrology. The movement of saltwater from the Gulf and bays through the bayou and marsh systems varies depending upon tidal action, storms, and storm runoff. Channel construction, including the GIWW and channelization of natural waterways, have facilitated the movement of saltwater from the Gulf further into the bayous and marsh systems than what occurred historically, or what would occur under natural conditions. The level and impacts of saltwater intrusion vary by area (USFWS 2008).

According to the 2022 Texas Integrated Report, Segment 0702 Intracoastal Waterway Tidal fully supports aquatic life (TCEQ 2022). The water body does not support fish consumption due to Polychlorinated Biphenyls (PCBs) and dioxin in edible tissue, does not support contact recreation due to a bacteria impairment, and has a concern for screening level for chlorophyll-*a*. The Texas Surface Water Quality Standards classify Intracoastal Waterway Tidal as suitable for primary contact recreation, and its waters are designated high for aquatic life (TCEQ Water Quality Standards 2018, 30 Texas Administrative Code (TAC) Section 307.10(1), Appendix A). The draft 2024 Texas Integrated Report de-listed the bacteria in water impairment for Segment 0702 based on new data (TCEQ 2024).

Air Quality and GHG Emissions

The project area is located in the Houston-Galveston-Brazoria Air Quality Control Region (Region 12). The Region is in nonattainment for 8-hour ozone (TCEQ 2021a).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project’s impacts on GHG emissions are considered.

Noise

The project location is near the GIWW, a heavily used maritime channel. Due to its location, the Anahuac NWR project area experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common around the Anahuac NWR Roberts Mueller Tract project area.

A.3.1.1.2 Biological Resources

The wetland habitats on the upper Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. A complex of protected lands along the coast, including NWRs such as Anahuac and state -managed Wildlife Management Areas (WMAs), serve as critical staging areas for waterfowl migrating to and from Mexico. The Galveston Bay estuary is a vital habitat for fish and shellfish species found in the Gulf of Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The coastal marshes of Anahuac NWR and the project area support many species of birds; fish; and other wildlife, such as the northern river otter (*Lontra canadensi*), bobcat (*Lynx rufus*), gray fox (*Urocyon cinereoargenteu*s), coyote (*Canis latrans*), and American alligator (*Alligator mississippiensis*). The lower elevations of the Anahuac NWR and the project area are predominantly a salt to brackish marsh complex comprised of emergent marshes, shallow subtidal flats, and open water. These shallow flats support diverse benthic communities that provide food sources for migratory waterfowl, estuarine fish and invertebrate species, and other marsh fauna.

Wildlife Species

The coastal marshes in Anahuac NWR and project area provide shallow water feeding, breeding, and resting habitat for numerous shorebirds, wading birds, and other marsh and waterbirds. The refuge is a primary wintering area for Central Flyway ducks and geese and serves as a critical staging area for waterfowl migrating to and from Mexico. Hundreds of thousands of shorebirds, wading birds, and other marsh and water birds also winter or migrate through the area. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall (*Mareca strepera*), northern pintail (*Anas acuta*), lesser scaup (*Aythya affinis*), American widgeon (*Mareca americana*), and blue-winged teal (*Spatula discors*). Other birds such as clapper rail (*Rallus crepitans*), seaside sparrow (*Ammodramus maritimus*), and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Estuarine habitats in the Anahuac NWR and the project area provide nursery and foraging habitat that supports various life stages of forage species and recreationally important marine fishery species, such as spotted seatrout (*Cynoscion nebulosus*), southern flounder (*Paralichthys lethostigma*), Atlantic croaker (*Micropogonias undulatus*), black drum (*Pogonias cromis*), Gulf menhaden (*Brevoortia patronus*), striped mullet (*Mugil cephalus*), and blue crab (*Callinectes sapidus)* (Nelson 1992). Estuarine habitats also support many benthic animals, including marine worms and crustaceans, which are consumed by higher trophic-level predators such as shrimp, crabs, and black drum. Invertebrates such as blue crab and brown and white shrimp (*Farfantepenaeus aztecus* and *Litopenaeus setiferus)*, respectively) are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected by project activities are listed in Table A-3 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-3 Federal Threatened and Endangered Species Potentially Affected in the Anahuac NWR Roberts Mueller Tract Wetland Habitat Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp's ridley sea turtle	Endangered

Eastern black rails (*Laterallus jamaicensis jamaicensis)* occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This project would have minimal indirect benefits to black rail habitat.

The red knot (*Calidris canutus*) and piping plover (*Charadrius melodus*) are winter residents on the Texas coast and in Chambers County. Both species are known to use the tidal shorelines and intertidal flats of bays and the Gulf of Mexico. There is no critical habitat for red knot or piping plover in the project area.

There are infrequent sightings of the West Indian manatee *(Trichechus manatus*) in Texas estuaries.

Loggerhead sea turtles (*Caretta caretta*), green sea turtles (*Chelonia mydas*), hawksbill sea turtles (*Eretmochelys imbricata)*, leatherback turtles (*Dermochelys coriacea*), and Kemp's ridley sea turtles (*Lepidochelys kempii*) may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-4 provides a list of managed EFH species in the Anahuac NWR Roberts Mueller Tract Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-4 EFH for Estuarine Habitats within the Anahuac NWR Roberts Mueller Tract Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp *(Farfantepenaeus duorarum)*			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum (*Sciaenops ocellatus*)	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel (*Scombridae*)			X		X	Estuarine, water column associated
Gray snapper *(Lutjanus griseus)*					X	Soft bottom, emergent marsh
Cobia (*Rachycentron canadum)*	X					Water column associated
Lane snapper (*Lutjanus synagris*)	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in East Galveston Bay and the GIWW is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees within the Galveston Bay estuary.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. Birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.1.1.3 Socioeconomic Resources

This section includes descriptions of socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational use, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Chambers County has a total population of 53,876, an increase of 15.7% since 2020, based on the 2023 U.S. Census population estimates. Approximately 61% of the county population identified as white (not Hispanic or Latino), 27% as Hispanic or Latino, 9% as Black or African American, with the remaining population including small percentages of American Indian and Alaska Native, Asian, and Native Hawaiian and Other Pacific Islander. Median household income (2018 to 2022) in Chambers County is $106,103, with 8.3% of the county living in poverty (USCB 2024a).

Socioeconomic indicators above the state’s 50th percentile included the unemployment rate and persons under 5 years of age. EJ indicators above the state’s 50th percentile included particulate matter 2.5, toxic releases to air, lead paint, superfund site proximity, risk management plan facility proximity, hazardous waste facility proximity, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the Texas Historical Commission (THC) Texas Historic Sites Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

The Railroad Commission of Texas (RRC) maintains an oil and gas pipeline and well database. According to the RRC geographic information system (GIS) viewer (RRC 2020), some active and decommissioned natural gas wells and pipelines lie in close proximity to the site. Additionally, the Texas General Land Office (GLO) Texas Sediment Geodatabase GIS viewer shows that buried pipelines run near the site (GLO 2017). Care was taken to avoid this infrastructure with the proposed design. Further delineation of pipeline easements and restrictions may be developed during the final design stage and before construction.

Land and Marine Management

The Anahuac NWR encompasses 34,000 acres in Chambers and Galveston counties, Texas, along the GIWW east of East Galveston Bay and north of High Island. It is undeveloped, except for oil and gas infrastructure. The maritime commerce on the GIWW flows through the NWR. The project area includes two sites, both are near the GIWW, and it is likely that sediments would be transported to the site via the GIWW. The project area is undeveloped, including unpaved NWR access roads. The land is managed by USFWS.

Tourism and Recreational Use

The Anahuac NWR marsh is managed by USFWS as part of the Texas Chenier Plain Refuge Complex, which also includes Texas Point NWR, McFaddin NWR, and Moody NWR. Management of the refuge and site includes use of the marsh for recreational fishing and waterfowl hunting. Hunting, fishing, hiking, and wildlife viewing are regularly enjoyed by the public in the Anahuac NWR.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

The project area is located within Anahuac NWR in eastern Chambers County and is relatively remote. There are several access roads into the NWR, but no through traffic. The project area is situated in proximity to canals, levees, the GIWW, Oyster Bayou, and East Galveston Bay.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of saline and brackish marsh and open water. The site near the GIWW is a busy maritime channel. The NWR is undeveloped, and the viewshed is dominated by the natural appearance of the area. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of the Anahuac NWR are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically intermediate and brackish marsh, but it has since converted to areas of open water primarily due to subsidence and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area’s functionality as a buffer for storm surges.

A.3.1.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.1.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to the placement of dredged material in shallow water areas, which may affect sediment dynamics. Placement of materials (such as dredged material or riprap) would result in long-term, but localized, adverse impacts to the existing substrate. Additionally, the project would require implementation of best practices to minimize or avoid adverse impacts. Best practices, such as silt curtains, buffer zones, and water quality monitoring, would be used to minimize such effects.

It is anticipated that the project would provide long-term benefits to wetlands and other shoreline habitats by raising substrate elevations affected by subsidence and sea level rise and re-establishing natural hydrology needed to restore the function of coastal wetland communities. This approach helps stabilize substrates, which increases the resilience of coastal wetlands to sea level rise and reduces coastal erosion.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands at the project area. Short-term impacts could result from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project, because maintenance dredging is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design may be a result of placement of dredged materials onto existing substrate. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain hydrologic linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality and GHG emissions could occur due to project equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied where appropriate and practical to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, and the incorporation of anti-idling procedures. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct, localized, and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. All placement of dredged material would occur in the interior of the Anahuac NWR and would not be directly adjacent to residential areas.

A.3.1.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to habitats could occur including disturbance to wetland vegetation during construction.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging of equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife species and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. Short- and long-term, minor, adverse impacts to protected species, including displacement of land-based or aquatic fauna species could occur as a result of staging equipment and materials. Long-term, minor, adverse impacts could include conversion of one wetland vegetation type to another (e.g., saline vegetation to more freshwater vegetation) with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to avoid and minimize adverse impacts.

Long-term benefits to EFH would occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh would have a long-term beneficial effect on the habitat's ability to support eastern black rails. The proposed project aims to restore estuarine emergent marsh, which will protect and improve sensitive resources utilized by these species. In addition, the proposed project will improve water quality by trapping sediments and filtering nutrients prior to water entering nearby waterways used by sea turtles and West Indian manatees. Long-term effects of project restoration activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which will ultimately protect and enhance suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the Project Design Criteria (PDC) described in NMFS's *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and Texas Parks and Wildlife Department (TPWD) biologists.

A.3.1.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. No residential communities are located adjacent to the project. As a result, there would be no potential for short-term impacts from construction.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

For each project selected for implementation under this RP/EA #3, a comprehensive review under Section 106 of the NHPA would be completed before any project activities began to develop practices that minimize or mitigate adverse effects on historic properties within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short-term or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the project area.

Land and Marine Management

No adverse short-term or long-term impacts to land and marine management are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place. The USFWS's Comprehensive Conservation Plan, and Draft Land Protection Plan for Texas Chenier Plain NWR Complex (USFWS 2008), which includes management of the Anahuac NWR evaluates expansion of the Anahuac NWR by up to 60,000 acres to achieve conservation of coastal wetlands and preservation of wildlife as part of land and marine management. The purpose in developing the conservation plan is to provide refuge managers with a 15-year strategy for achieving refuge purposes and contributing toward the mission of the NWR System, consistent with sound principles of fish and wildlife science, conservation, legal mandates, and service policies. Habitat restoration efforts in this area would contribute to furthering that Plan.

Tourism and Recreational Use

Short-term, minor, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area to protect public safety and temporary increases in road traffic due to movement of construction vehicles.

It is anticipated that the project would provide long-term benefits to recreationalists through enhanced experiences for wildlife viewing, kayaking, canoeing, fishing, and other activities. The marsh habitat in the Anahuac NWR is a foundation for many recreational activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) from restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No short- or long-term adverse impacts to land and marine transportation are anticipated.

Transportation routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would not significantly interrupt the channel traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment, sediment containment levees, or other changes to the surrounding environment. These impacts would be minor in nature and limited to the construction period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure the safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.2 Goose Island Wetland Restoration

The project area is within Aransas Bay on or adjacent to Goose Island State Park. Dredged material would provide fill for two containment cells constructed at the site of an earlier marsh restoration project on Goose Island as well as two new cells on the northern side of the existing cells. The containment levees will be constructed and rehabilitated using on-site sediments.

The predominant wetland habitats near the project site are characterized as salt marsh, seagrasses, and estuarine open water. The combination of rising sea levels, erosion, subsidence, and reduced sediment supplies have resulted in loss of wetlands and other coastal habitats on Goose Island. This project is consistent with regional efforts to counteract land and habitat loss through estuarine marsh restoration.

The overarching goal of the Texas TIG for this project is to restore and conserve wetlands and coastal habitats by beneficially using dredged material to create a viable, vegetated wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage.

The primary objective of this project is to return current shallow open water habitat within the project site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 195,000 cubic yards of suitable hydraulically dredged material within containment levees. As part of the project, existing levees would be rehabilitated and additional levees constructed. Sediment would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 40 acres of marsh habitat, including the conversion of approximately 34 acres of existing open water to intertidal and high marsh habitat (Figure A-3).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. The impact analysis for this alternative is based in the analyses presented in the *Aquatic Ecosystem Restoration for Gulf Intracoastal Waterway*

– Beneficial Use of Dredged Material, Aransas County, Texas, Detailed Project Report and Environmental Assessment (USACE 2024a). Resources of the affected environment are described in Section A.3.2.1; project-level environmental consequences are summarized in Table A-5 and described in Section A.3.2.2.

This section presents the affected resources of the Goose Island Wetland Restoration Project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

Throughout the USACE project engineering and design process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial and the adverse impacts would generally be short-term and minor (Table A-5). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.2.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.2.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The coastline in and near the project area is the coastal belt of the Texas Coastal Plain, extending from Galveston Bay to Nueces Bay underlain by sedimentary strata of the Mesozoic and Cenozoic eras. The coastal belt is a gently sloping area bordering the Gulf of Mexico underlain by the Beaumont clays and the Lissie Formation, both of Pleistocene age. Geophysical data suggest that the strata within these two formations represent multiple episodes of deposition, erosion, and soil formation (Paine et al. 2018). The fluctuating advance and recession of glaciers during the Pleistocene era caused large changes in sea level and created rivers and valleys. During the Holocene area, as sea level rose to its current level, the river valleys were flooded, and sediments were dispersed from deltaic headlands. The drowned river valleys became the current bays and estuaries of the Texas coast. The shorelines of Aransas and adjacent Copano bays are in a state of erosion. The erosion is caused by relative sea level rise and a lack of new sediment entering the system (Evans et al. 2012 as cited in USACE 2024a).

Figure A-3 Location of Proposed Restoration Areas Within the Goose Island Wetland Restoration Area

Table A-5 Summary of Adverse and Beneficial Impacts from Implementation of the Goose Island Wetland Restoration Project

Resource Category	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: would provide benefits

The most common sediment type in the Mission-Aransas Estuary is mud, which is comprised of silt and clay. Aransas Bay has a higher proportion of clay. Copano Bay also has areas where the sediments have as high as 75% shell material occurring near oyster reefs. There is a high percentage of sand in the margins of Copano and Aransas bays (White et al. 1983 as cited in Evans et al. 2012).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Mission and Aransas rivers flow into Copano Bay and provide the main freshwater inflows for Copano and Aransas bays (Evans et al. 2012). Aransas Bay borders San Jose Island with Aransas Pass providing the tidal outlet to the Gulf. The bays experience large ranges in salinity because of drought, low freshwater inflows, tidal fluctuations, and high evaporation rates.

The Goose Island Wetland Restoration project area is within the Aransas Bay watershed (Hydrologic Unit Code 12100405) and within Reservoir Segment 2472 Copano Bay/Port Bay/Mission Bay. There are no water quality concerns or impairments on the waterbody, except a concern for chlorophyll-*a* in Assessment Unit 03, according to the 2022 Texas Integrated Report. Copano Bay/Port Bay/Mission Bay carries a primary contact recreation designation in the 2018 Texas Surface Water Quality Standards (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

The project area is located in the Corpus Christi Air Quality Control Region (Region 14). The Region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021b).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project is located between Aransas and St. Charles bays, close to Copano Bay. The surrounding area is residential and agricultural. Recreational fishing and boating are popular around the site. Due to its location, the project area experiences the ambient noise of marine transportation and recreational traffic.

A.3.2.1.2 Biological Resources

The wetland habitats on the Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. The Aransas Bay estuary is a vital habitat for fish and shellfish species found in the Gulf of Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The Goose Island project site contains primarily tidal salt marshes and mudflats with small patches of seagrass beds and oyster reefs (NOAA 2006). The project site consists primarily of shallow open water with some small pockets of marsh and some deeper cuts and channels.

Wildlife Species

Saline marshes and shallow open water are the primary habitats within the project area. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets (*Egretta thula*), great egrets (*Ardea alba*), roseate spoonbills (*Platalea ajaja*), yellow-crowned night herons (*Nyctanassa violacea*), black-crowned night herons (*Nycticorax nycticorax*), and great blue herons (*Ardea herodias*) use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Saline marshes and shallow open water are the primary habitats within the project area. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-6 (USFWS 2024).

Table A-6 Federal Threatened and Endangered Species Potentially Affected in the Goose Island Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
Whooping crane	Endangered
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp’s ridley sea turtle	Endangered

The last wild flock of whooping cranes (*Grus americana*) winter on the Texas coast in and around the Aransas National Wildlife Refuge. Whooping cranes feed on blue crabs, so the integrity of the blue crab population is vital to maintaining the health of the whooping crane population. The construction activities for this project are unlikely to affect whooping cranes, which usually inhabit an area east of the project area.

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 centimeters [cm]) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This marsh restoration provided by this project would have long-term beneficial impacts on eastern black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and in Aransas County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for red knot or piping plover in the project area.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead, green, hawksbill, leatherback, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-7 provides a list of managed EFH species in the Goose Island Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-7 EFH for Estuarine Habitats Within the Goose Island Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in Aransas Bay is the bottlenose dolphin. There are infrequent sightings of the West Indian manatee in Texas estuaries.

Bald and Golden Eagles

Bald eagles potentially forage within the project area, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.2.1.3 Socioeconomic Resources

This section includes descriptions of socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational use, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Aransas County has a total population of 25,374, an increase of 6.5% since 2020, based on the 2023 U.S. Census population estimates. Approximately 67% of the county population identified as white (not Hispanic or Latino), 27% as Hispanic or Latino, with the remaining population including small percentages of Black or African American, American Indian and Alaska Native, Asian, and Native Hawaiian and Other Pacific Islander. Median household income (2018 to 2022) in Aransas County is $58,168, with 17.4% of the county living in poverty (USCB 2024b).

Socioeconomic indicators above the state's 50th percentile included the supplemental demographic index, low income, unemployment rate, limited English-speaking households, persons with less than a high school education, and persons over the age of 64. EJ indicators above the state's 50th percentile included particulate matter 2.5, toxic releases to air, lead paint, superfund site proximity, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist within the boundaries of the project area (THC 2024).

Infrastructure

RRC maintains an oil and gas pipeline and well database. According to the GIS viewer (RRC 2020), there are no identified pipelines or wells located in the immediate vicinity of the Goose Island Wetland Restoration project area. Additionally, the GLO Texas Sediment Geodatabase GIS viewer shows no buried natural gas and crude oil pipelines running under the site (GLO 2017). Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The project area is located within Aransas Bay on or adjacent to Goose Island State Park. The site is undeveloped with no vehicular access. A GLO Coastal Surface Lease would be acquired prior to project initiation to allow for construction activities.

Tourism and Recreational Use

The project area offers recreational opportunities for the public, including fishing and wildlife viewing. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

The project area is adjacent to residential and agricultural land transportation routes. There is a road from the mainland to the island that parallels the bayside shoreline. The road does not extend to the project area. The site is 5 miles from the GIWW. There are shallow draft channels in close proximity to the site that are used to access the residences north of the site.

Aesthetics and Visual Resources

The landscape in the vicinity of the proposed wetland restoration is characterized by open water. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of Goose Island are accustomed to navigating around the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions.

A.3.2.2 Environmental Consequences

This section analyzes the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.2.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands at the project area. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce loss of sediments.

It is anticipated that the project would provide long-term benefits to geology and substrate in the project area by restoring historical marsh habitat. The Goose Island Wetland Restoration will benefit wetlands and other shoreline habitats by raising substrate elevations affected by subsidence, erosion, and sea level rise and re-establishing natural hydrology needed to restore the function of coastal wetland communities. This approach helps stabilize substrates, which increases the resilience of coastal wetlands to sea level rise and reduces coastal erosion.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands at the project area. Short-term impacts could result from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project, because maintenance dredging is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain hydrologic linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical, to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments will capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause short-term, minor, adverse impacts due to noise. This impact would be limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. To prevent disturbance to nearby residential communities, construction activities that produce significant noise would be limited to daylight hours.

A.3.2.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to habitats could occur due to disturbance to wetland vegetation during construction.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, adverse impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh would have a long-term beneficial effect on the habitat’s ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which would protect and improve sensitive resources utilized by these species. In addition, the proposed project would improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which would ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by the PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impacts to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as placement of hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include use of signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.2.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. Best practices would be implemented during construction to avoid short-term impacts to nearby residential communities.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short-term or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the project area.

Land and Marine Management

No adverse short-term or long-term impacts to land and marine management are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area to protect public safety and temporary increases in road traffic due to movement of construction vehicles.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) by restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No short- or long-term adverse impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Boating routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would not significantly interrupt the channel traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.3 Guadalupe River Old Delta Wetland Restoration

The project site is at the northern portion of San Antonio Bay and forms a peninsula between Hynes Bay to the west and Guadalupe Bay to the east. Dredged material would provide fill for four dredge placement cells, using containment levees built from material collected on site to restore up to 1,140 acres of intertidal marsh in degraded portions of the delta.

Over the past several decades, the vegetated marsh of the site has undergone physical deterioration through erosion of portions of the marshes encompassing the site as well as the expansion of interior open water areas. This change is particularly noticeable along the southern boundary of the delta where it is exposed to San Antonio Bay.

The predominant wetland habitat in the Guadalupe River Old Delta site is characterized as a mosaic of brackish marsh and estuarine open water. The combination of rising sea levels, erosion, storm impacts, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the project area. This project is consistent with regional efforts to counteract land and habitat loss through hydrology enhancements and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in the Guadalupe River Old Delta by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to return current submerged open water in the project site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 1.91 million cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediments. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 1,140 acres of marsh habitat, including the conversion of up to 480 acres of existing open water to intertidal marsh (Figure A-4).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the Victoria Barge Canal (VBC), private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.3.1; project-level environmental consequences are summarized in Table A-8 and described in Section A.3.3.2.

This section presents the affected resources of the Guadalupe River Old Delta Wetland Restoration project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

Figure A-4 Location of Proposed Restoration Areas Within the Guadalupe River Old Delta Wetland Restoration Area

Table A-8 Summary of Adverse and Beneficial Impacts from Implementation of the Guadalupe River Old Delta Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: would provide benefits

The description and analysis of the project are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. Throughout the completion of the 100% designs under this process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-8). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.3.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.3.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The Guadalupe River Old Delta project area is located in the Texas coastal plain, which is underlain by a complex assemblage of fluvial, deltaic, estuarine, and marine-influenced deposits that make up two Pleistocene formations: the younger Beaumont Formation and the older Lissie Formation. Geophysical data suggest that the strata within these two formations represent multiple episodes of deposition, erosion, and soil formation (Paine et al. 2018). Surface geology is of the late Pleistocene Beaumont Formation and younger deposits. The Beaumont Formation was deposited as a large alluvial plain, after which sea levels fell during a period of glacial advance. A period of erosion then followed, with incision of stream channels. At the end of the last glacial period, as sea levels rose again, the area was flooded, and a series of estuaries and bays formed. The soils currently feature river floodplain muds and fluvial-deltaic sands (Thomas and Durkin 2012).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Guadalupe River, the San Antonio River, and their associated watersheds provide freshwater inflows to the San Antonio Bay system. The Guadalupe Delta formed as a result of the San Antonio and Guadalupe rivers depositing sediments at the mouth of the Guadalupe River where it enters San Antonio Bay. Historically, the delta gradually enclosed an open-bay area, forming what is now Green Lake, and more recently, the delta is in the process of filling in and around Mission Lake. Traylor’s Cut, on the Guadalupe River, was excavated in 1935 and effectively diverts water and sediment under normal and high flows into Mission Lake and Guadalupe Bay. Under overbank conditions, water and sediment will flood the entire delta; however, this diversion has limited delta maintenance, and erosion along the delta shoreline has resulted (Tremblay and Calnan 2011).

The Guadalupe River Old Delta site is within the Hynes Bay-San Antonio Bay watershed (Hydrologic Unit Code 12100404). The 2022 Integrated Report for San Antonio Bay/Hynes Bay/Guadalupe Bay/Mission Lake (Segment 2462) identifies a water quality concern for chlorophyll-*a*, but otherwise the water body fully supports aquatic life and contact recreation (TCEQ 2022). The Texas Surface Water Quality Standards designate San Antonio Bay/Guadalupe Bay/Mission Lake as suitable for primary contact recreation, and its waters are classified excellent for aquatic life (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

Guadalupe River Old Delta is located in the Corpus Christi Air Quality Control Region (Region 14). The Region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021b).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project location is adjacent to the VBC. Due to its location, the Guadalupe River Old Delta site experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common around Guadalupe River Old Delta.

A.3.3.1.2 Biological Resources

The wetland habitats on the Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. The San Antonio Bay estuary is a vital habitat for fish and shellfish species found in the Gulf of Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The Guadalupe River Old Delta project area is composed of intertidal marshes and open water. The physical components of the site currently provide habitat for a variety of coastal plants and animals. The salt flats and tidal marshes serve as habitat for a variety of bird species, crabs, and juvenile fish. The brackish waters further inland within the marsh support blue crab and other species of shellfish, egrets, herons, and many others. Smooth cordgrass is the most common marsh vegetation species encountered at the site. This plant filters the water of pollutants and provide habitat, nesting, and foraging for many of species that inhabit this local area.

Wildlife Species

Tidal marshes and shallow open water are the primary habitats within the Guadalupe River Old Delta marsh. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Tidal marshes and shallow open water are the primary habitats within the project area. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or the NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-9 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-9 Federal Threatened and Endangered Species Potentially Affected in the Guadalupe River Old Delta Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
Whooping crane	Endangered
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp's ridley sea turtle	Endangered

The last wild flock of whooping cranes winters on the Texas coast in the area around San Antonio Bay. Whooping cranes feed on blue crabs, so the integrity of the blue crab population is vital to maintaining the health of the whooping crane. Low levels of freshwater inflows have threatened the blue crab population in San Antonio Bay in recent years. The state has initiated planning for freshwater inflows to San Antonio Bay to address this problem. The construction activities for the project are unlikely to affect whooping cranes, which usually inhabit an area west of the project on Blackjack Peninsula in Aransas NWR.

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. The project would have minimal indirect benefits to black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and in Refugio County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for red knot or piping plover in the Guadalupe River Old Delta Wetland Restoration project area.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead, green, hawksbill, leatherback, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-10 provides a list of managed EFH species in the Guadalupe River Old Delta Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-10 EFH for Estuarine Habitats Within the Guadalupe River Old Delta Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in San Antonio Bay is the bottlenose dolphin. West Indian manatees are rarely sighted on the Texas coast.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.3.1.3 Socioeconomic Resources

This section describes the socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational use, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Refugio County has a total population of 6,666, a decrease of 1.2% since 2020, based on the 2023 U.S. Census population estimates. Approximately 51% of the county population identified as Hispanic or Latino, 41% as white (not Hispanic or Latino), 7% as Black or African American, with the remaining population including small percentages of American Indian and Alaska Native and Asian. Median household income (2018 to 2022) in Refugio County is $54,304, with 17.5% of the county living in poverty (USCB 2024c).

Socioeconomic indicators above the state's 50th percentile included the demographic index, the supplemental demographic index, people of color, low income, unemployment rate, limited English-speaking households, less than high school education, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included toxic releases to air, lead paint, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

The Texas RRC maintains an oil and gas pipeline and well database. According to the GIS viewer (RRC 2020), there are no identified pipelines or wells located in the immediate vicinity of the Guadalupe River Old Delta project area. Additionally, the GLO Texas Coastal Sediment Geodatabase GIS viewer shows no buried pipelines running near the site (GLO 2017). Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The Guadalupe River Old Delta project area is used primarily for hunting and fishing. It borders the VBC on the east. The adjacent land is either undeveloped or used for agricultural purposes. Maritime traffic can be observed from the site. The project area is inaccessible by vehicle.

Tourism and Recreational Use

The Guadalupe River Old Delta project area is adjacent to bay waters, and, therefore, portions are accessible to the public and are used for fishing, boating, and wildlife viewing.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

Guadalupe River Old Delta is relatively remote with no public roads within its boundaries and limited pedestrian access. The site is adjacent to the VBC.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of saline and brackish marsh and open water. The site is adjacent to the VBC, a busy maritime channel. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of the Guadalupe River Old Delta are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically salt and brackish marsh, but it has since been inundated primarily due to relative sea level rise, erosion, and storm surge. This has had adverse impacts on coastal resiliency and deleterious effects on the area's functionality as a buffer for storm surges.

A.3.3.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.3.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct, localized, and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce erosion and loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor, adverse impacts to water quality from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project, because maintenance dredging of the VBC is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical, to reduce the release of GHGs. Best practices considered would include the use of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Restoration of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct, localized, and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds.

A.3.3.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices including the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM material to create estuarine emergent marsh will have a long-term beneficial effect on the habitat's ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which will protect and improve sensitive resources utilized by these species. In addition, the proposed project will improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which will ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site, because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as placement of hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.3.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. No residential communities are located adjacent to the project. As a result, there would be no potential for short-term impacts from construction.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the Guadalupe River Old Delta project area.

Land and Marine Management

No adverse short- or long-term impacts to land and marine management are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) by restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Boating routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would result in a short-term, minor interruption to the channel traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.4 Lower Neches WMA Old River Unit Wetland Restoration

The project area is within the Old River Unit of the Lower Neches WMA managed by TPWD. The Old River Unit of the WMA consists of 4,386 acres on the north shore of Old River Cove of Sabine Lake and near the GIWW. Dredged material would provide fill for six marsh restoration placement cells, using containment levees built from material collected on site to restore up to 224 acres of intertidal marsh.

The site is composed primarily of intertidal marsh and shallow open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant, rapid loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands at the project site by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in Lower Neches WMA Old River Unit to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 400,000 cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation would consider sediment compaction and expected sea level rise. Project actions would restore up to 224 acres of intertidal marsh, including the conversion of 96 acres of existing open water to intertidal marsh (Figure A-5).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the SNWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.4.1; project-level environmental consequences are summarized in Table A-11 and described in Section A.3.4.2.

This section presents the affected resources of the Lower Neches WMA Old River Unit Wetland Restoration Project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

The description and analysis of the project are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. Throughout the completion of the 100% designs under this process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-11). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.4.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.4.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The Lower Neches WMA Old River Unit project area is located in the Chenier Plain region of Texas. A distinguishing feature of the region is the cheniers, ridges representing ancient Gulf shorelines generally aligned parallel to the Gulf or as fan-shaped alluvial deposits at the mouths of rivers. It is comprised of a chenier plain that formed from a Pleistocene promontory overlain by Holocene marginal-deltaic sediments (King 2007). The geologic substrate of the Chenier Plain region is primarily composed of sediments deposited during the late recent epoch with some subsurface Pleistocene outcropping. These deposits are overlain at the coast by a geologically recent series of inland ridges representing stranded beaches that align parallel to the coast. Accumulation of fine-grained sediment deposited between these multiple beach ridges formed marshes and mudflats. (USFWS 2008).

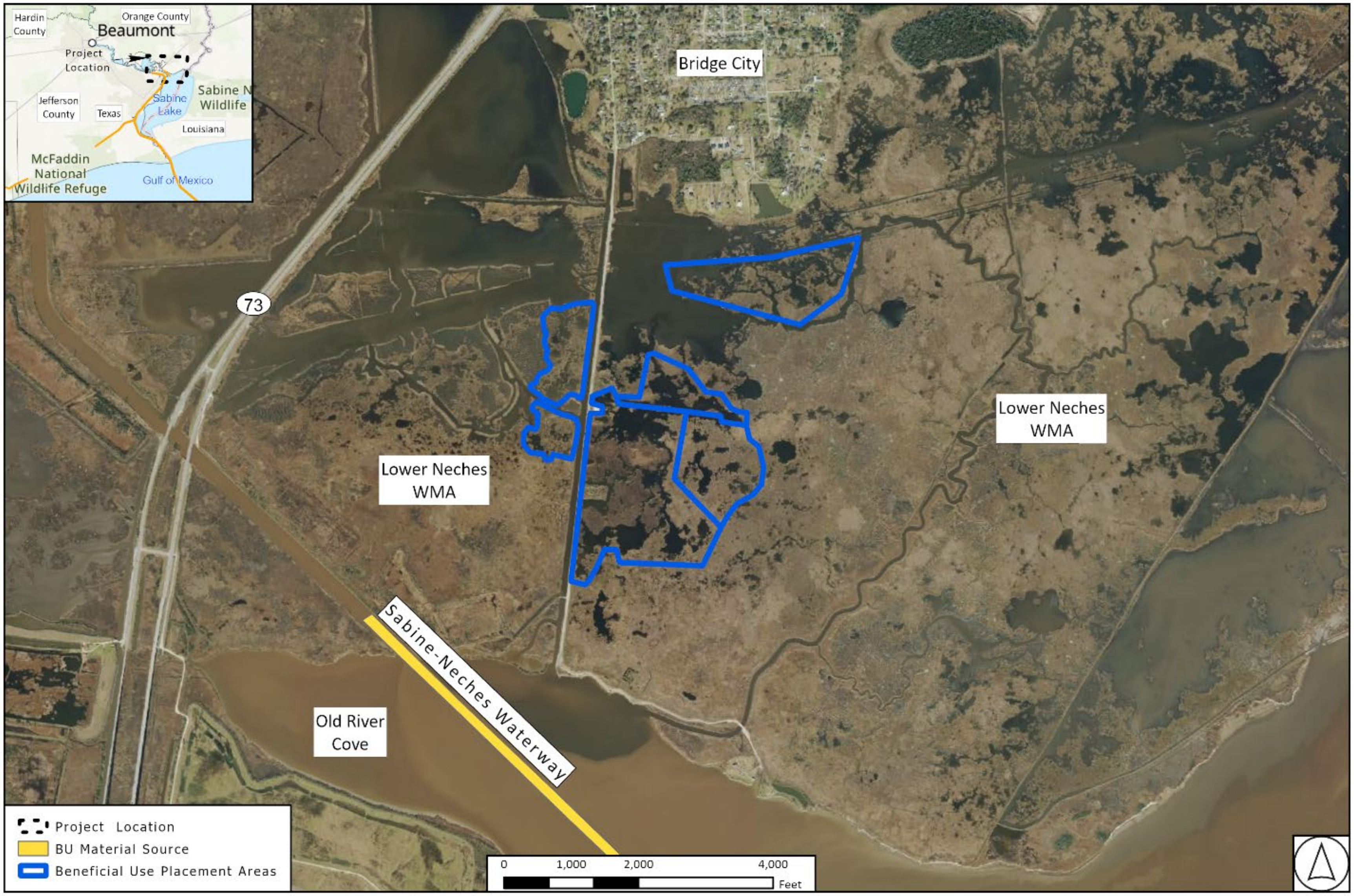

Figure A-5 Location of Proposed Restoration Areas Within the Lower Neches WMA Old River Unit Wetland Restoration Area

Table A-11 Summary of Adverse and Beneficial Impacts from Implementation of the Lower Neches WMA Old River Unit Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and Estuarine Resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: provides benefits

The ground surface within the project area is mostly comprised of chenier plain and coastal plain sediments deposited by fluvial, tidal, littoral, and deltaic processes. The coastal plain is characterized as seaward-thickening sediment deposits to depths of thousands of feet below the present land surface. The terrain is relatively flat to gently sloping. Two types of landforms characterize the area: broad marshes containing organic clays and peat and long, narrow relict cheniers, which appear as ridges parallel to the coast. Chenier ridges form as a result of cyclic shoreline advance and retreat and are typically mixtures of silt, sand, and shell fragments. They are slightly elevated features and attain elevations of 5 to 10 feet above sea level (Federal Energy Regulatory Commission [FERC] 2011).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Lower Neches WMA Old River Unit Wetland Restoration Project area is within the Old River Bayou watershed (Hydrologic Unit Code 120402010500), which includes Sabine Lake in Texas, Louisiana, and the SNWW. The Sabine and Neches rivers discharge into Sabine Lake from the north. The Sabine Pass Channel is at the southern end of the watershed. This narrow tidal inlet is the outlet for this system to the Gulf of Mexico. Wind-driven tides predominate the area and affect the estuary environment, producing wind-tidal flats and marshes (FERC 2011).

The Sabine and Neches river basins provide about 85% of the freshwater inflows in the Sabine-Neches estuary. Additional freshwater enters the system through streams; municipal, industrial, and agricultural flows; and precipitation. The Neches River floodplain, which includes the project area, is characterized by marsh areas that drain primarily through existing stream channels, and, in some cases, flow goes directly to wetland areas. Most likely, flow to the project area occurs primarily through rainfall and tidal push (USACE 2015).

USACE is building a coastal storm risk management project near the project site. The Orange 3 coastal storm risk management project would consist of a 26.7-mile-long levee/floodwall system along the edge of the Sabine and Neches River floodplains from Orange to the vicinity of Orangefield, Texas. This system, which would be directly north of the project area, could affect hydrology. Its effects will be taken into account in the project’s final design phase.

There is a fish consumption advisory related to PCBs in edible fish tissue in Sabine Lake (Segment 2412) documented in the 2022 Integrated Report, but otherwise the water body fully supports aquatic life and contact recreation (TCEQ 2022). The Texas Surface Water Quality Standards classify Sabine Lake as suitable for primary contact recreation, and its waters are designated high aquatic life use (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

The Lower Neches WMA Old River Unit is located in the Beaumont-Port Arthur Air Quality Control Region (Region 10). The Region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021c).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project’s impacts of GHG emissions are considered.

Noise

The project location is in the Old River Unit of the Lower Neches WMA, which is largely undeveloped. The recreational uses of the WMA create a low level of ambient noise. The project location is a few miles south of Bridge City, a community of about 8,000 residents.

A.3.4.1.2 Biological Resources

The wetland habitats on the upper Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. A complex of protected lands along the coast, including NWRs and state-managed WMAs such as Lower Neches WMA, serves as a critical staging area for waterfowl migrating to and from Mexico. The Sabine Lake estuary is a vital habitat for fish and shellfish species found in the Gulf of

Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The wetlands of the Sabine Lake estuary contribute nutrients to and enhance productivity of Sabine Lake and serve as important nursery and adult habitat for a variety of oligohaline and marine fish and invertebrate species. Sabine Lake is a low-salinity, estuarine embayment of the Gulf of Mexico and is characterized by shallow, productive waters. The Neches River in the vicinity of the site is tidally influenced and part of the Sabine Lake estuary. The land and waters surrounding the project area support a wide array of birds, wildlife, fish, and plant species. Phytoplankton, zooplankton, and aquatic invertebrates living in these habitats provide food web support for a diversity of fish and bird species. No seagrasses or oyster reefs were identified in the vicinity of the project site.

Wildlife Species

Intermediate marshes and shallow open water are the primary habitats within the Lower Neches WMA Old River Unit. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

The tidal marshes and shallow open water are the primary habitats within the project area. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-12 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-12 Federal Threatened and Endangered Species Potentially Affected by the Lower Neches WMA Old River Unit Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
West Indian manatee	Threatened

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so that wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This project would have minimal indirect benefits to black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and in Orange County. Both species are known to use the shoreline of bays and mudflats.

The West Indian manatee has been found in Texas estuaries on rare occasions. There have been infrequent reports of manatee sightings in the Sabine-Neches estuary.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-13 provides a list of managed EFH species in the Lower Neches WMA Old River Unit Wetland Restoration Project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-13 EFH for Estuarine Habitats within the Lower Neches WMA Old River Unit Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in Sabine Lake is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees within the estuary.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.4.1.3 Socioeconomic Resources

This section includes descriptions of socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational uses, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Orange County has a total population of 85,722, an increase of 1.1% since 2020, based on the 2023 U.S. Census population estimates. Approximately 78% of the county population identified as white (not Hispanic or Latino), 10% as Hispanic or Latino, 9% as Black or African American, with the remaining population including small percentages of American Indian and Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander. Median household income (2018 to 2022) in Orange County is $71,910, with 13.8% of the county living in poverty (USCB 2024d).

Socioeconomic indicators above the state's 50th percentile included the supplemental demographic index, unemployment rate, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included toxic releases to air, lead paint, superfund site proximity, risk management plan facility proximity, hazardous waste facility proximity, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

Various oil and gas pipelines and wells exist at the site. RRC maintains an oil and gas pipeline and well database with a GIS viewer, which shows the infrastructure within the boundaries of the Lower Neches WMA Old River Unit (RRC 2020). Additionally, GLO Texas Sediment Geodatabase GIS viewer shows buried natural gas and crude oil pipelines running under the site (GLO 2017). Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The Lower Neches WMA Old River Unit is comprised of 4,386 acres located in Orange County, Texas, south of Bridge City and bordering the Neches River and Old River Cove to the west and south, which connects to Sabine Lake and the greater Sabine-Neches estuary. The project area does not have any road access to the placement location. The WMA is managed by TPWD.

Tourism and Recreational Use

Hunting, fishing, hiking, and wildlife viewing are regularly enjoyed by the public in the Lower Neches WMA Old River Unit and these activities are accessible in the project area.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

Lower Neches WMA Old River Unit is relatively remote with one public road within its boundaries and limited pedestrian and water access.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of brackish and intermediate marsh and open water. The site is undeveloped. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of the Lower Neches WMA Old River Unit are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically intermediate marsh, but it has since been inundated primarily due to subsidence and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area's functionality as a buffer for storm surges.

A.3.4.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.4.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor adverse impacts to water quality from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project because maintenance dredging of the SNWW is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would have long-term benefits from the restoration and levee protection of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical, to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct, localized, and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. To prevent disturbance to nearby residential communities, construction activities that produce significant noise would be limited to daylight hours.

A.3.4.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project will provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including *the Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, adverse impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH would occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM material to create estuarine emergent marsh would have a long-term beneficial effect on the habitat's ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which would protect and improve sensitive resources utilized by these species. In addition, the proposed project would improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which would ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site, because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas, if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as placement of hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.4.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. Best practices would be implemented during construction to avoid short-term impacts to nearby residential communities.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the Lower Neches WMA Old River Unit.

Land and Marine Management

No adverse short- or long-term impacts to infrastructure are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationalists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) from restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Shipping and boating routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would not significantly interrupt the channel traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment during the construction period and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.5 McFaddin NWR Willow Lake Terraces Wetland Restoration

The project site is located in the McFaddin NWR managed by the USFWS. The restoration site boundaries were based on a previous effort to regenerate marsh using terraces within subtidal open water areas surrounding Willow Lake. The addition of dredge material to the terraced area would restore up to 218 acres of intertidal marsh habitat.

The predominant wetland habitats near the McFaddin NWR are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands by rapidly converting emergent marsh to open water. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in Willow Lake by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in Willow Lake to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 475,000 cubic yards of suitable hydraulically dredged material within levees constructed from on-site material. Sediment would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 218 acres of marsh habitat, including the conversion of up to 140 acres of existing open water to low marsh (Figure A-6).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW and SNWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.5.1; project-level environmental consequences are summarized in Table A-14 and described in Section A.3.5.2.

This section presents the affected resources of the McFaddin NWR Willow Lake Terraces Wetland Restoration project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

The description and analysis of the project are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. Throughout the completion of the 100% designs under this process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-14). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

Figure A-6 Location of Proposed Restoration Areas Within the McFaddin NWR Willow Lake Terraces Wetland Restoration Area

Table A-14 Summary of Adverse and Beneficial Impacts from Implementation of the Mcfaddin NWR Willow Lake Terraces Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: would provide benefits

A.3.5.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.5.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

McFaddin NWR project area is located in the Chenier Plain region of Texas. A distinguishing feature of the region is the cheniers, ridges representing ancient Gulf shorelines generally aligned parallel to the Gulf or as fan-shaped alluvial deposits at the mouths of rivers. It is comprised of a mainland beach fronting a chenier plain that formed from a Pleistocene promontory overlain by Holocene marginal-deltaic sediments (King 2007). The geologic substrate of the Chenier Plain region is primarily composed of sediments deposited during the late recent epoch with some subsurface Pleistocene outcropping. These deposits are overlain at the coast by a geologically recent series of inland ridges representing stranded beaches that align parallel to the coast. Accumulation of finegrained sediment deposited between these multiple beach ridges formed marshes and mudflats. Tidal channels lie between successive ridges. The shore of the coast is formed by a narrow beach or washover terrace that developed over time through the deposition of sand and shell. The coastline is breached by inlets that connect estuaries extending inland up river valleys. (USFWS 2008).

The ground surface within the project area is mostly comprised of chenier plain and coastal plain sediments deposited by fluvial, tidal, littoral, and deltaic processes. The coastal plain is characterized as seaward-thickening sediment deposits to depths of thousands of feet below the present land surface. The terrain is relatively flat to gently sloping. Two types of landforms characterize the area: broad marshes containing organic clays and peat and long, narrow relict cheniers, which appear as ridges parallel to the coast. Chenier ridges form as a result of cyclic shoreline advance and retreat and are typically mixtures of silt, sand, and shell fragments. They are slightly elevated features and attain elevations of 5 to 10 feet above sea level (FERC 2011).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

Historically, hurricanes and other rain events brought large volumes of freshwater that would slowly flow across the coastal prairies and marshes of the Texas Chenier Plain complex. The natural drainage of the cheniers allowed a pattern of drying and flooding under which wetland plants evolved and adapted. These diverse wetland plants in turn supported a diversity of wildlife, but manufactured changes over the last century have altered the landscape’s hydrology (USACE 2016). Coastal marshes in the Texas Chenier Plain area have been impacted by major alterations of historic hydrology, including loss of freshwater and sediment inflows and increased saltwater intrusion. Construction of the GIWW and the SNWW have significantly affected hydrology of coastal marshes in the project area. Collectively, altered hydrological regimes resulting in saltwater intrusion, reduced freshwater supplies, reduction of mineral sediment supply to marsh systems, sea level rise, and land subsidence are resulting in coastal erosion and shoreline retreat along the Gulf of Mexico and bay shorelines and the conversion of interior vegetated marshes to open water (USFWS 2008).

The project area lies south of the GIWW in the Salt Bayou watershed. Those areas are cut off from the sheet flow of freshwater from the north, resulting in the wetlands becoming intermediate and brackish due to lack of freshwater inflows that occurred prior to the creation of the GIWW (TPWD 2013).

The McFaddin NWR Willow Lake Terraces Wetland Restoration project area is within the Salt Bayou watershed (Hydrologic Unit Code 12042010300) and within Stream Segment 0702 Intracoastal Waterway Tidal. In the 2022 Texas Integrated Report, Segment 0702 Intracoastal Waterway Tidal is not supporting fish consumption due to PCBs and dioxin in edible tissue and is not supporting contact recreation due to bacteria. Segment 0702 is designated for primary contact recreation use and intermediate aquatic life use in the 2018 Texas Surface Water Quality Standards (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

The McFaddin NWR is located in the Beaumont-Port Arthur Air Quality Control Region (Region 10). The Region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021c).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project location is adjacent to the GIWW, a heavily used maritime channel. Due to its location, the McFaddin NWR project area experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common at the McFaddin NWR Willow Lake Terraces site.

A.3.5.1.2 Biological Resources

The wetland habitats on the upper Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. A complex of protected lands along the coast, including NWRs such as McFaddin and state-managed Wildlife Management Areas, serve as critical staging areas for waterfowl migrating to and from Mexico. The nearby Sabine-Neches estuary is a vital habitat for fish and shellfish species found in the Gulf of Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The coastal marshes of McFaddin NWR, including the project area, support many species of birds; fish; and other wildlife, such as the northern river otter, bobcat, gray fox, coyote, and American alligator. The refuge is a primary wintering area for Central Flyway ducks and geese and serves as a critical staging area for waterfowl migrating to and from Mexico and other locations. The McFaddin NWR is predominantly a saline-brackish marsh complex comprised of emergent marshes, shallow subtidal flats, and open water. These shallow flats support diverse benthic communities that provide food sources for migratory waterfowl, estuarine fish and invertebrate species, and other marsh fauna. The southern edge of McFaddin NWR borders the Gulf of Mexico. The low saline marsh landward of the beach ridge is dominated by smooth cordgrass and black rush. Upland brackish marsh is vegetated with saltmeadow cordgrass, saltgrass (*Distichlis spicata*), and saltmarsh bulrush (*Scirpus maritimus*).

Wildlife Species

Tidal brackish marshes and shallow open water are the primary habitats within the McFaddin NWR including the project area. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

The tidal marshes and shallow open water are the primary habitats within the project area. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-15 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-15 Federal Threatened and Endangered Species Potentially Affected in the McFaddin NWR Willow Lake Terraces Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp’s ridley sea turtle	Endangered

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so that wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This project would have minimal indirect benefits to black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and occur in Jefferson County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for red knot or piping plover in the McFaddin NWR.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead, green, hawksbill, leatherback, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-16 provides a list of managed EFH species in the Texas Point NWR Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-16 EFH for Estuarine Habitats Within the McFaddin NWR Willow Lake Terraces Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in the adjacent GIWW is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees in the nearby estuary.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.5.1.3 Socioeconomic Resources

This section describes the socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational uses, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Jefferson County has a total population of 251,496, a decrease of 2% since 2020, based on the 2023 U.S. Census population estimates. Approximately 37% of the county population identified as white (not Hispanic or Latino), 34% as Black or African American, 25% as Hispanic or Latino, 4% as Asian, with the remaining population including small percentages of American Indian and Alaska Native and Native Hawaiian or Other Pacific Islander. Median household income (2018 to 2022) in Jefferson County is $57,294, with 18.8% of the county living in poverty (USCB 2024e).

Socioeconomic indicators above the state's 50th percentile included the demographic index, the supplemental demographic index, people of color, low income, unemployment rate, limited English-speaking households, less than high school education, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included diesel particulate matter, toxic releases to air, lead paint, superfund site proximity, risk management plan facility proximity, hazardous waste facility proximity, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

RRC maintains an oil and gas pipeline and well database. According to the RRC Public GIS viewer (RRC 2020), no existing oil and gas infrastructure is present on the site. Additionally, the GLO Texas Sediment Geodatabase GIS viewer shows no buried natural gas and crude oil pipelines running under the site (GLO 2017). Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The McFaddin NWR encompasses 58,861 acres located in Jefferson County, Texas, on the upper Texas coast west of the Sabine-Neches estuary. The McFaddin NWR is bounded on the south by the Gulf of Mexico with approximately 20 miles of Gulf shoreline. It is bounded on the east by Sea Rim State Park. The GIWW forms part of the northern boundary, and it transects the northeastern portion of the NWR near where the Willow Lake Terraces site is located. The project area is not accessible to the public but is accessible by service road. The project area is managed by TPWD.

Tourism and Recreational Use

The McFaddin NWR marsh is managed by USFWS as part of the Texas Chenier Plain Refuge Complex, which also includes Texas Point NWR, Anahuac NWR, and Moody NWR. Management includes use of the marsh for recreational fishing and waterfowl hunting. Hunting, fishing, hiking, and wildlife viewing are regularly enjoyed by the public in the McFaddin NWR.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

McFaddin NWR is relatively remote with no public roads within its boundaries and limited pedestrian and water access. The site is adjacent to the GIWW.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of saline and brackish marsh, elevated cheniers, and open water. The site is adjacent to the GIWW, a busy waterbody. The NWR is undeveloped and, other than the maritime traffic on the GIWW, the viewshed is dominated by the nature features of the area. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of the McFaddin NWR are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically brackish marsh, but it has since been predominated by open water primarily due to subsidence and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area's functionality as a buffer for storm surges.

A.3.5.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.5.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse, indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor, adverse impacts to water quality from increased turbidity during construction activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project because maintenance dredging is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical, to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct localized and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. All placement of dredged material would occur in the interior of the McFaddin NWR and would not be directly adjacent to residential areas.

A.3.5.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, adverse impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh will have a long-term beneficial effect on the habitat’s ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which will protect and improve sensitive resources utilized by these species. In addition, the proposed project will improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which will ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS’s *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site, because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas, if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.5.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. No residential communities are located adjacent to the project. As a result, there would be no potential for short-term impacts from construction.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the McFaddin NWR.

Land and Marine Management

No adverse short- or long-term impacts to land and marine management are anticipated.

The project is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species which, in turn, would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) from restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Shipping and boating routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would not significantly interrupt the GIWW traffic. Most of the commercial traffic takes place on a routine schedule and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.6 San Bernard NWR Sargent Oil Field Wetland Restoration

The project site is located on the San Bernard NWR managed by USFWS. Dredged material would provide fill for a contained placement area within the abandoned oil field adjacent to the GIWW to restore up to 200 acres of intertidal marsh.

The predominant wetland habitats in the San Bernard NWR Sargent Oil Field project area are characterized as salt and brackish marsh and estuarine open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, subsidence, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through beach renourishment, dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in the San Bernard NWR Sargent Oil Field area by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage. The primary objective of this project is to restore shallow open water habitat in the San Bernard NWR Sargent Oil Field site to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 120,000 cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 200 acres of marsh habitat, including the conversion of up to 119 acres of existing open water to low marsh (Figure A-7).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the GIWW, private dredging sources, and material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.6.1; project-level environmental consequences are summarized in Table A-17 and described in Section A.3.6.2.

This section presents the affected resources of the San Bernard NWR Sargent Oil Field Wetland Restoration Project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

The description and analysis of the project are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. Throughout the completion of the 100% designs under this process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-17). Benefits to the biological, physical, human uses and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.6.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.6.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions and noise characteristics of the area.

Figure A-7 Location of Proposed Restoration Areas Within the San Bernard NWR Sargent Oil Field Wetland Restoration Area

Table A-17 Summary of Adverse and Beneficial Impacts from Implementation of the San Bernard NWR Sargent Oil Field Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: Would provide benefits

Geology and Substrates

The San Bernard NWR Sargent Oil Field project area is located in the Texas coastal plain, which is underlain by a complex assemblage of fluvial, deltaic, estuarine, and marine-influenced deposits that make up two Pleistocene formations: the younger Beaumont Formation and the older Lissie Formation. Geophysical data suggest that the strata within these two formations represent multiple episodes of deposition, erosion, and soil formation (Paine et al. 2018). Surface geology is of the late Pleistocene Beaumont Formation and younger deposits. The Beaumont Formation was deposited as a large alluvial plain, after which sea levels fell during a period of glacial advance. A period of erosion then followed, with incision of stream channels. At the end of the last glacial period, as sea levels rose again, the area was flooded, and a series of estuaries and bays formed. The soils currently feature river floodplain muds and fluvial-deltaic sands (Thomas and Durkin 2012).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The San Bernard NWR Sargent Oil Field Wetland Restoration project area is within the East Matagorda Bay watershed (Hydrologic Unit Code 12090400), and flows into Reservoir Segment 2501, Gulf of Mexico, and Stream Segment 1304, Caney Creek Tidal. Surface water quality in the region is influenced by industrial and agricultural practices and saltwater intrusion. The movement of saltwater from the Gulf and bays inland through the bayou and marsh systems varies depending upon tidal action, storms, and storm runoff. Channel construction, including the GIWW and channelization of natural waterways such as the MSC, have facilitated the movement of saltwater further inland than what occurred historically or what would occur under natural conditions.

The portion of the GIWW that is adjacent to the project site is not a designated stream segment and historic water quality data is not available. However, the 2022 Water Quality Inventory documents that East Matagorda Bay (Stream Segment 2441), located near the western edge of the project site, fully supports aquatic life, contact recreation, and general uses (TCEQ 2022). The Texas Surface Water Quality Standards classify East Matagorda Bay as suitable for primary contact recreation, and its waters are designated excellent aquatic life (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

San Bernard NWR is located in the Houston-Galveston-Brazoria Air Quality Control Region (TCEQ Region 12). The Region is in nonattainment for 8-hour ozone (TCEQ 2021a).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project location is adjacent to the GIWW. Due to its location, the San Bernard NWR project area experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common around the San Bernard NWR Sargent Oil Field project area.

A.3.6.1.2 Biological Resources

San Bernard NWR includes an important coastal marsh wilderness that provides habitat for millions of migrating and nesting birds, including over 230 different species annually. Some of these include geese, herons, egrets, terns, and gulls, and neotropical bird species. Bobcats and alligators reside there, and it supports estuaries that flourish fish; shellfish; and reefs of colonial oysters; supplying a feeding ground for adult fish and crabs (Houston-Galveston Area Council 2012). The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The physical components of the site currently provide habitat for a variety of coastal plants and animals. The marsh vegetation occurs in somewhat distinct communities within the site. Smooth cordgrass dominates within the open-water area and those that are most tidally affected. The saltier flats that are intermittently flooded in the southeastern portion of the area are dominated by saltwort. Vegetation in the eastern and northern portions of the site are dominated by saltgrass in the intermittently flooded sites and transitions to Gulf cordgrass as the elevation rises. The site provides migrating and wintering habitat for migratory waterfowl and provides year-round habitat for resident mottled ducks.

Wildlife Species

Tidal marshes and shallow open water are the primary habitats within the project area. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Saline marshes and shallow open water are the primary habitats within the project area. These habitats are critical for many species of plants, fish, birds, and other wildlife. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web.

Bird species such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as king rail, seaside sparrow, and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Tidal marshes and shallow open water are the primary habitats within the project area The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-18 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-18 Federal Threatened and Endangered Species Potentially Affected in the San Bernard NWR Sargent Oil Field Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
Whooping crane	Endangered
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp's ridley sea turtle	Endangered

The last wild flock of whooping cranes winters on the Texas coast in the area around San Antonio Bay, southwest of East Matagorda Bay. The construction activities for the project are unlikely to affect whooping cranes, which usually inhabit an area west of the project on Blackjack Peninsula in Aransas NWR.

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so that wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This project would have minimal indirect benefits to black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and occur in Matagorda County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for piping plover or red knot in San Bernard NWR.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead, green, hawksbill, leatherback, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-19 provides a list of managed EFH species in the San Bernard NWR Sargent Oil Field Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-19 EFH for Estuarine Habitats Within the San Bernard NWR Sargent Oil Field Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in East Matagorda Bay is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees in this part of the Texas coast.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.6.1.3 Socioeconomic Resources

This section describes the socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational uses, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Matagorda County has a total population of 36,359, an increase of 0.3% since 2020, based on the 2023 U.S. Census population estimates. Approximately 44% of the county population identified as Hispanic or Latino, 42% as white (not Hispanic or Latino), 11% as Black or African American, with the remaining population including small percentages of American Indian and Alaska Native, Asian, and Native Hawaiian or Other Pacific Islander. Median household income (2018 to 2022) in Matagorda County is $56,412, with 19.9% of the county living in poverty (USCB 2024f).

Socioeconomic indicators above the state's 50th percentile included the demographic index, the supplemental demographic, low income, unemployment rate, limited English-speaking households, less than high school education, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included toxic releases to air, lead paint, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

RRC maintains an oil and gas pipeline and well database. According to the RRC GIS viewer (RRC 2020), some active and decommissioned natural gas wells and pipelines lie in close proximity to the proposed site. Additionally, the GLO Texas Sediment Geodatabase GIS viewer shows buried pipelines running near the site (GLO 2017). Care was taken to avoid this infrastructure with the proposed 60% design. Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The San Bernard NWR encompasses 54,000 acres located in Brazoria and Matagorda counties, Texas. The project area is in the western part of the Refuge, which is bordered on the south by the GIWW. The community of Sargent is located adjacent to its western boundary. The project area is not accessible by the public but is accessible by service roads. The project area is managed by USFWS.

Tourism and Recreational Use

The San Bernard NWR is managed by USFWS as part of the Texas Mid-Coast Refuge Complex, which also includes Brazoria NWR and Big Boggy NWR. Management includes use of the marsh for recreational fishing and waterfowl hunting. Hunting, fishing, hiking, and wildlife viewing are regularly enjoyed by the public in the San Bernard NWR.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

The San Bernard NWR Sargent Oil Field project area has no public roads within its boundaries and limited pedestrian and water access. The site is adjacent to the commercially important GIWW.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of saline and brackish marsh and open water. The site is adjacent to the GIWW, a busy maritime channel. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational users of the San Bernard NWR are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically salt and brackish marsh, but it has since been inundated primarily due to subsidence and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area’s functionality as a buffer for storm surges.

A.3.6.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.6.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor, adverse impacts to water quality from increased turbidity during construction activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project because maintenance dredging of the GIWW is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from. Equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct localized and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. All placement of dredged material would occur in the interior of the San Bernard NWR and would not be directly adjacent to residential areas.

A.3.6.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing*

Entrapment Risk to Protected Species (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh will have a long-term beneficial effect on the habitat's ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which will protect and improve sensitive resources utilized by these species. In addition, the proposed project will improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which will ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site, because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas, if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using BMPs such as hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.6.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the San Bernard NWR.

Land and Marine Management

No adverse short- or long-term impacts to land and marine management are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and recreational use could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) by restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Shipping and boating routes would be identified prior to the beneficial use operations to prevent any impacts to marine transportation. It is expected that activities would not significantly interrupt the GIWW traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.7 Schicke Point Wetland Restoration

The project site is located adjacent to the peninsula separating Matagorda Bay and Caranchua Bay. A segmented rubble-mound breakwater was constructed along the shoreline facing Matagorda Bay in 2017. Dredged material would provide sediment to restore up to 72 acres of intertidal marsh behind the existing breakwater.

Over the past several decades, the marsh portion of the site has undergone physical deterioration through erosion of its bayward boundary as well as the expansion of interior open water areas. The predominant wetland habitats at Schicke Point are characterized as salt and brackish marsh and estuarine open water. The combination of rising sea levels, erosion, reduced sediment supplies, wind-wave erosion, and storm impacts have resulted in significant loss of wetlands and other coastal habitats in the region. This project is consistent with regional efforts to combat land and habitat loss through hydrology enhancements, oyster reef, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats in Schicke Point by beneficially using dredged material to create a viable, vegetated, wetland habitat for fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage.

The primary objective of this project is to restore shallow open water habitat in Schicke Point to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 182,000 cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 72 acres of marsh habitat (Figure A-8).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the MSC, private dredging sources, and material mined from dredged material placement areas. As part of the completion of E&D for the BUDM site, the specific sources of dredged material would be determined during project implementation. Any dredged material used would pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the affected environment are described in Section A.3.7.1; project-level environmental consequences are summarized in Table A-20 and described in Section A.3.7.2.

Figure A-8 Location of Proposed Restoration Areas Within the Schicke Point Wetland Restoration Area

Table A-20 Summary of Adverse and Beneficial Impacts from Implementation of the Schicke Point Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: would provide benefits

This analysis expands upon the relevant portions of Section 6.4.1.1 of the Final PDARP/PEIS in relation to the project. The description and analysis of the project below are based on the 60% basis of design concepts developed under the Texas Dredged Material Planning for Wetland Restoration project authorized in RP/EA #1. Throughout the completion of the 100% designs under this process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the 100% E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-20). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project was implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.7.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.7.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The Schicke Point Wetland Restoration project area is located in the Texas coastal plain, which is underlain by a complex assemblage of fluvial, deltaic, estuarine, and marine-influenced deposits that make up two Pleistocene formations: the younger Beaumont Formation and the older Lissie Formation. Geophysical data suggest that the strata within these two formations represent multiple episodes of deposition, erosion, and soil formation. (Paine et al. 2018). Surface geology is of the late Pleistocene Beaumont Formation and younger deposits. The Beaumont Formation was deposited as a large alluvial plain, after which sea levels fell during a period of glacial advance. A period of erosion then followed, with incision of stream channels. At the end of the last glacial period, as sea levels rose again, the area was flooded, and a series of estuaries and bays formed. The soils currently feature river floodplain muds and fluvial-deltaic sands (Thomas and Durkin 2012).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Schicke Point Wetland Restoration project area is within the Central Matagorda Bay watershed (Hydrologic Unit Code 121004010500). Surface water quality in the region is influenced by industrial and agricultural practices and saltwater intrusion. The movement of saltwater from the Gulf and bays inland through the bayou and marsh systems varies depending upon tidal action, storms, and storm runoff. Channel construction, including the GIWW and channelization of natural waterways such as the MSC, have facilitated the movement of saltwater further inland than what occurred historically or what would occur under natural conditions.

The 2022 Water Quality Inventory has inadequate data to assess most water quality metrics in Matagorda Bay/Powderhorn Lake (Segment 2451). The Texas Surface Water Quality Standards classify Matagorda Bay/Powderhorn Lake as suitable for primary contact recreation, and its waters are designated excellent aquatic life use (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

Schicke Point Wetland Restoration project area is located in the Corpus Christi Air Quality Control Region (Region 14). The Region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021b).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project location is remote, located on a peninsula between Carancahua and Matagorda bays. Nearby land is residential, undeveloped, or used for agriculture. Due to its location, the Schicke Point project area experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common around Schicke Point.

A.3.7.1.2 Biological Resources

Relatively undeveloped compared to other Texas bay systems, Matagorda Bay is a biologically diverse environment home to an array of coastal plants, fish, and wildlife. It boasts an impressive avian biodiversity and productive fishing grounds. The region provides habitat for millions of migrating and nesting birds. Some of these include geese, herons, terns, and gulls, and neotropical bird species. It also supports fish, shellfish, and blue crab.

The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The physical components of Schicke Point currently provide habitat for a variety of coastal plants and animals. The salt flats and tidal marshes serve as habitat for bird species including killdeer, black-necked stilt, and willet, as well as crabs and juvenile flounder. The brackish waters further inland within the marsh support blue crab and other species of shellfish, egrets, herons, and many others (USACE 2019). Smooth cordgrass is the most common marsh vegetation species encountered at the site. This plant filters the water of pollutants and provides habitat, nesting, and foraging for many species that inhabit this area.

Wildlife Species

Saline marshes and shallow open water are the primary habitats within the project area. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Saline marshes and shallow open water are the primary habitats within the project area. The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of non-commercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-21 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-21 Federal Threatened and Endangered Species Potentially Affected in the Schicke Point Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
Whooping crane	Endangered
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp’s ridley sea turtle	Endangered

The last wild flock of whooping cranes winters on the Texas coast in the area around San Antonio Bay, southwest of Matagorda Bay. The construction activities for the project are unlikely to affect whooping cranes, which usually inhabit an area west of the project on Blackjack Peninsula in Aransas NWR.

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so that wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability. This project would have minimal indirect benefits to black rail habitat.

The red knot and piping plover are winter residents on the Texas coast and in Calhoun County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for red knot or piping plover in Schicke Point.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead sea turtles, green sea turtles, hawksbill sea turtles, leatherback turtles, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-22 provides a list of managed EFH species in the Schicke Point Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-22 EFH for Estuarine Habitats Within the Schicke Point Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal that is regularly found in Matagorda Bay is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees within the estuary.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.7.1.3 Socioeconomic Resources

Socioeconomics and EJ

Calhoun County has a total population of 19,696, a decrease of 2% since 2020, based on the 2023 U.S. Census population estimates. Approximately 50% of the county population identified as Hispanic or Latino, 42% as white (not Hispanic or Latino), 5% as Asian, 3.1% as Black or African American, with the remaining population including small percentages of American Indian and Alaska Native and Native Hawaiian or Other Pacific Islander. Median household income (2018 to 2022) in Calhoun County is $62,267, with 15.9% of the county living in poverty (USCB 2024g).

Socioeconomic indicators above the state's 50th percentile included the demographic index, the supplemental demographic index, low income, unemployment rate, limited English-speaking households, less than high school education, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included toxic releases to air, lead paint, superfund site proximity, risk management plan facility proximity, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA will be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024).

Infrastructure

RRC maintains an oil and gas pipeline and well database. According to the RRC GIS viewer (RRC 2020), no active and decommissioned oil or natural gas wells or pipelines lie in close proximity to the proposed site. Additionally, the GLO Texas Sediment Geodatabase GIS viewer shows no buried pipelines running near the site (GLO 2017). No pipelines or wells were identified during the recent design and construction of the offshore breakwater. Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The Schicke Point project area is located on a peninsula in Matagorda Bay at the mouth of Carancahua Bay. It is adjacent to private land used for residential purposes. The project site is publicly accessible.

Tourism and Recreational Use

Schicke Point is located adjacent to private residential land, and the bay waters are open to the public for fishing, boating, and wildlife viewing.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

Schicke Point is relatively remote with a few public roads providing access to the small adjacent residential community.

Aesthetics and Visual Resources

Schicke Point is relatively remote with a few public roads providing access to the small adjacent residential community.

Public Health and Safety

The people residing in the adjacent residential properties would be affected by the construction, as would recreational boaters who pass the site. The immediate vicinity of the project area was historically salt and brackish marsh, but it has since been inundated primarily due to erosion and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area’s functionality as a buffer for storm surges.

A.3.7.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.7.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce erosion and loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor, adverse impacts to water quality from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project, as maintenance dredging of the GIWW is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water, and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct, localized, and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. To prevent disturbance to nearby residential communities, construction activities that produce significant noise would be limited to daylight hours. All placement of dredged material would occur on the south side of Schicke Point and so would not be directly adjacent to residential areas.

A.3.7.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, final project design would ensure adequate shallow open water would remain in the project area to maintain the synergies between these two habitats. The creation of additional salt marsh generates habitat for a number of marsh residents and is anticipated to benefit the local ecosystem, enhancing the food web and supporting many ecologically and economically important fish and invertebrate species.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web and supporting many ecologically and economically important wildlife species.

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including *the Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh would have a long-term beneficial effect on the habitat's ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which would protect and improve sensitive resources utilized by these species. In addition, the proposed project would improve water quality by reducing sedimentation from coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which would ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on Final PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as use of hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.7.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, the project does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. Best practices would be implemented during construction to avoid short-term impacts to nearby residential communities.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure because new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in Schicke Point.

Land and Marine Management

No adverse short- or long-term impacts to land and marine management are anticipated.

The proposed project is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and recreational use in the immediate area could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project could provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) by restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. There are no transportation channels in the area; therefore, there will be no impact on marine beneficial use operations transportation. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.3.8 Texas Point NWR Wetland Restoration

The project site is within the Texas Point NWR managed by the USFWS. Dredged material would provide fill for three marsh restoration cells, using containment levees built from sediments collected on site to restore up to 623 acres of intertidal marsh.

The predominant wetland habitats near the Texas Point NWR are characterized as salt and brackish marsh and estuarine open water. Over the past several decades, the vegetated marsh at the site has undergone physical deterioration resulting in the expansion of shallow open water. The combination of rising sea levels, erosion, and reduced sediment supplies have resulted in significant loss of wetlands and other coastal habitats in the region and project site. This project is consistent with regional efforts to combat land and habitat loss through dune restoration, hydrology enhancements, and estuarine marsh restoration.

The overarching goal of the project is to restore and conserve wetlands and coastal habitats by beneficially using dredged material to create viable, vegetated, wetland habitat for a variety fish and wildlife. In addition, rebuilding the wetlands contributes to coastal resiliency by creating buffers that protect adjacent natural areas from storm surge damage.

The primary objective of this project is to restore shallow submerged open water habitat in the Texas Point NWR to reference marsh elevations to support habitat restoration and revegetation with native vegetation such as smooth cordgrass and saltmeadow cordgrass. This project would place up to 1.6 million cubic yards of suitable hydraulically dredged material within levees constructed from on-site sediment. Dredge material would be placed in the site to build elevations suitable for marsh growth as determined from adjacent healthy wetlands. The final target elevation will consider sediment compaction and expected sea level rise. Project actions would restore up to 623 acres of marsh habitat, including the conversion of up to 239 acres of existing open water to intertidal marsh (Figure A-9).

The potential sources of dredged material for the project include material obtained through USACE maintenance dredging from the SNWW, private dredging sources, or material mined from dredged material placement areas. The specific sources of dredged material would be determined during project implementation. Any dredged material used must pass all environmental compliance and permitting requirements to be suitable for the project, regardless of source. Resources of the Affected Environment are described in Section A.3.8.1; project-level environmental consequences are summarized in Table A-23 and described in Section A.3.8.2.

This section presents the affected resources of the Texas Point NWR Wetland Restoration project and the environmental consequences of the proposed actions in context of the project-specific affected environment.

Figure A-9 Location of Proposed Restoration Areas Within the Texas Point NWR Wetland Restoration Area

Table A-23 Summary of Adverse and Beneficial Impacts from Implementation of the Texas Point NWR Wetland Restoration Project

Resource Categories	Resource Subcategories	Benefits	Adverse Short Term	Adverse Long Term
Physical Resources	Geology and substrates	Yes	Minor	Minor
	Hydrology and water quality	Yes	Minor	Minor
	Air quality and GHG emissions	Yes	Minor	NE
	Noise	NE	Minor	NE
Biological Resources	Habitats	Yes	Minor to moderate	NE
	Wildlife species	Yes	Minor to moderate	NE
	Marine and estuarine resources	Yes	Minor to moderate	NE
	Protected species	Yes	Minor	Minor
Socioeconomic Resources	Socioeconomics and EJ	Yes	NE	NE
	Cultural resources	NE	NE	NE
	Infrastructure	NE	NE	NE
	Land and marine management	NE	NE	NE
	Tourism and recreational use	Yes	Minor	NE
	Fisheries and aquaculture	Yes	Minor	NE
	Land and marine transportation	NE	NE	NE
	Aesthetics and visual resources	Yes	Minor to moderate	NE
	Public health and safety	NE	NE	NE

Notes:
Adverse short-term and long-term effects are designated as minor, moderate, or major.
NE: no effect
Yes: Would provide benefits

The description and analysis of the project are based on a 60% basis of design concept, rather than 100% engineering plans. Throughout the design process, every practical attempt would be made to avoid and minimize potentially adverse environmental and cultural resource impacts. The following descriptions for each of the construction elements are preliminary and based on current planning efforts and resource agency experience with similar marsh restoration projects. Although the Texas TIG does not consider it likely, it is possible that the E&D process could generate a plan that has adverse environmental impacts that are different in type or magnitude from those discussed in this document. If that is the case, the Texas TIG would consider whether further environmental impacts analysis would be necessary.

The impacts from the project are anticipated to be largely beneficial, and the adverse impacts would generally be short-term and minor to moderate (Table A-23). Benefits to the biological, physical, human uses, and socioeconomics environment would result if the project were implemented. Best practices required in the permit, consultations, or environmental analyses would be followed. Additionally, best practices described in Appendix 6.A of the Final PDARP/PEIS would be considered and applied where appropriate to reduce or eliminate adverse impacts to the environment.

A.3.8.1 Affected Environment

This section discusses the Affected Environment of the project area including physical resources, biological resources, and socioeconomic resources.

A.3.8.1.1 Physical Resources

The physical resources are divided into geology and substrates, hydrology and water quality, air quality and GHG emissions, and noise characteristics of the area.

Geology and Substrates

The Texas Point NWR project area is located in the Chenier Plain region of Texas. A distinguishing feature of the region is the cheniers, ridges representing ancient Gulf shorelines generally aligned parallel to the Gulf or as fan-shaped alluvial deposits at the mouths of rivers. It is comprised of a mainland beach fronting a chenier plain that formed from a Pleistocene promontory overlain by Holocene marginal-deltaic sediments (King 2007). The geologic substrate of the Chenier Plain region is primarily composed of sediments deposited during the late recent epoch with some subsurface Pleistocene outcropping. These deposits are overlain at the coast by a geologically recent series of inland ridges representing stranded beaches that align parallel to the coast. Accumulation of fine-grained sediment deposited between these multiple beach ridges formed marshes and mudflats. Tidal channels lie between successive ridges. The shore of the coast is formed by a narrow beach or washover terrace that developed through the deposition of sand and shell. The coastline is breached by inlets that connect estuaries extending inland up-river to valleys (USFWS 2008).

The ground surface within the project area is mostly comprised of chenier plain and coastal plain sediments deposited by fluvial, tidal, littoral, and deltaic processes. The coastal plain is characterized as seaward-thickening sediment deposits to depths of thousands of feet below the present land surface. The terrain is relatively flat to gently sloping. Two types of landforms characterize the area: broad marshes containing organic clays and peat and long, narrow relict cheniers, which appear as ridges parallel to the coast. Chenier ridges form as a result of cyclic shoreline advance and retreat and are typically mixtures of silt, sand, and shell fragments. They are slightly elevated features and attain elevations of 5 to 10 feet above sea level (FERC 2011).

The BUDM restoration technique emulates riverine deltaic and other coastal sediment processes that have been interrupted by human alterations to the land and seascape. Emulating these natural accretion processes is a useful restoration tool to restore valuable coastal habitats where the rate of relative sea level rise exceeds accretion.

Hydrology and Water Quality

The Texas Point NWR Wetland Restoration Project site is within the Gulf of Mexico watershed (Hydrologic Unit Code 120402020500), downstream of Sabine Lake, and within Reservoir Segment 2411 Sabine Pass. The Sabine and Neches rivers discharge into Sabine Lake from the north. The Sabine Pass Channel, which borders the Texas Point NWR, is at the southern end of the watershed. This narrow tidal inlet is the outlet for this system to the Gulf of Mexico. Wind-driven tides predominate the area and affect the estuary environment, producing wind-tidal flats and marshes (FERC 2011).

The Sabine and Neches river basins provide about 85% of the freshwater inflows in the Sabine-Neches estuary. Additional freshwater enters the system through streams; municipal, industrial, and agricultural flows; and precipitation. The SNWW Navigation Channel is a deep-draft channel that runs through the Sabine Pass Channel and serves as a pathway for both freshwater from the inflowing rivers and saltwater from the Gulf of Mexico. Saltwater is denser than freshwater. This results in highly stratified conditions in the navigation channel, bringing saltwater up the SNWW and into the northwest corner of Sabine Lake and the lower reaches of the Neches River (USACE 2011).

In the 2022 Texas Integrated Report, Segment 2411 Intracoastal Waterway Tidal is not supporting fish consumption due to PCBs in edible tissue. Segment 2411 is designated for primary contact recreation use and intermediate aquatic life use in the 2018 Texas Surface Water Quality Standards (30 TAC Section 307.10(1), Appendix A).

Air Quality and GHG Emissions

The Texas Point NWR is located in the Beaumont-Port Arthur Air Quality Control Region (Region 10). The region is in attainment for 8-hour ozone and in compliance with the NAAQS for all other criteria pollutants (TCEQ 2021c).

Electricity production, vehicular movements, and commercial and residential buildings using electricity generate criteria air pollutants and GHG emissions. Because of the climate effects of GHG emissions, the project's impacts of GHG emissions are considered.

Noise

The project location is adjacent to the SNWW, the fourth-busiest waterway in the United States in terms of gross tonnage as of 2018 (USDOT 2021). Due to its location, the Texas Point NWR project area experiences the ambient noise of marine transportation. Recreational and commercial waterborne traffic are common around Texas Point NWR.

A.3.8.1.2 Biological Resources

The wetland habitats on the upper Texas coast provide important wintering and migration stopover habitat for migratory birds, including Central Flyway waterfowl, shorebirds, wading birds, and marsh and waterbirds. A complex of protected lands along the coast—including NWRs such as Texas Point and state-managed WMAs—serve as critical staging areas for waterfowl migrating to and from Mexico. The Sabine Lake estuary is a vital habitat for fish and shellfish species found in the Gulf of Mexico. The biological resources discussion is divided into habitats, wildlife species, marine and estuarine resources, and protected species.

Habitats

The Texas Point NWR is predominantly a saline-brackish marsh complex comprised of emergent marshes, shallow subtidal flats, and open water. These shallow flats support diverse benthic communities that provide food sources for migratory waterfowl, estuarine fish and invertebrate species, and other marsh fauna. The southeastern portion of the Texas Point NWR, where the project is located, is strongly influenced by daily tidal action. This low saline marsh is dominated by smooth cordgrass and black rush. Upland brackish marsh is vegetated with saltmeadow cordgrass, seashore saltgrass, and saltmarsh bulrush. Small areas of intermediate marsh are found in the western and northern portions of the NWR. Slightly elevated chenier ridges, aligned east to west, traverse the marshes.

Wildlife Species

Tidal marshes and shallow open water are the primary habitats within the Texas Point NWR marsh. These habitats are critical for many species of plants, fish, birds, and other wildlife. Bird species, such as snowy egrets, great egrets, roseate spoonbills, yellow-crowned night herons, black-crowned night herons, and great blue herons use marsh as feeding habitat. The area also supports a large waterfowl population in the winter and a variety of year-round bird species. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area. Wintering waterfowl include gadwall, northern pintail, lesser scaup, American widgeon, and blue-winged teal. Other birds such as clapper rail, seaside sparrows and other secretive marsh species use the marsh as well.

Marine and Estuarine Resources

Tidal marshes and shallow open water are the primary habitats within the project area The wetland edge is a particularly important habitat for white and brown shrimp (Whaley and Minello 2002). Other marsh-dwelling species include blue crab, red drum, spotted seatrout, Atlantic croaker, southern flounder, and Gulf menhaden. Wetlands act as nurseries to hundreds of noncommercial species that comprise a large part of the estuarine food web. Invertebrates such as blue crab and brown and white shrimp are common in the region.

Protected Species

Protected species and their habitats include ESA-listed species and designated critical habitats, which are regulated by either USFWS or NMFS. Protected species and habitat also include marine mammals protected under the MMPA, EFH protected under the MSA, migratory birds protected under the MBTA, and eagles protected under the BGEPA.

Threatened or Endangered Species

The threatened or endangered species that could potentially be affected are listed in Table A-24 (USFWS 2024). No activities related to implementation of the project would take place in any area designated as critical habitat.

Table A-24 Federal Threatened and Endangered Species Potentially Affected in the Texas Point NWR Wetland Restoration Project Area

Common Name	Status
Piping plover	Threatened
Red knot	Threatened
Eastern black rail	Threatened
West Indian manatee	Threatened
Loggerhead sea turtle	Threatened
Green sea turtle	Threatened
Hawksbill sea turtle	Endangered
Leatherback sea turtle	Endangered
Kemp’s ridley sea turtle	Endangered

The eastern black rail can be present anywhere suitable habitat is present along the Texas coast. Suitable habitat consists of high estuarine marsh and palustrine wet prairies containing dense perennial herbaceous wetland vegetation and proximity to shallow standing water (typically ≤3 cm) that may be ephemeral. No critical habitat has been designated for this species. Eastern black rails occur across an elevational gradient that lies between lower and wetter portions of the marsh and their adjacent uplands. These habitat gradients have gentle slopes so that wetlands can have large areas of shallow inundation (sheet water). Eastern black rails also require adjacent higher elevation areas (i.e., the wetland-upland transition zone) with dense cover to survive high water events. The dense vegetative cover allows movement underneath the canopy to avoid predators. The dense plant structure is more important than plant species composition in predicting habitat suitability.

The red knot and piping plover are winter residents on the Texas coast and in Jefferson County. Both species are known to use the shoreline of bays and mudflats. There is no critical habitat for red knot or piping plover in the Texas Point NWR.

The West Indian manatee has been found in Texas estuaries on rare occasions.

Loggerhead sea turtles, green sea turtles, hawksbill sea turtles, leatherback turtles, and Kemp's ridley sea turtles may be present in the project area.

EFH

The MSA (16 U.S.C. 1801 *et seq.*) promotes the stewardship of economically important marine and estuarine fisheries by requiring NMFS, regional Fishery Management Councils, and other federal agencies to identify and protect EFH during the review of projects to be conducted under federal permits and licenses or other authorities that affect or have the potential to affect such habitat. The MSA- defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH for these species consists of tidally influenced waters and tidally influenced marsh. Table A-25 provides a list of managed EFH species in the Texas Point NWR Wetland Restoration project area, habitat preference, and life stage when they may be expected to occur (NMFS 2021).

Table A-25 EFH for Estuarine Habitats Within the Texas Point NWR Wetland Restoration Project Area

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Brown shrimp	X					Water column associated
Brown shrimp			X			Emergent marsh, soft bottom
Brown shrimp				X		Soft bottom
Pink shrimp			X	X		Soft bottom
White shrimp		X				Water column associated
White shrimp			X			Emergent marsh, soft bottom
White shrimp				X	X	Soft bottom

Name	Larvae/ Eggs	Post-Larvae	Juvenile	Subadult	Adult	Habitat Type
Red drum	X					Water column associated, soft bottom (larvae)
Red drum		X				Emergent marsh, soft bottom
Red drum			X			Emergent marsh (late juvenile), soft bottom
Red drum					X	Emergent marsh, soft bottom
Spanish mackerel			X		X	Estuarine, water column associated
Gray snapper					X	Soft bottom, emergent marsh
Cobia	X					Water column associated
Lane snapper	X	X				Water column associated
Lane snapper			X			Soft bottom

Marine Mammals

The only marine mammal regularly found in Sabine Lake is the bottlenose dolphin. There are infrequent reports of sightings of West Indian manatees within the estuary.

Bald and Golden Eagles

Bald eagles potentially forage within the project location, and golden eagles may occasionally migrate through the project area.

Migratory Birds

Many species of birds spend all or a portion of their life cycle along the Gulf of Mexico using a variety of habitats at different stages. Major groups of birds that inhabit the northern Gulf of Mexico include waterfowl and other water-dependent species, pelagic seabirds, raptors, colonial waterbirds, marsh-dwelling birds, and passerines. It is possible that birds protected under the MBTA and Texas Parks and Wildlife Code may nest in the project area.

A.3.8.1.3 Socioeconomic Resources

This section describes the socioeconomics and EJ, cultural resources, infrastructure, land and marine management, tourism and recreational uses, fisheries and aquaculture, land and marine transportation, aesthetics and visual resources, and public health and safety.

Socioeconomics and EJ

Jefferson County has a total population of 251,496, a decrease of 2% since 2020, based on the 2023 U.S. Census population estimates. Approximately 37% of the county population identified as white (not Hispanic or Latino), 34% as Black or African American, 25% as Hispanic or Latino, 4% as Asian, with the remaining population including small percentages of American Indian and Alaska Native and Native Hawaiian or Other Pacific Islander. Median household income (2018 to 2022) in Jefferson County is $57,294, with 18.8% of the county living in poverty (USCB 2024e).

Socioeconomic indicators above the state's 50th percentile included the demographic index, the supplemental demographic index, people of color, low income, unemployment rate, limited English-speaking households, less than high school education, persons under the age of 5, and persons over the age of 64. EJ indicators above the state's 50th percentile included diesel particulate matter, toxic releases to air, lead paint, superfund site proximity, risk management plan facility proximity, hazardous waste facility proximity, underground storage tanks, wastewater discharge, and drinking water noncompliance (USEPA 2024c).

Cultural Resources

Coordination under Section 106 of the NHPA would be initiated for the project. A preliminary analysis of the THC Atlas database indicated that no known historic sites or significant cultural, scientific, or historic resources exist in the area within the boundaries of the project area (THC 2024). However, two shipwrecks have been reported near the project area, part of a cluster of shipwrecks in the Outer Bar Channel: the Ella, a sail-steam merchant vessel, wrecked in 1866; and the Catherine, a schooner, wrecked in 1862 (Gaines 2008). The site has not been evaluated for eligibility for the National Register of Historic Places.

Infrastructure

Various oil and gas pipelines and wells exist at the site. RRC maintains an oil and gas pipeline and well database with a GIS viewer, which shows four plugged wells within the boundaries of the NWR and several "dry hole" locations and pipelines near the wells (RRC 2020). Additionally, GLO Texas Sediment Geodatabase GIS viewer shows buried natural gas and crude oil pipelines running under the site (GLO 2017). Further delineation of pipeline easements and restrictions may be developed during the final design stage of the site before construction.

Land and Marine Management

The Texas Point NWR encompasses 8,972 acres located in Jefferson County, Texas, on the southeastern tip of the upper Texas coast. The Texas Point NWR is bounded on the south by the Gulf of Mexico with approximately 6 miles of Gulf shoreline. It is bounded on the east by a narrow strip of private land adjacent to the SNWW, which connects the Sabine-Neches estuary with the Gulf and on the west and north by Sea Rim State Park. The project area contains no access roads. The project area is managed by USFWS.

Tourism and Recreational Use

The Texas Point NWR is managed by USFWS as a part of the Texas Chenier Plain Refuge Complex, which also includes McFaddin NWR, Anahuac NWR, and Moody NWR. Management includes use of the marsh for recreational fishing and waterfowl hunting. Hunting, fishing, hiking, and wildlife viewing are regularly enjoyed by the public in the Texas Point NWR.

Fisheries and Aquaculture

This area is an important nursery for marine and estuarine fishery species, including several that are important to the local economy. Recreational fishing in the area focuses on spotted seatrout, red drum, southern flounder, and other species. Commercially valuable species include brown shrimp, white shrimp, blue crab, black drum, and Gulf menhaden.

Land and Marine Transportation

Texas Point NWR is relatively remote with no public roads within its boundaries and limited pedestrian and water access. The site is adjacent to the commercially important SNWW.

Aesthetics and Visual Resources

The affected environment consists of the construction footprint of the project. The landscape in the vicinity of the proposed wetland restoration is characterized by a mosaic of saline and brackish marsh, elevated cheniers, and open water. The site is adjacent to the SNWW, a highly industrialized waterbody, and though the NWR is adjacent and undeveloped, the viewshed is dominated by the industrial nature of the area. There are no designated protected viewsheds in the vicinity of the project. Equipment and construction activities related to the restoration actions would be visible.

Public Health and Safety

The recreational and industrial users of the Texas Point NWR are accustomed to navigating the marsh via the existing channels and avoiding shallow areas and areas that contain obstructions. The immediate vicinity of the project area was historically salt and brackish marsh, but it has since been inundated primarily due to erosion and relative sea level rise. This has had adverse impacts on coastal resiliency and deleterious effects on the area’s functionality as a buffer for storm surges.

A.3.8.2 Environmental Consequences

This section analyses the Environmental Consequences of the project to the Affected Environment including physical resources, biological resources, and socioeconomic resources.

A.3.8.2.1 Physical Resources

Geology and Substrates

Short- and long-term, minor, adverse impacts to geology and substrates could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. Impacts from construction activities, use of heavy equipment, and trenching for sediment transport can cause direct localized and short-term, minor, adverse impacts from sediment disturbance and compaction. Long-term, minor, adverse indirect impacts on the physical environment could occur from the placement of dredged material, which may affect sediment dynamics. Mitigation measures to minimize adverse impacts to geology and substrates could include employment of standard best practices for construction to reduce erosion and loss of sediments.

It is anticipated that the project would provide long-term benefits by restoring the area to a suitable elevation to sustain historical marsh habitat.

Hydrology and Water Quality

Short- and long-term, minor, adverse impacts to hydrology and water quality could occur due to construction activities related to creating, restoring, and enhancing coastal wetlands. The project would have short-term, minor, adverse impacts to water quality from increased turbidity during dredging activities and placement of fill material. Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by temporary containment levees with weir structures to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Similar impacts due to turbidity at the borrow site would occur regardless of the implementation of the project because maintenance dredging of the GIWW is a routine activity of USACE and is scheduled independently of the project. Long-term, minor, adverse impacts may occur to the existing substrate due to placement of dredged materials. This may have long-term, minor, adverse impacts to hydrology where tidal connectivity is modified per the project design. Measures to control turbidity and sediment movement would be in place to ensure water quality standards are met and sensitive resources are not affected. These measures may include appropriate water control structures to decant water and the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary levees to control sediments and avoid negative impacts associated with the fill placement.

It is anticipated that the project would provide long-term benefits from the restoration and levee protection of the marsh. The project would maintain linkages within the broader coastal and nearshore ecosystem by facilitating the natural movement of water, sediments, energy, and nutrients among habitats.

Air Quality and GHG Emissions

Short-term, minor, adverse impacts to air quality could occur due to vehicle emissions from equipment used during construction and monitoring. Engine exhaust from barges, boats, excavators, and equipment would contribute to an increase in GHG emissions. Best practices would be considered and applied, where appropriate and practical, to reduce the release of GHGs. Best practices considered would include the deployment of energy-efficient machinery and equipment, the incorporation of anti-idling procedures, and the use of gasoline, rather than diesel. Adverse impacts to air quality would be short-term, occurring only during active construction.

It is anticipated that the project would provide long-term benefits for air quality. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments would capture carbon and provide enduring environmental benefits.

Noise

Short-term, minor, adverse impacts to soundscapes could occur due to noise from construction activities. Heavy equipment can cause direct, localized, and minor adverse impacts due to noise. This impact would be short term and limited to the period of construction. Mitigation measures to reduce adverse impacts due to noise could include timing noise-producing activities to minimize disturbance to nesting birds. All placement of dredged material would occur in the interior of the Texas Point NWR and would not be directly adjacent to residential areas.

A.3.8.2.2 Biological Resources

Habitats

Short-term, minor-to-moderate, adverse impacts to the habitat could occur due to the conversion of shallow open water to intertidal marsh habitat.

It is anticipated that the project would provide long-term benefits to the local ecosystem. Mosaics of shallow open water and vegetated marsh have been shown to have higher ecologic function than either of these habitats in isolation (Whaley and Minello 2002). Therefore, the final design would ensure adequate shallow open water would remain in the Texas Point NWR project area to maintain the synergies between these two habitats.

Wildlife Species

Short-term, minor-to-moderate, adverse impacts to wildlife species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important wildlife species. The creation of additional marsh habitat provides benefits for a number of marsh wildlife and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting many ecologically and economically important wildlife species

Marine and Estuarine Resources

Short-term, minor-to-moderate, adverse impacts to marine and estuarine species could occur due to project activities including levee construction, sediment deposition, and staging equipment and materials.

It is anticipated that the project would provide long-term benefits for many ecologically and economically important marine and estuarine fauna. The creation of additional marsh habitat provides benefits for a number of marsh dependent marine and estuarine fauna and is anticipated to benefit the local ecosystem, enhancing the food web, and supporting ecologically and economically important marine and estuarine fauna.

Protected Species

Environmental consequences for protected species are addressed as a summary of the impacts to each of the protected species described in the Affected Environment section including Threatened or Endangered Species, EFH, Marine Mammals, Bald and Golden Eagles, and Migratory Birds. There would be short- and long-term, minor, adverse impacts to protected species. Impacts to wildlife would be avoided via management guidelines and techniques as appropriate. Best practices, including the *Sea Turtle and Smalltooth Sawfish Construction Conditions* (NMFS 2006) and *Measures for Reducing Entrapment Risk to Protected Species* (NMFS 2012), would be followed during levee construction to avoid entrapping marine mammals and other resources.

During construction, there would be short-term, minor, adverse impacts to EFH through dredged material deposition and increased turbidity. Long-term, minor, impacts could include conversion of one wetland vegetation type to another with changes in the distribution of fauna communities. These impacts are expected to be confined to the immediate vicinity of the project, and best practices would likely be implemented to minimize adverse impacts.

Long-term benefits to EFH will occur from the improvement of habitat for commercially important prey species. The creation of additional estuarine marsh generates additional EFH that is anticipated to benefit the local ecosystem by enhancing the food web and supporting many ecologically and economically important fish species. Many of the species that directly utilize coastal estuarine marshes as juveniles later migrate offshore, where they serve as prey for ecologically and economically important open-ocean species. Thus, these highly productive habitats support ecological connectivity both within the coastal ecosystem and between the coastal, nearshore, and open-ocean ecosystems through the movement of species that use wetlands during their life cycle to grow and reproduce.

Placement of BUDM to create estuarine emergent marsh will have a long-term beneficial effect on the habitat's ability to support sea turtles, West Indian manatees, and eastern black rails. The proposed project aims to restore estuarine emergent marsh, which will protect and improve sensitive resources utilized by these species. In addition, the proposed project will improve water quality by reducing sedimentation from subsidence and coastal erosion into the GIWW and shallow bay systems utilized by sea turtles and West Indian manatees. Long-term effects of project construction activities are considered to be beneficial to the eastern black rail, as this is an estuarine marsh restoration project, which will ultimately protect and enhance thousands of acres of suitable eastern black rail foraging and nesting habitat.

The project has been designed to meet the PDC described in NMFS's *Framework Biological Opinion on PDARP/PEIS* (NMFS 2016). Programmatic consultation implements a framework to streamline the ESA Section 7 consultation process for all USACE projects that fit within the scope of the programmatic analysis. The scope of the analysis is defined by PDC. NMFS's PDC consider where construction would occur, construction methodologies, best practices that would be implemented, and reporting requirements (NMFS 2016). Best practices included in NMFS *Measures for Reducing the Entrapment Risk to Protected Species* (NMFS 2012) would be followed to avoid and minimize impact to protected sea turtle species. Additionally, either a hydraulic cutter-head dredge or clamshell dredge would be used to place sediments into the project site because these do not pose a risk to pelagic aquatic organisms, such as sea turtles. A hydraulic dredge pipeline would transport material to the placement area. The dredge pipeline would be routed to avoid disturbance to sensitive resource areas if identified along the pipeline route. Any areas containing such resources in the construction area and pipeline route would be protected using best practices such as hay bales, silt fences, or other appropriate methods.

Efforts would be made to avoid construction activities during the nesting season for protected migratory birds (February 15 through July 31). However, if construction activities occur during the nesting season, the area affected by project activities would be surveyed for the presence of nesting birds by a qualified biologist. If nesting birds are present or indications of pre-nesting behavior are observed, appropriate best practices would be employed to ensure that no incidental take of any individuals occurs. Best practices may include signage, exclusion zones for workers and equipment, hazing, and deterrents. Best practice activities would be coordinated with USFWS and TPWD biologists.

A.3.8.2.3 Socioeconomic Resources

Socioeconomics and EJ

No adverse short- or long-term impacts to socioeconomics or EJ are anticipated.

In consideration of EOs 12898, 14008, and 14096, this restoration activity does not have the potential to adversely and/or disproportionately affect minority or low-income populations, including economically, socially, or in terms of conditions affecting their health. This restoration project would help restore an environment that benefits all citizens, populations, and groups in the region. The project would have a positive, beneficial socioeconomic impact on surrounding communities of people equally. No residential communities are located adjacent to the project. As a result, there would be no potential for short-term adverse impacts from construction.

Cultural Resources

No adverse short- or long-term impacts to cultural resources are anticipated.

A complete review of the project under Section 106 of the NHPA would be completed prior to any project activities to develop practices that would avoid, minimize, or mitigate any adverse effects on historic properties located within the project area. The project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. If culturally or historically important resources are identified during project preparations or pre-deployment surveys, consultation would be re-initiated.

Infrastructure

No adverse short- or long-term impacts to infrastructure are anticipated.

The project is not anticipated to affect energy production, transport, or infrastructure. The project is anticipated to have no impact to infrastructure, since new infrastructure would not be built, and existing infrastructure in the area would be avoided to the extent practicable. Final E&D would include measures to avoid, as much as practicable, known oil and gas pipelines in the Texas Point NWR.

Land and Marine Management

No adverse short- or long-term impacts to land and marine management are anticipated.

The proposed action is anticipated to have no impact to land and marine management because the project would be consistent with the prevailing management, practices, plans, and direction governing the use of the areas where restoration actions would take place.

Tourism and Recreational Use

Short-term, minor, indirect, adverse impacts to tourism and creational use could occur due to limits on recreational activities near the construction area and temporary increases in road traffic due to movement of construction vehicles. In addition, recreational opportunities would be limited during the construction period and while the marsh is revegetating.

It is anticipated that the project would provide long-term benefits to recreationists through enhanced experiences for wildlife viewing, kayaking, canoeing, hunting, fishing, and other activities. Long-term benefits would come from restoring the nursery habitat of many recreationally important fish species, which would benefit recreational fishing in the area. Benefits to the local economy could accrue through an increase in employment and associated spending in the project area during construction and increased expenditures due to increased recreational visitation following completion of the restoration project.

Fisheries and Aquaculture

Short-term, minor, adverse impacts to fisheries could occur due to construction activities such as dredging, addition of sediments or borrow materials, and removal of sediments.

It is anticipated that the project would provide long-term benefits to the public through increased fishing opportunities (both commercial and recreational) by restoring coastal habitats that benefit fish. Long-term benefits would arise from the improvement of habitat for commercially important brown and white shrimp fisheries and the recreational red drum fishery. To the extent that these increased recreational opportunities result in increased visitation, local businesses may benefit from visitors' increased expenditures.

Land and Marine Transportation

No adverse short- or long-term impacts to land and marine transportation are anticipated.

Since there is minimal access to the site, there would be no impact to land-based traffic. Shipping and boating routes would be identified prior to the beneficial use operations to prevent impacts to marine transportation. It is expected that activities would not significantly interrupt the SNWW traffic. Most of the commercial traffic takes place on a routine schedule, and construction activities would be timed to reduce interference with commercial operators. The dredged material pipeline route would be clearly marked to avoid vessel strikes to the pipeline.

Aesthetics and Visual Resources

Short-term, minor-to-moderate, adverse effects to aesthetics and visual resources could occur due to the presence of construction equipment and the barren, muddy appearance during the revegetation period.

It is anticipated that the project would provide long-term benefits to the area's aesthetics and visual resources. The creation of marsh habitat and planting of vegetation would improve the overall viewscape of the project area. In addition, the new habitat is anticipated to attract additional birds and wildlife, which could be enjoyed by recreational users of the area.

Public Health and Safety

No adverse short- or long-term impacts to public health and safety are anticipated.

Due to the location and nature of the project area, no adverse impacts to public health and safety are anticipated as a result of this project. All occupational and marine safety regulations and laws would be followed to ensure safety of all workers and monitors. The project deployment would use mechanical equipment and marine vessels that use oil, lubricants, and fuels. All hazardous materials handled during construction would be contained and appropriate barriers would be in place to ensure the protection of adjacent water resources from potential spills and leaks. In the event of a discharge of oil or release of hazardous substances, the release would be reported to the National Response Center (800-424-8802) and Texas Emergency Oil Spill and Hazardous Substance Reporting line (800-832-8224) as required. Best practices in accordance with Occupational Safety and Health Administration and state and local requirements would be incorporated into construction activities on site to ensure the proper handling, storage, transport and disposal of all hazardous substances. Personal protective equipment would be required for all construction personnel and authorized access zones would be established at the perimeter of the worksite during construction. Due to the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to ensure water related accidents and conflicts are minimized.

A.4 No Action Analysis

If the No Action alternative is selected, implementation of projects included within the RP/EA #3 would not occur, and no action would be taken to restore or protect coastal wetlands within the project area. Marsh loss would continue to occur, resulting in a decline in fish, wildlife, and marine productivity. Under the No Action alternative, project areas reviewed within the RP/EA #3 would likely continue to be altered by ongoing processes of shoreline erosion, shoreline breaching, and marsh deterioration. This would result in continued loss of coastal wetland resources that are vital for fish, wildlife, and marine organisms that depend on these habitats. The No Action alternative does not provide the substantial environmental benefits to injured natural resources and services that would occur through active restoration and does not fulfill the Texas TIG goal to create, restore, and enhance coastal wetlands.

The No Action Alternative is anticipated to result in long-term, moderate to major, adverse impacts to physical resources such as geology and substrates and hydrology and water quality from degraded hydrologic connectivity, continued wetland habitat degradation, and conversion of wetlands to open water. Continued wetland degradation would also result in long-term, moderate to major, adverse impacts to biological resources such as habitats, wildlife species, marine and estuarine resources, and protected species. Continued wetland degradation would also result in long-term, minor, adverse impacts to socioeconomic resources including infrastructure, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety.

Natural resources would not recover without restoration, and the public would not be compensated for losses to natural resources and their services during this recovery time period.

A.5 NEPA Cumulative Impacts Analysis

A.5.1 Cumulative Impacts Methodology

The Council on Environmental Quality (CEQ) regulations for implementing NEPA require the assessment of cumulative impacts in the decision-making process. CEQ defines cumulative impacts as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR §1508.7). As stated in the CEQ handbook, *Considering Cumulative Effects* (CEQ, 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on impacts that are truly meaningful. Cumulative impacts should be considered for all alternatives, including the No Action alternative.

The Final PDARP/PEIS (Section 6.17.2) states that consideration of cumulative impacts of proposed alternatives in RP/EA #3 should build on the programmatic analyses and focus on site-specific issues (DWH NRDA Trustees 2016). This is consistent with CEQ guidance regarding the effective use of programmatic NEPA analysis.

Section 6.6 and Appendix 6B of the Final PDARP/PEIS are incorporated by reference into the following cumulative impacts analysis, including methodologies for assessing cumulative impacts, identification of affected resources, and the cumulative impacts scenario. The Final PDARP/PEIS found that implementation of restoration projects under the Restoration of Wetlands, Coastal and Nearshore Habitats would be consistent with the Final PDARP/PEIS Restoration Goals and would not be expected to contribute substantially to short- and long-term adverse cumulative impacts on physical, biological, or socioeconomic resources when analyzed in combination with other past, present, and reasonably foreseeable future actions.

A.5.2 Resources Affected by the Proposed Alternatives

Section 6.6.2 of the Final PDARP/PEIS outlines the following steps involved in a cumulative impact analysis: 1) identify the resources affected; 2) establish the boundaries of analysis; 3) identify the cumulative impacts scenario; and 4) conduct a cumulative impacts analysis.

Chapter A.3 of this document includes an environmental consequences analysis for each of the proposed alternatives/projects. Many of the resources analyzed would only have negligible to minor adverse effects. Resources with negligible-to-minor effects will not be included in the cumulative impacts analysis to appropriately narrow the scope of the environmental analysis to issues that would have an influence on the decision-making process or deserve attention from an environmental perspective (CEQ 1997). Resources excluded from this cumulative impact analysis based on their negligible-to-minor adverse effects are listed as follows:

- Physical Resources: hydrology and water quality; air quality and GHG emissions; and noise
- Socioeconomics: socioeconomics and EJ; cultural resources; infrastructure; land and marine management; tourism and recreational; fisheries and aquaculture; land and marine transportation; aesthetics and visual resources; and public health and safety

The following resources were analyzed in detail for environmental consequences that could result from implementation of the proposed alternatives/projects:

- Physical Resources: geology and substrates
- Biological Resources: habitats; wildlife species; marine and estuarine resources; and protected species

To effectively consider the potential cumulative impacts, the Texas TIG identified past, current, and reasonably foreseeable future actions that are considered relevant to identifying any cumulative impacts the alternatives may have on a local scale. These actions fall inside the counties of Aransas, Calhoun, Chambers, Jefferson, Matagorda, Orange, and Refugio located within the Texas coastal zone, which is within the established spatial boundaries identified in the Final PDARP/PEIS. For RP/EA #3, the Texas TIG considered the cumulative impact scenario to include categories of cumulative actions presented in Section 6.6.4 of the Final PDARP/PEIS and identified past, present, and reasonably foreseeable future actions through outreach to local, state and/or federal experts familiar with major environmental and development initiatives that have a potential to contribute significantly to cumulative impacts. Projects considered in previous restoration plans (*Deepwater Horizon Oil Spill: Programmatic and Phase III Early Restoration Plan and Early Restoration Programmatic Environmental Impact Statement* (DWH NRDA Trustees 2014), *Deepwater Horizon Oil Spill Final Phase IV Early Restoration Plan and Environmental Assessments* (DWH NRDA Trustees 2015), the Final PDARP/PEIS, RP/EA #1, and *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final Restoration Plan/Environmental Assessment #2: Restoration of Wetlands, Coastal, and Nearshore Habitats; Nutrient Reduction; Oysters; Sea Turtles; and Birds* [Texas TIG 2022a]) were also reviewed to develop this list of actions. The Texas TIG also relied on expert judgments, primarily qualitative, about the potential for adverse impacts, using publicly available information about the likely design and location of these actions. Table A-26 provides the resulting list of past, present, and reasonably foreseeable future actions considered.

A.5.3 Cumulative Impacts Analysis

The following section provides the cumulative impacts analysis for RP/EA #3. Table A-26 provides the resulting list of past, present, and reasonably foreseeable future actions considered.

Appendix A.3 analyzes the environmental consequences for each of the alternatives proposed for implementation in this RP/EA #3. The alternatives evaluated in this RP/EA #3 are designed to create, enhance, or restore coastal wetlands. Adverse effects would not be anticipated to extend beyond the construction period for the projects. None of the projects included in this RP/EA #3 would result in any long-term adverse effects that rise above a moderate adverse impact. Most of the projects would result in short- term, minor-to-moderate, localized adverse impacts to geology and substrates; biological resources such as habitats, wildlife species, marine resources, and protected species.

Geology and substrates would primarily experience short-term, minor, adverse, localized impacts to substrates from sediment-disturbing activities such as the construction of sediment containment levees, dredging, and placement of dredged materials. Impacts would be caused by the conversion of soft bottom to hard-bottom habitats and the removal and burial of sediments. There would be negligible cumulative adverse impacts from the depletion of sediment resources because materials would be beneficially reused from other maintenance projects (e.g., dredging of a waterway) or would be or have been specifically identified for the project. Natural sediment transport processes would replenish dredge borrow sites. Once implemented, the proposed alternatives/projects would provide long-term benefits to geology and substrates from reduction in erosion, replenishment of historic substrates, protection of geology and substrates, and addition of hard-bottom substrates.

Biological resources, including habitats, wildlife species, marine and estuarine resources, and protected species would primarily experience short-term minor and short-term moderate-to-minor adverse, localized impacts from human disturbance associated with project implementation. Minor impacts would be caused by turbidity and noise during construction activities. Typically, species most affected would be in the benthos but would recover quickly. No moderate or major adverse impacts would affect protected species. There would be negligible-to-minor cumulative adverse impacts from the temporary changes in habitat quality. Resources would recover quickly and affect only a fraction of the local population. Once implemented, the proposed alternatives would provide long-term benefits to wildlife species and marine and estuarine resources from improvements in habitat.

The Texas TIG has concluded that although some of the projects may have an incremental contribution to adverse cumulative impacts, the contribution would not be substantial over the long term. Many of the alternatives have the potential to provide long-term beneficial cumulative impacts to physical, biological, and socioeconomic resources. Thus, the Texas TIG concludes that the Restoration of Wetlands, Coastal, and Nearshore Habitats alternatives in this RP/EA #3 would not contribute substantially to adverse cumulative impacts when added to other past, present, or reasonably foreseeable future actions as outlined in Table A-26.

Table A-26 List of Past, Present, and Reasonably Foreseeable Future Actions Considered in the Cumulative Impacts Analysis

Activities	Action	Action Description	Key Resource Areas with Potential for Adverse Cumulative Impacts
Restoration Projects Related to DWH Oil Spill	DWH funded habitat restoration projects (including NRDA, NFWF-GEBF, and the Resources and Ecosystem Sustainability, Tourist Opportunity, and Revived Economies of the Gulf Coast States Act)	These programs leverage other funding sources to achieve habitat restoration. These programs seek to restore habitat, water quality, wildlife species, and marine and estuarine resources. Currently funded projects will restore marsh habitat; improve avian, oyster, and sea turtle populations; restore dune habitat; and improve coastal resiliency through shoreline protection.	Geology and substrate Wildlife species and marine and estuarine resources Habitats; protected species
Resource Stewardship Activities	Oyster restoration	Significant efforts have occurred and are underway to restore oyster reefs along the Texas coast. Restoration projects are adding habitat for oysters to colonize or restoring oyster reefs that have been lost from overharvesting, hurricanes, and changes in freshwater inflow.	Geology and substrates Wildlife species and marine and estuarine fauna Habitats; protected species
Resource Stewardship Activities	Marsh restoration	Marsh restoration occurs and will continue to occur along the Texas coast. Marshes assist in protection of infrastructure during storm events; provide valuable habitat for fish, wildlife, and marine organisms; improve water quality via nutrient filtration; and provide groundwater recharge functions.	Geology and substrates Wildlife species and marine and estuarine resources Habitats; protected species

Activities	Action	Action Description	Key Resource Areas with Potential for Adverse Cumulative Impacts
Resource Stewardship Activities	Land acquisition	Land acquisition by Non-Governmental Organizations and state and federal agencies for the purpose of restoration and preservation has occurred in the past and is likely to continue occurring in Texas coastal areas.	Geology and substrates Wildlife species and marine and estuarine resources
Resource Stewardship Activities	Restoration programs administered through GLO (Coastal Erosion Planning and Response Act, Coastal Impact Assistance Program, Coastal Management Program, Beach Maintenance Reimbursement Fund)	Funding programs administered through GLO to reduce the effects of coastal erosion, remediate the impact of offshore oil and gas exploration, implement projects in the coastal zone (e.g., water sediment quantity and quality improvements; ecotourism; public access), increase knowledge through research, and clean and maintain Gulf beaches have occurred in the past and will continue to occur in Texas coastal areas.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species
Energy Activities	Ongoing oil and gas exploration	The coastal region of Texas is among the most productive for oil and gas exploration and production. During 2023, wells in Texas produced over 1.92 billion barrels, and operators produced over 2.01 trillion cubic feet of natural gas (RRC 2024). In addition to the drilling of wells and construction of liquefied natural gas facilities, the transport of staff, equipment, and supplies necessary to support this exploration and production effort requires a large number of surface vessels and helicopters that will continue to occur in Texas coastal areas.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species
Dredged Material Disposal	USACE maintenance dredging	Ship channels leading to Texas ports, as well as the GIWW, are routinely dredged to maintain authorized depths to facilitate waterborne cargo transportation. Dredged materials are either beneficially used as part of another project or deposited in a designated disposal location. Maintenance dredging activities will continue to occur in Texas coastal areas. The projects described in this RP/EA #3 are beneficially using dredged material.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species

Activities	Action	Action Description	Key Resource Areas with Potential for Adverse Cumulative Impacts
Coastal Development and Land Use	Commercial and residential development	The Texas coastal area is rapidly developing and will continue to be developed. The rate of development is often tied to the economy and has been increasing since the end of the 2008 to 2009 recession. According to the 2020 Census, the Gulf Coast region has a population of about 7.3 million, or 25% of the state's total population. The need for commercial and residential housing is expected to continue growing with Texas coastal areas.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species
Coastal Development and Land Use	Shoreline armoring	Armoring of waterways (e.g., GIWW) and other bay and gulf shorelines have been implemented to protect marine transportation and/or decrease erosion. Activities have occurred and will continue to occur along the Texas coast. Armoring may be used to protect infrastructure or as part of a habitat restoration and protection project.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species
Coastal Development and Land Use	Beach nourishment	Texas has a scheduled maintenance plan to renourish engineered beaches. Beaches in the maintenance plan range from South Padre Island to the Texas/Louisiana border. GLO will continue to maintain and renourish beaches within Texas coastal areas. The Texas General Land Office is in the process of completing a large-scale beach nourishment project adjacent to the McFaddin NWR that will have synergistic benefits to the wetland system that contains the McFaddin NWR Willow Lakes Terraces site.	Geology and substrates Wildlife species and marine and estuarine resources Habitat: protected species
Fisheries and Aquaculture	Recreational fishing	The Texas coast is a popular destination for bay, beachfront, and offshore fishing. In 2022, there were approximately 1.7 million saltwater anglers (National Opinion Research Center at the University of Chicago 2022) and 1,644 all-water fishing guides licensed in Texas (Z. Thomas from Texas Parks and Wildlife, personal communication, November 21, 2024). According to the American Sports Fishing Association (ASA), the direct economic impact of these fishing trips is estimated at over $7.7 billion (ASA 2023).	Wildlife species and marine and estuarine resources Habitat; protected species

Activities	Action	Action Description	Key Resource Areas with Potential for Adverse Cumulative Impacts
Fisheries and Aquaculture	Commercial fishing	The Texas coast supports a fleet of commercial fishing vessels that target primarily demersal bay species, as well as offshore reef fish and pelagic species. During 2023, licensed fishermen landed 1.3 billion pounds of finfish valued at $9.1 million (NOAA 2022).	Wildlife species and marine and estuarine resources Habitat; protected species
Marine Transportation	Marine transportation including shipping	The Texas coastline has 13 shallow-draft ports and 15 deep-draft ports, as well as 423 miles along the Texas portion of the GIWW, for a total of 760 miles of shallow-draft and 240 miles of deep-draft channels (USACE 2024b). Deep-draft ports handle commercial cargo and shipping activities, while shallow-draft ports are used for commercial and recreational fishing. Texas ports are connected by the GIWW in Texas. In 2020, 75 million tons of goods were moved on the Texas portion of the GIWW (Texas Department of Transportation [TxDOT] 2022). Texas leads the nation in the total volume of intrastate maritime cargo (TxDOT 2022). There are no planned marine transportation projects that would negatively impact these eight restoration sites.	Geology and substrates Wildlife species and marine and estuarine resources Habitat; protected species

A.6 Comparison of Alternatives

The environmental analysis demonstrated that there would primarily be short-term, minor, adverse impacts and long-term, minor, adverse impacts, as well as beneficial effects from implementation of the RP/EA #3 alternatives. In general, implementation of the RP/EA #3 alternatives would result in short-term, minor, adverse impacts to physical resources including geology and substrates and hydrology and water quality. Implementation of the RP/EA #3 alternatives would result in short-term, minor adverse impacts to air quality and GHG emissions and short-term, minor-to-moderate impacts to noise. There would be some long-term, minor adverse impacts to geology and substrates and hydrology and water quality associated with alternatives that involve sediment removal and placement for implementation.

In general, implementation of the RP/EA #3 alternatives would result in short-term, minor, adverse impacts to biological resources, including protected species, and short-term, minor-to-moderate, impacts to habitats, wildlife species, and marine and estuarine resources. Biological resources would primarily experience short-term, minor-to-moderate adverse impacts from human- and construction -related disturbances associated with project implementation. There would be some long-term, minor, adverse impacts to protected species due to material placement. Overall, biological resources, including wildlife species and marine and estuarine resources, would experience long-term benefits from improved habitats. In general, implementation of the RP/EA #3 alternatives would result in short-term, minor adverse impacts to socioeconomic resources, including tourism and recreational use, fisheries and aquaculture, and public health and safety, and short-term, minor-to-moderate impacts to aesthetics and visual resources. The RP/EA #3 alternatives would result in short-term, minor-to-moderate, adverse impacts to aesthetics and visual resources. No long-term, adverse impacts are anticipated. Most alternatives evaluated in this RP/EA #3 would result in short- and long-term benefits to socioeconomic resources, in particular, tourism and recreation, aesthetics and visual resources, and public health and safety.

All RP/EA #3 alternatives would result in benefits to physical resources, including geology and substrates, hydrology and water quality, and air quality and GHG emissions; biological resources including habitats, wildlife species, marine and estuarine resources, and protected species; and socioeconomic resources including socioeconomics and EJ, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety.

The No Action alternative is anticipated to result in long-term minor-to-major adverse impacts. A summary of impacts for each restoration alternative and the No Action alternative is provided in Table A-27.

Table A-27 Summary of Impact for Each Restoration Alternative and the No Action Alternative

Project	Geology and Substrates	Hydrology and Water Quality	Air Quality and GHG Emissions	Noise	Habitats	Wildlife Species	Marine and Estuarine Resources	Protected Species	Socioeconomics and EJ	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Land and Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety
No Action	L	L	NE	NE	L	L	L	L	NE	NE	l	l	l	l	NE	l	l
Anahuac NWR Roberts Mueller Tract Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Goose Island Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Guadalupe River Old Delta Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Lower Neches WMA Old River Unit Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
McFaddin NWR Willow Lake Terraces Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
San Bernard NWR Sargent Oil Field Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Schicke Point Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE
Texas Point NWR Wetland Restoration	s, l, +	s, l, +	s, +	s	s*, +	s*, +	s*, +	s, l, +	NE, +	NE	NE	NE	s, +	s, +	NE	s*, +	NE

Notes:
+: beneficial effect
l: long-term, minor adverse effect
L: long-term, moderate-to-major adverse effect
NE: no adverse effect
s: short-term, minor adverse effect
s*: short-term, minor-to-moderate effect
S: short-term, moderate-to-major adverse effect

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U.S. Department of Agriculture (USDA)	Ronald Howard Craig Johnson Jon Morton
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Appendix C. List of Repositories

Port Arthur, Texas
Port Arthur Public Library
4615 9th Avenue
Port Arthur, Texas 77642

Galveston, Texas
Jack K. Williams Library
Texas A&M University at Galveston
200 Seawolf Parkway Building #3010
Galveston, Texas 77554

Rockport, Texas
Aransas County Public Library
701 East Mimosa Street
Rockport, Texas 78382

Appendix D. Impact Intensity Definitions

The impact intensity definitions used to evaluate potential environmental impacts from the reasonable range of alternatives considered in this RP/EA #3 are provided in the following table. These definitions are also provided in Table 6.3-2 in the Final PDARP/PEIS.

Table D-1 Impact Intensity Definitions

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Geology and Substrates	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	Disturbance to geologic features or soils could be detectable but small and localized. There might be no change to local geologic features or soil characteristics. Erosion and/or compaction might occur in localized areas.	Disturbance could occur over local and immediately adjacent areas. Impacts on geology or soils might be readily apparent and result in changes to the soil character or local geologic characteristics. Erosion and compaction impacts might occur over local and immediately adjacent areas.	Disturbance could occur over a widespread area. Impacts on geology or soils might be readily apparent and result in changes to the character of the geology or soils over a widespread area. Erosion and compaction might also occur over a widespread area. Disruptions to substrates or soils may be permanent.
Hydrology and Water Quality	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	**Hydrology:** The effect on hydrology might be measurable but small and localized. The effect might only temporarily alter the area's hydrology, including surface and groundwater flows. **Water Quality:** Impacts could result in a detectable change to water quality, but the change expected might be small and localized. Impacts could quickly become undetectable. State water quality standards as required by the Clean Water Act could not be exceeded. **Floodplains:** Impacts could result in a detectable change to water quality, but the change expected might be small and localized. Impacts might quickly become undetectable. State water quality standards as required by the Clean Water Act could not be exceeded. **Wetlands:** The effect on wetlands could be measurable but small in terms of area and the nature of the impact. A small impact on the size, integrity, or connectivity of the wetlands could occur; however, wetland function might not be affected, and natural restoration might occur if left alone.	**Hydrology:** The effect on hydrology might be measurable but small and localized. The effect might only temporarily alter the area's hydrology including surface and groundwater flows. **Water Quality:** Impacts on water quality could be observable over a relatively large area. Impacts could result in a change to water quality that might be readily detectable and limited to local and adjacent areas. Change in water quality might persist; however, it would likely not exceed the state water quality standards required by the Clean Water Act. **Floodplains:** Impacts could result in a change to natural and beneficial floodplain values and might be readily detectable but limited to local and adjacent areas. The location of operations in floodplains could increase risk of flood loss, including impacts on human safety, health, and welfare. **Wetlands:** The action could cause a measurable effect on wetlands indicators (size, integrity, or connectivity) or might result in a permanent loss of wetland acreage across local and adjacent areas. However, wetland functions might be permanently altered only in limited areas.	**Hydrology:** The effect on hydrology might be measurable and widespread. The effect could permanently alter hydrologic patterns including surface and groundwater flows. **Water Quality:** Impacts could likely result in a change to water quality that might be readily detectable and widespread. Impacts could likely result in exceedance of state water quality standards and/or might impair designated uses of a waterbody. **Floodplains:** Impacts could result in a change to natural and beneficial floodplain values and could have substantial consequences over a widespread area. The location of operations could increase risk of flood loss, including impacts on human safety, health, and welfare. **Wetlands:** The action could cause a permanent loss of wetlands across a widespread area. The character of the wetlands might change and the functions typically provided by the wetland permanently lost.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Air Quality	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	The impact on air quality might be measurable but localized and temporary, such that the emissions do not exceed the Environmental Protection Agency's (EPA's) de minimis criteria for a general conformity determination under the Clean Air Act (40 CFR §93.153).	The impact on air quality might be measurable and limited to local and adjacent areas. Emissions of criteria pollutants might be at EPA's de minimis criteria levels for a general conformity determination.	The impact on air quality might be measurable over a widespread area. Emissions are high, such that they might exceed EPA's de minimis criteria for a general conformity determination.
Noise	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	Increased noise could attract attention, but its contribution to the soundscape would be localized and unlikely to affect current user activities.	Increased noise could attract attention and contribute to the soundscape, including in local areas and those adjacent to the action, but might not dominate. User activities might be affected.	Increased noise could attract attention and dominate the soundscape over widespread areas. Noise levels might eliminate or discourage user activities.
Habitats	**Short-term:** Lasting less than two growing seasons **Long-term:** Lasting longer than two growing seasons	Impacts on native vegetation may be detectable but might not alter natural conditions and might be limited to localized areas. Infrequent disturbance to individual plants could be expected but would not affect local or regional population stability. Infrequent or insignificant one-time disturbance to locally suitable habitat could occur, but sufficient habitat could remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non-native species might be detectable but would be temporary and localized and would not displace native species' populations and distributions.	Impacts on native vegetation could be measurable but limited to local and adjacent areas. Occasional disturbance to individual plants could be expected. These disturbances could adversely affect local populations but would not be expected to affect regional population stability. Some impacts might occur in key habitats, but sufficient local habitat might retain function to maintain the viability of the species both locally and regionally. Opportunity for increased spread of non-native species might be detectable and limited to local and adjacent areas but might only result in temporary changes to native species' population and distributions.	Impacts on native vegetation might be measurable and widespread. Frequent disturbances of individual plants could be expected, with adverse impacts on both local and regional population levels. These disturbances could adversely affect regional population stability. Some impacts might occur in key habitats, and habitat impacts might adversely affect the viability of the species, both locally and regionally. Actions could result in the widespread increase of non-native species and result in broad and permanent changes to native species' populations and distributions.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Wildlife Species (including birds)	**Short-term:** Lasting up to two breeding seasons, depending on length of breeding season **Long-term:** Lasting more than two breeding seasons	Impacts on native species, their habitats, or the natural processes sustaining them might be detectable, but localized, and might not measurably alter natural conditions. There could be infrequent responses to disturbance by some individuals but without interference to feeding, reproduction, resting, migrating, or other factors, affecting population levels. Small changes to local population numbers, population structure, and other demographic factors could occur. Sufficient habitat might remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non-native species might be detectable but temporary and localized, and these species might not displace native species' populations and distributions.	Impacts on native species, their habitats, or the natural processes sustaining them could be measurable but limited to local and adjacent areas. There could be occasional responses to disturbance by some individuals, with some adverse impacts on feeding, reproduction, resting, migrating, or other factors, affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat might retain function to maintain the viability of the species both locally and regionally. Opportunity for increased spread of non-native species might be detectable and limited to local and adjacent areas but might result only in temporary changes to native species' population and distributions.	Impacts on native species, their habitats, or the natural processes sustaining them might be detectable and widespread. There could be frequent responses to disturbance by some individuals, with adverse impacts on feeding, reproduction, migrating, or other factors, resulting in a decrease in both local and regional population levels and habitat type. Impacts might occur during critical periods of reproduction or in key habitats and could result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large changes or declines. Actions could result in the widespread increase of non-native species and result in broad and permanent changes to native species' populations and distributions.
Marine and Estuarine Fauna (fish, shellfish, benthic organisms)	**Short-term:** Lasting up to two spawning seasons, depending on length of season **Long-term:** Lasting more than two spawning seasons	Impacts might be detectable and localized but small. Disturbance of individual species could occur; however, there might be no change in the diversity or local populations of marine and estuarine species. Any disturbance could not interfere with key behaviors such as feeding and spawning. There could be no restriction of movements daily or seasonally. Opportunity for increased spread of non-native species might be detectable but temporary and localized, and these species might not displace native species' populations and distributions.	Impacts might be readily apparent and result in a change in marine and estuarine species populations in local and adjacent areas. Areas being disturbed may display a change in species diversity; however, overall populations might not be altered. Some key behaviors might be affected but not to the extent that species viability is affected. Some movements might be restricted seasonally. Opportunity for increased spread of non-native species might be detectable and limited to local and adjacent areas but might result only in temporary changes to native species' population and distributions.	Impacts might be readily apparent and could substantially change marine and estuarine species populations over a wide-scale area, possibly river-basin-wide. Disturbances could result in a decrease in fish species' diversity and populations. The viability of some species might be affected. Species' movements might be seasonally constrained or eliminated. Actions could result in the widespread increase of non-native species and result in broad and permanent changes to native species' populations and distributions.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Protected Species	**Short-term:** Lasting up to one breeding/ growing season **Long-term:** Lasting more than one breeding/ growing season	Impacts on protected species, their habitats, or the natural processes sustaining them might be detectable, but small and localized, and could not measurably alter natural conditions. Impacts might likely result in a "may affect, not likely to adversely affect" determination for at least one listed species.	Impacts on protected species, their habitats, or the natural processes sustaining them might be detectable and some alteration in the numbers of protected species or occasional responses to disturbance by some individuals might be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local and adjacent population levels. Impacts might occur in key habitats, but sufficient population numbers or habitat might remain functional to maintain the viability of the species both locally and throughout their range. Some disturbance to individuals or impacts to potential or designated critical habitat could occur. Impacts might likely result in a "may affect, likely to adversely affect" determination for at least one listed species. No adverse modification of critical habitat could be expected.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, widespread, and permanent. Substantial impacts to the population numbers of protected species, or interference with their survival, growth, or reproduction could be expected. There could be impacts to key habitat, resulting in substantial reductions in species numbers. Results in an "is likely to jeopardize proposed or listed species/adversely modify proposed or designated critical habitat (impairment)" determination for at least one listed species.
Socioeconomics and Environmental Justice	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts might be small and localized. These impacts are not expected to substantively alter social and/or economic conditions. Actions could not disproportionately affect minority and low-income populations.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts might be readily apparent and detectable in local and adjacent areas and might have a noticeable effect on social and/or economic conditions. Actions could disproportionately affect minority and low-income populations. However, the impact might be temporary and localized.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts might be readily detectable and observed, extend over a widespread area, and have a substantial influence on social and/or economic conditions. Actions could disproportionately affect minority and low-income populations, and this impact might be permanent and widespread.
Cultural Resources	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	The disturbance of a site(s), building, structure, or object might be confined to a small area with little, if any, loss of important cultural information potential.	The disturbance of a site(s), building, structure, or object is not expected to result in a substantial loss of important cultural information.	The disturbance of a site(s), building, structure, or object might be substantial and may result in the loss of most or all its potential to yield important cultural information.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Infrastructure	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	The action could affect public services or utilities, but the impact might be localized and within operational capacities. There might be negligible increases in local daily traffic volumes, resulting in perceived inconvenience to drivers but no actual disruptions to traffic.	The action could affect public services or utilities in local and adjacent areas, and the impact might require the acquisition of additional service providers or capacity. There could be a detectable increase in daily traffic volumes (with slightly reduced speed of travel), resulting in slowed traffic and delays, but no change in level of service (LOS). Short service interruptions (temporary closure for a few hours) to roadway and railroad traffic might occur.	The action could affect public services or utilities over a widespread area, resulting in the loss of certain services or necessary utilities. Extensive increase in daily traffic volumes (with reduced speed of travel) could result in an adverse change in LOS to worsened conditions. Extensive service disruptions (temporary closure of one day or more) to roadways or railroad traffic might occur.
Land and Marine Management	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	The action could require a variance or zoning change or an amendment to a land use, area comprehensive, or management plan but could not affect overall use and management beyond the local area.	The action could require a variance or zoning change or an amendment to a land use, comprehensive area plan, or management plan and could affect overall land use and management in local and adjacent areas.	The action could cause permanent changes to and conflict with land uses or management plans over a widespread area.
Tourism and Recreational Use	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	There could be partially developed recreational site closures to protect local public safety. The same site capacity and visitor experience might remain unchanged after construction. The impact might be detectable and/or only affect some recreationists. Users might likely be aware of the action, but changes in use might be slight. There might be a change in local recreational opportunities; however, it might affect relatively few visitors or not affect any related recreational activities.	There could be complete site closures to protect public safety. However, the sites might be reopened after activities occur. There might be slightly reduced site capacity. The visitor experience might be slightly changed but still available. The impact might be readily apparent and/or affect many recreationists locally and in adjacent areas. Users might be aware of the action. Some users might choose to pursue activities in other local or regional areas available.	Developed facilities might be closed and removed, and all developed site capacity might be eliminated. Visitors might be displaced to facilities over a widespread area, and visitor experiences might no longer be available in many locations. The impact could affect most recreationists over a widespread area. Users might be highly aware of the action and choose to pursue activities in other available regional areas.
Fisheries and Aquaculture	**Short-term:** Lasting up to two spawning seasons, depending on length of season **Long-term:** Lasting more than two spawning seasons	A few individuals, groups, businesses, properties, or institutions could be affected. Impacts might be small and localized. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties, or institutions could be affected. Impacts might be readily apparent and detectable in local and adjacent areas and have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties, or institutions could be affected. Impacts might be readily detectable and observed, extend over a widespread area, and have a substantial influence on social and/or economic conditions.

Resource	Impact Duration	Minor Intensity	Moderate Intensity	Major Intensity
Marine Transportation	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	The action could affect public services or utilities, but the impact might be localized and within operational capacities. There might be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators, but no actual disruptions to transportation.	The action could affect public services or utilities in local and adjacent areas, and the impact might require the acquisition of additional service providers or capacity. Detectable increase in daily marine traffic volumes might occur (with slightly reduced speed of travel), resulting in slowed traffic and delays. Short service interruptions might occur (temporary delays for a few hours).	The action could affect public services utilities over a widespread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily marine traffic volumes might occur (with reduced speed of travel), resulting in extensive service disruptions (temporary closure of one day or more).
Aesthetics and Visual Resources	**Short-term:** During construction period **Long-term:** Over the life of the project or longer	There could be a change in the viewshed that was readily apparent but could not attract attention, dominate the view, or detract from current user activities or experiences.	There could be a change in the viewshed that was readily apparent and attracts attention. Changes might not dominate the viewscape, although they might detract from the current user activities or experiences.	Changes to the characteristic views could dominate and detract from current user activities or experiences.
Public Health and Safety, Including Flood and Shoreline Protection	**Short-term:** During construction period **Long-term**: Over the life of the project or longer	Actions could not result in the following: 1) soil, groundwater, and/or surface water contamination; 2) exposure of contaminated media to construction workers or transmission line operations personnel; and/or 3) mobilization and migration of contaminants currently in the soil, groundwater, or surface water at levels that could harm the workers or general public. Increased risk of potential hazards (e.g., increased likelihood of storm surge) to visitors, residents, and workers from decreased shoreline integrity could be temporary and localized.	Actions could result in the following: 1) exposure, mobilization and/or migration of existing contaminated soil, groundwater, or surface water to an extent that requires mitigation; and/or 2) detectable levels of contaminants to soil, groundwater, and/or surface water in localized areas within the project boundaries such that mitigation/remediation is required to restore the affected area to the pre-construction conditions. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be sufficient to cause a permanent change in use patterns and area avoidance in local and adjacent areas.	Actions could result in the following: 1) soil, groundwater, and/or surface water contamination at levels exceeding federal, state, or local hazardous waste criteria, including those established by 40 *Code of Federal Regulations* (CFR) 261; 2) mobilization of contaminants currently in the soil, groundwater, or surface water, resulting in exposure of humans or other sensitive receptors such as plants and wildlife to contaminant levels that could result in health effects; and 3) the presence of contaminated soil, groundwater, or surface water within the project area, exposing workers and/or the public to contaminated or hazardous materials at levels exceeding those permitted by the federal Occupational Safety and Health Administration (OSHA) in 29 CFR 1910. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be substantial and could cause permanent changes in use patterns and area avoidance over a widespread area.

Appendix E. Monitoring and Adaptive Management Plans

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Anahuac NWR Roberts Mueller Tract Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Anahuac National Wildlife Refuge (NWR) Roberts Mueller Tract Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Anahuac NWR Roberts Mueller Tract Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the Anahuac NWR located in Chambers County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project selected in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 550 acres of intertidal marsh.

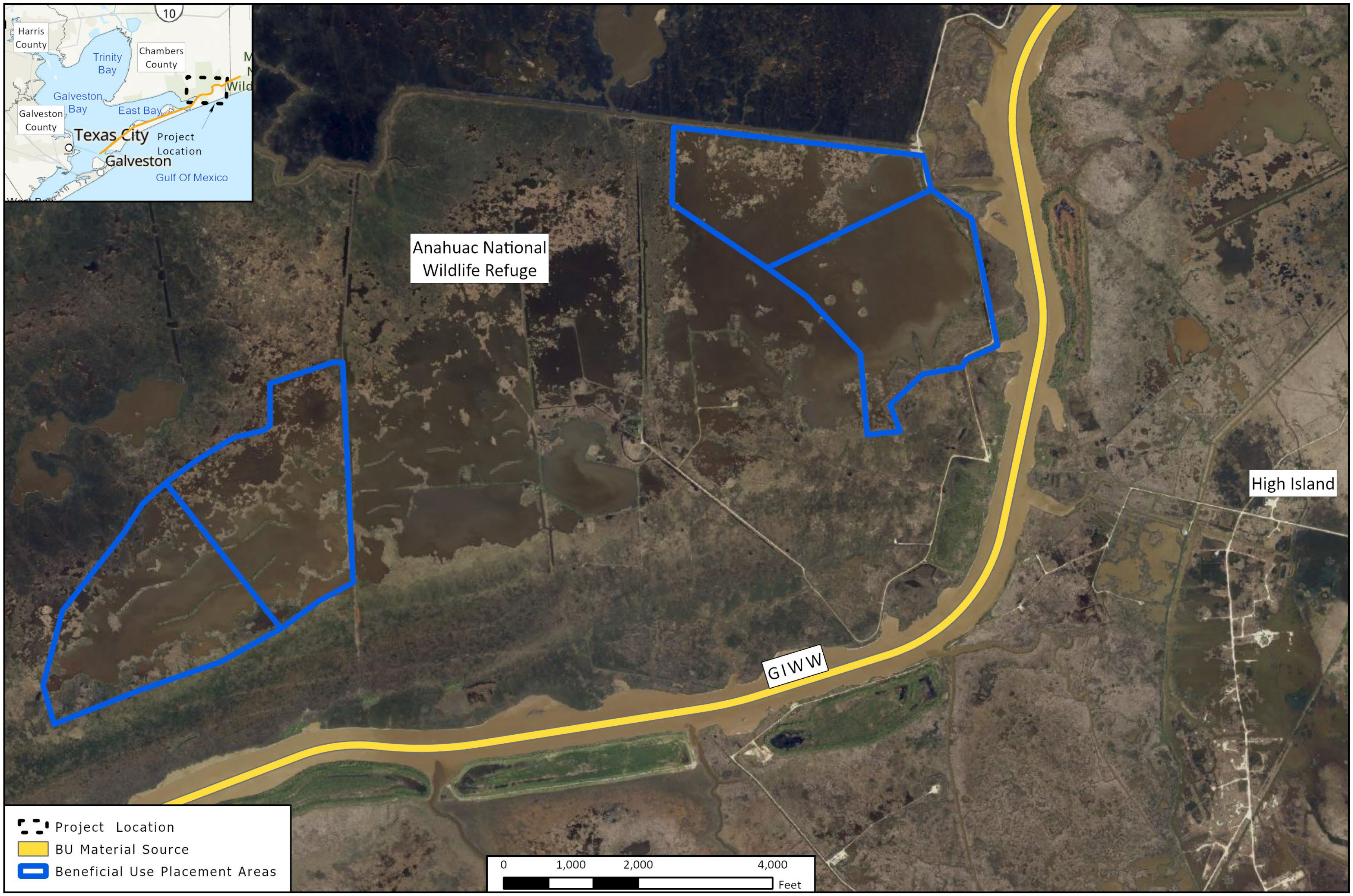

Figure 1 Vicinity Map Showing the Location of the Anahuac NWR Roberts Mueller Tract Wetland Restoration Project in Chambers County, Texas

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project would restore priority areas within the Roberts Mueller Tract located within the 34,000-acre Anahuac NWR, Chambers County, Texas. The Roberts Mueller Tract is located in East Galveston Bay on the north side of the Gulf Intracoastal Waterway, northwest of High Island, Texas (Figure 1). The predominant wetland habitats near the Anahuac NWR are characterized as salt and brackish marsh and estuarine open water. The Project is composed of two areas with primarily open water and some remnants of fragmented marsh. The westernmost area contains terraces in some of the open-water area from a project completed in 2011. The project areas identified for restoration were historically healthy marsh but, over the past two decades, have eroded away into mostly open water. Sea level rise, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats, as well as reduce vulnerability of critical infrastructure to hurricanes and storm surges.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be key drivers of the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be implemented to inform these uncertainties and appropriate corrective actions in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other Project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 1Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water control structures.	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of the	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	reference control cell.	monitoring period is changed, the decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 32 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Vegetation Composition	N/A	N/A	X	X	X	X	X

Note:
PM: post-construction monitoring

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

Exec. Order No. 13642, 78 Fed. Reg. 28111 (May 14, 2013). Accessed August 6, 2024. Available at: https://www.govinfo.gov/content/pkg/DCPD-201300318/pdf/DCPD-201300318.pdf

National Oceanic and Atmospheric Administration, 2024. "DIVER Restoration Portal." NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/.

Texas Trustee Implementation Group, 2017. Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters. Accessed August 6, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf

12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

Goose Island Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Goose Island Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Goose Island Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material adjacent to Goose Island located within Aransas County, Texas, at the end of Lamar Peninsula north of Rockport, Texas, at the north end of Aransas Bay (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project selected in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 40 acres of intertidal marsh.

Figure 1 **Vicinity Map Showing the Location of the Goose Island Wetland Restoration Project in Aransas County, Texas**

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore on or adjacent to Goose Island in Aransas County, Texas, at the end of Lamar Peninsula, north of Rockport, Texas, at the north end of Aransas Bay (Figure 1). Historically, the upland area of Goose Island was much larger, but decades of tidal erosion, rising sea levels, subsidence, and altered sediment supplies have reduced the area to its current footprint. Habitat degradation is exhibited by the increase in the aerial extent of open water and the decrease in estuarine marsh area.

Containment dikes and an offshore breakwater were constructed in 2008 during a previous attempt to restore the island encompassed by the two existing cells. The previous restoration effort did not create a functional marsh elevation, likely due to inadequate quantities of fill material provided opportunistically from a nonfederal channel during development of a community just north of the state park. Since 2008, no additional restoration efforts have been undertaken at this location.

Over the past decade, the containment dikes have undergone erosion due to tidal movement, wave energy, and storm impacts, and the previously pumped material has settled substantially, as well as been lost. To successfully place new material, the existing containment dikes would be repaired by excavating sediment on site to increase elevation.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect Project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize Project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water control structures. Reference	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and/or 2) percent cover is within ±5% of	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	the reference control cell.	changed, the decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X
Vegetation Composition	N/A	N/A	X	X	X	X	X

Note:
PM: post-construction monitoring

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

Exec. Order No. 13642, 78 Fed. Reg. 28111 (May 14, 2013). Accessed August 6, 2024. Available at: https://www.govinfo.gov/content/pkg/DCPD-201300318/pdf/DCPD-201300318.pdf

National Oceanic and Atmospheric Administration, 2024. “DIVER Restoration Portal.” NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/

Texas Trustee Implementation Group, 2017. Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters. Accessed August 6, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf

12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

Guadalupe River Old Delta Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Guadalupe River Old Delta Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Guadalupe River Old Delta Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the Guadalupe River Old Delta located along Guadalupe Bay in Refugio County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project as presented in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 1,140 acres of intertidal marsh.

Figure 1 Vicinity Map Showing the Location of the Guadalupe River Old Delta Wetland Restoration Project in Refugio County, Texas

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project would restore priority areas in Refugio County, Texas, at the northern portion of San Antonio Bay that forms a peninsula between Hynes Bay to the west and Guadalupe Bay to the east (Figure 1). The Project site consists primarily of coastal marshes and open-water areas. Sea level rise, erosion, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the extent of open water and the decrease in estuarine marsh area. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats, as well as reduce vulnerability of critical infrastructure to hurricanes and storm surges.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from Project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect Project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize Project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the	Annual topographic surveys, visual inspections, and field	One survey/inspection per entire construction area cell.	70% of sediment fill area within target	Reshaping sediments, adding additional sediments, breaching

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
estuarine marsh restoration as determined by adjacent reference wetlands		placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	Minimum of one settlement plate per 75 acres or three per cell.	elevation 5 years post-construction.	containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of the reference control cell.	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	because the performance criteria have been met, it will be documented in the annual MAM report.	three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.		
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Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X
Vegetation Composition	N/A	N/A	X	X	X	X	X

Note:
PM: post-construction monitoring

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GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

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7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

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12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

Lower Neches WMA Old River Unit Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Lower Neches Wildlife Management Area Old River Unit Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Lower Neches Wildlife Management Area (WMA) Old River Unit Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the Lower Neches WMA located south of Bridge City and north of Sabine Lake in Orange County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project as presented in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 224 acres of intertidal marsh.

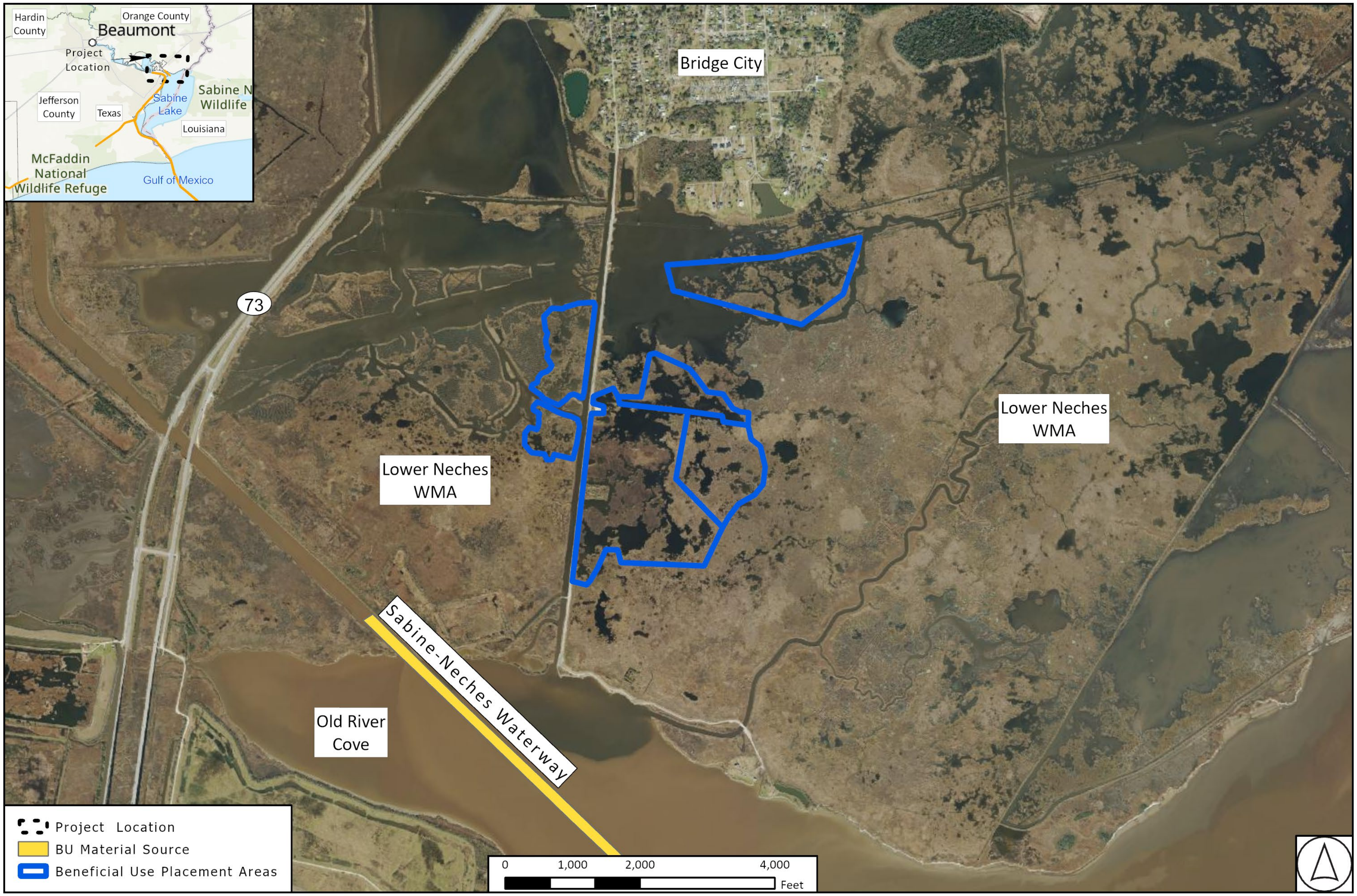

Figure 1 Vicinity Map Showing the Location of the Lower Neches WMA Old River Unit Wetland Restoration Project in Orange County, Texas

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan:** Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore priority areas in the Lower Neches WMA Old River Unit, which consists of 4,386 acres on the north shore of Old River Cove of Sabine Lake and near the Gulf Intracoastal Waterway (Figure 1). The site is composed primarily of marsh land and open water. Sea level rise, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Contractor controls	Dredging contracts will be owned by the USACE or other Project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	within ±5% of the reference control cell.	decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration Project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X
Vegetation Composition	N/A	N/A	X	X	X	X	X

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

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12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

McFaddin NWR Willow Lake Terraces Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–McFaddin National Wildlife Refuge (NWR) Willow Lake Terraces Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The McFaddin NWR Willow Lake Terraces Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the McFaddin NWR located along the Gulf Intracoastal Waterway (GIWW) in Jefferson County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project as presented in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 218 acres of intertidal marsh.

Figure 1 Vicinity Map Showing the Location of the McFaddin NWR Willow Lake Terraces Wetland Restoration Project in Jefferson County, Texas

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats Restoration Type Goals and Project Restoration Objectives

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore priority areas in the McFaddin NWR, which includes 58,681 acres in Jefferson County, Texas, along the GIWW (Figure 1). The predominant wetland habitats near the McFaddin NWR are characterized as salt and brackish marsh and estuarine open water. The site boundaries were predetermined by a previous effort in 2014 to regenerate marsh using terraces within open-water areas surrounding Willow Lake. Sea level rise, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area. The loss of this marsh habitat has increased the risk of storm surge impacts to economically important industries and nationally significant ports along the Texas Coast. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats, as well as reduce vulnerability of critical infrastructure to hurricanes and storm surges.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post-construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of the	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		for revisiting over time. Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	reference control cell.	decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X
Vegetation Composition	N/A	N/A	X	X	X	X	X

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

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National Oceanic and Atmospheric Administration, 2024. “DIVER Restoration Portal.” NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/

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12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

San Bernard NWR Sargent Oil Field Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–San Bernard National Wildlife Refuge (NWR) Sargent Oil Field Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the Deepwater Horizon (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The San Bernard NWR Sargent Oil Field Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the San Bernard NWR located near the Refuge's western boundary on the Gulf Intracoastal Waterway (GIWW) and south of Bay City, Texas in Matagorda County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project as presented in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG], 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 200 acres of intertidal marsh.

Figure 1 Vicinity Map Showing the Location of the San Bernard NWR Sargent Oil Field Wetland Restoration Project in Matagorda County, Texas

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan:** Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats. To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore priority areas at the site of an abandoned oil field in the San Bernard NWR in Matagorda County, south of Sargent, Texas, along the Gulf Intracoastal Waterway (Figure 6-2). The San Bernard NWR includes more than 70,000 acres of shallow open water, small pockets of marsh, and some deeper cuts and channels in Brazoria and Matagorda counties (Figure 1). The Project site consists primarily of shallow open water, some small pockets of marsh, and some deeper cuts and channels. The Project area was historically healthy marsh, which has eroded away into mostly open water throughout the past three decades. Sea level rise, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area. The loss of this marsh habitat has increased the risk of storm surge impacts to economically important industries and nationally significant ports along the Texas Coast. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats, as well as reduce vulnerability of critical infrastructure to hurricanes and storm surges.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from Project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 6-1) could affect Project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize Project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other Project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post-construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	the reference control cell.	decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X
Vegetation Composition	N/A	N/A	X	X	X	X	X

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

Exec. Order No. 13642, 78 Fed. Reg. 28111 (May 14, 2013). Accessed August 6, 2024. Available at: https://www.govinfo.gov/content/pkg/DCPD-201300318/pdf/DCPD-201300318.pdf

National Oceanic and Atmospheric Administration, 2024. “DIVER Restoration Portal.” NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/

Texas Trustee Implementation Group, 2017. Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters. Accessed August 6, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf

12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

Schicke Point Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Schicke Point Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the *Deepwater Horizon* (DWH) Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Schicke Point Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in Schicke Point located at the eastern side of the inlet into Carancahua Bay from Matagorda Bay in Calhoun County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project selected in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 72 acres of intertidal marsh.

Figure 1 **Vicinity Map Showing the Location of the Schicke Point Wetland Restoration Project in Calhoun County, Texas**

This Project is being implemented as restoration for the DWH oil spill NRDA, consistent with the Final PDARP/PEIS (DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore priority areas at Schicke Point, which is located in Calhoun County, Texas, along the northern rim of Matagorda Bay at the mouth of Carancahua Bay (Figure 1). The site is submerged, owned by the State of Texas, and managed by the Texas General Land Office. A segmented rubble-mound breakwater was constructed along the shoreline facing Matagorda Bay in 2017. The predominant wetland habitats at Schicke Point are characterized as salt and brackish marsh and estuarine open water. The Project site currently consists primarily of open water. Sea level rise, erosion, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area. The loss of this marsh habitat has increased the risk of storm surge impacts to economically important industries and nationally significant ports along the Texas Coast. Restoration and protection of marshes in the region would ensure long-term ecological resiliency for the habitats, as well as reduce vulnerability of critical infrastructure to hurricanes and storm surges.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from Project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 1) could affect Project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize Project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

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Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

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Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	the reference control cell.	decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration Project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

5 Project Level Decisions: Performance Criteria and Potential Corrective Actions

Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Vegetation Composition	N/A	N/A	X	X	X	X	X

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, and other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The

Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

The Implementing Trustee is responsible for ensuring that documents and electronic data files are stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of MAM activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

Exec. Order No. 13642, 78 Fed. Reg. 28111 (May 14, 2013). Accessed August 6, 2024. Available at: https://www.govinfo.gov/content/pkg/DCPD-201300318/pdf/DCPD-201300318.pdf

National Oceanic and Atmospheric Administration, 2024. "DIVER Restoration Portal." NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/

Texas Trustee Implementation Group, 2017. Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters. Accessed August 6, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf

12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #

Texas Point NWR Wetland Restoration Project Monitoring and Adaptive Management Plan

1 Introduction

This Monitoring and Adaptive Management Plan (MAM Plan) identifies the performance criteria and monitoring needed to evaluate progress toward meeting project objectives and to support any necessary adaptive management of the restoration project consistent with the Deepwater Horizon (DWH) Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS; Deepwater Horizon Natural Resource Damage Assessment Trustees [DWH NRDA Trustees] 2016). This plan was developed according to the Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0 (MAM Manual; DWH NRDA Trustees 2021b) and was adapted to fit the needs of the Texas Dredged Material Planning for Wetland Restoration–Texas Point National Wildlife Refuge (NWR) Wetland Restoration project.

This MAM Plan is a living document and may be updated as needed to reflect changing conditions and/or new information. Any future revisions to this document will be made publicly available through the National Oceanic and Atmospheric Administration (NOAA) Data Integration Visualization Exploration and Reporting (DIVER) Restoration Portal (NOAA 2024) and accessible through the DWH Natural Resource Damage Assessment (NRDA) Trustee Council's website: https://www.gulfspillrestoration.noaa.gov (DWH NRDA Trustees 2021a).

1.1 Project Overview

The Texas Point NWR Wetland Restoration project (Project) would restore wetlands through the beneficial use of dredged material in the Texas Point NWR located in Jefferson County, Texas (Figure 1). The Project is one of the eight restoration sites identified for engineering and design under the Texas Dredged Material Planning for Wetland Restoration project selected in the *Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters* (Texas Trustee Implementation Group [Texas TIG] 2017). The Project would beneficially use suitable sediment to restore coastal wetlands. The placement of dredged material from navigation channels and dock berths, construction of containment levees, and associated planting of estuarine marsh vegetation would restore up to 623 acres of intertidal marsh.

Figure 1 Vicinity Map Showing the Location of the Texas Point NWR Wetland Restoration Project in Jefferson County, Texas

This Project is being implemented as restoration for the Deepwater Horizon oil spill (DWH oil spill) NRDA, consistent with the Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement (Final PDARP/PEIS; DWH NRDA Trustees 2016). Per the Final PDARP/PEIS, the Project falls into the following restoration categories:

a) **Programmatic Goal:** Restore and conserve habitat

b) **Restoration Type:** Wetlands, coastal, and nearshore habitats

c) **Restoration Approach:** Create, restore, and enhance coastal wetlands

d) **Restoration Technique:** Create or enhance coastal wetlands through placement of dredged material

e) **Trustee Implementation Group:** Texas Trustee Implementation Group

f) **Restoration Plan**: Texas Trustee Implementation Group Draft Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats Restoration Type Goals and Project Restoration Objectives

1.2 Restoration Type Goals and Project Restoration Objectives

This Project is designed to address the Wetlands, Coastal, and Nearshore Habitat Restoration Type. As summarized in Chapter 5 of the Final PDARP/PEIS, the restoration goals for injuries to coastal habitats are as follows:

a) Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf Coast states to maintain ecosystem diversity, with particular focus on maximizing ecological functions for the range of resources injured by the spill, such as oysters, estuarine-dependent fish species, birds, marine mammals, and nearshore benthic communities.

b) Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.

c) While acknowledging the existing distribution of habitats throughout the Gulf of Mexico, restore habitats in appropriate combinations for any given geographic area. Consider design factors, such as connectivity, size, and distance between projects, to address injuries to the associated living coastal and marine resources and restore the ecological functions provided by those habitats.

To accomplish the Restoration Type goals, the Project objectives are to 1) increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands and 2) establish estuarine marsh vegetation.

1.3 Conceptual Setting

The Project will restore priority areas in the Texas Point NWR, which manages approximately 8,972 acres and is located along the western bank of the Sabine Pass Channel and north of the Gulf of Mexico. (Figure 1). The area is within the Chenier Plain of southeast Texas and contains estuarine marshes interspersed with elevated fan-shaped salty prairie known as "cheniers." Sea level rise, subsidence, insufficient sediment inflow due to anthropogenic alterations, and erosion have severely degraded marsh and wetland habitat in the region. This habitat degradation is exhibited by the increase in the areal extent of open water and the decrease in estuarine marsh area.

The Project would be a continuation of similar marsh restoration efforts in the region that are beneficially using dredged material. The initial establishment of marsh vegetation is anticipated to occur within two years of the placement of dredged material within the restoration cells.

This Project will rely on external partners, such as the U.S. Army Corps of Engineers (USACE), to provide sediment dredged from sites in close proximity to the restoration site. The quantity, quality, and timing of availability of dredged sediments will be a key driver in the final acreage of intertidal marsh habitat restored.

1.4 Sources of Uncertainty

Although the likelihood of Project success is evaluated under Oil Pollution Act regulations (15 CFR § 990.54(a)(3)), uncertainties may exist regarding how to best implement projects to achieve the greatest benefits for the injured resources. These uncertainties may arise from an incomplete understanding of the current conceptual setting; from unknown conditions in the future; or from Project elements that do not perform as anticipated. For this Project, the uncertainties (summarized in Table 8-1) could affect Project success and could, therefore, be key drivers of corrective actions or adaptive management decisions. Sections 2 and 3 summarize Project monitoring protocols and describe how this information will be used to inform adaptive management to address these uncertainties.

Potential uncertainties are defined as those that may affect the ability to achieve Project restoration objective(s). To aid in the identification of uncertainties, Trustees utilized a variety of sources, including but not limited to, Final PDARP/PEIS Monitoring and Adaptive Management (MAM) Section 5.5.15 (DWH NRDA Trustees 2016); MAM Manual (DWH NRDA Trustees 2021b); and other documents. Monitoring activities can be undertaken to inform these uncertainties, and appropriate corrective actions can be implemented in the event the Project is not meeting its performance criteria.

Table 1 Key Uncertainties

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Extreme weather	Extreme weather may result in damage to the Project prior to, during, or post construction. This could result in the need to postpone construction or reconstruct damaged portions of the Project. Extreme weather could also affect the growth/survival of transplanted vegetation and/or allow invasive species to be established and/or dominate the vegetation community.
Survival of transplanted vegetation	Survival of transplanted vegetation could be hindered by extreme weather, precipitation, and sediment elevation.
Vegetation recruitment and/or colonization	Recruitment and/or colonization patterns of flora may be insufficient.
Precipitation patterns	Drought could hinder growth and/or survival of transplanted vegetation and/or allow nontarget vegetation communities to evolve (e.g., invasive species).
Sea level rise and subsidence	Site-specific rates of sea level rise and subsidence will impact the proper functioning of the elevation gradient needed to support estuarine marsh.

Key Uncertainty	Description on How the Uncertainty Could Impact Project Success and/or Decision-Making
Market instability	Unforeseen market instability may delay, prevent, or change the spatial extent of construction of the Project.
Contractor controls	Dredging contracts will be owned by the USACE or other Project partner, and the Implementing Trustee may have limited direct control over contractor actions and communications. This could produce communication delays, resulting in contractors overfilling or underfilling portions of the restoration site.
Source and quality of dredged material	The source and quality (e.g., grain size distribution) of sediments can have an impact on time and elevation of sediment settlement and marsh development.

The list of key uncertainties in Table 1 is not exhaustive. Additional uncertainties may be identified as the Project is implemented and monitored. These uncertainties may affect the achievement of the restoration objectives of the Project. If any drivers or stressors are negatively impacting the Project, adaptive management may be necessary to ensure that Project objectives are being achieved.

2 Project Monitoring

The monitoring described in this MAM Plan was developed to evaluate Project performance and identify potential corrective actions, if needed. Information on each monitoring parameter is provided below, organized by objective (Table 2). Note that Table 2 does not include all possible options for corrective actions; rather, it includes a list of potential actions for each individual parameter to be considered if the Project is not performing as expected once implemented. Other corrective actions may be identified post- construction, as appropriate. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 2 Project Objectives, Parameters, Data Collection Activities, Performance Criteria, and Potential Corrective Actions

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Structural integrity of levees and water control structures	As-built topographic surveys of the containment berms will be collected as deemed appropriate by the Project engineer. Subsequent surveys will consist of visual surveys to ensure physical integrity of the berms and water control structures and will be documented with photographs.	Topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted annually until a management decision is made for berm breaching and water control structures (approximately 1 year post-construction).	One survey/inspection per entire construction area site.	As-built elevation, integrity, and function of the containment berms and water control structures is maintained as designed until a management decision is made for berm breaching and water control structure removal (approximately 1 year post-construction).	Reshaping or repairing containment berms, adding additional sediments to the berms, repairing or modifying water control structures, or lowering contained water levels.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Target grade elevation	Topographic surveys of the marsh restoration cells will be conducted along parallel transects 300 feet apart (a minimum of three transects per marsh restoration cell). Transect locations will be established during the preconstruction survey and reoccupied during subsequent survey events. Survey points will be collected every 100 feet (a minimum of 24 points per restoration cell) along each transect and at locations with a noticeable break in slope. Survey points will also be collected at each settlement plate location.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation will be conducted over the 5-year monitoring period near the end of the growing season.	One survey/inspection per entire construction cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Sediment compaction	Settlement plates will be installed within the marsh restoration cells prior to the placement of dredged material to monitor compaction of the fill material and underlying native soils during and after construction. Monitoring will be conducted either by manual survey or through automated telemetry.	Annual topographic surveys, visual inspections, and field and aerial photographic documentation at the settlement plates will be conducted over the 5 -year monitoring period near the end of the growing season.	One survey/inspection per entire construction area cell. Minimum of one settlement plate per 75 acres or three per cell.	70% of sediment fill area within target elevation 5 years post-construction.	Reshaping sediments, adding additional sediments, breaching containment berms, and removing water containment structures.
Increase grade elevations to be suitable for estuarine marsh restoration as determined by adjacent reference wetlands	Area restored	The areal extent of Project and habitat boundaries will be mapped using aerial imagery collected by airplane, helicopter, unmanned aerial systems, satellite imagery, or other appropriate remote sensing platforms. Imagery will map the extent of vegetated marsh and open water within the restoration cell.	Aerial imagery will be collected during preconstruction to establish pre-Project baseline conditions. Subsequent aerial imagery collection will be conducted at 1, 3, and 5 years post-construction and, if needed, after events that could alter habitat within the Project area such as severe storms, flooding, or oil spills.	One survey/inspection per entire construction area cell.	Vegetated estuarine marsh habitat occupies no more than 60%–80% of the marsh restoration cell area 5 years after Project construction.	Reshaping sediments, adding additional sediments, breaching containment berms, removing water control structures, and making hydrologic modifications (construction of ponds and channels).
Establish estuarine marsh vegetation	Vegetation percent cover	Monitoring transects will be established with 300 feet between transects. One 1 by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the	Monitoring plots of 1- by 1 m (minimum of 24 plots per restoration cell) will be established at 1 year post-construction or when the managers decide to remove berms and water	One of two criteria should be met: 1) percent cover will be maintained at or greater than 70% in monitoring subplots, 5 years after planting activities initiated; and 2) percent cover is within ±5% of the	Replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the

Project Objective	Parameter(s)	Method	Timing and Frequency of Data Collection	Sample Size/Cells	Performance Criteria	Potential Corrective Actions
		Visual estimates of total plant cover (sum of all plant species) will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration site plots.	reference control cell.	decision will be documented in annual MAM reports.
Establish estuarine marsh vegetation	Vegetation composition	Monitoring transects will be established 300 feet between transects. One 1- by 1-m plot will be established every 100 feet or a minimum of 24 plots per restoration cell. The corners of each plot will be recorded with GPS and marked with corner poles for revisiting over time. Visual estimates of total plant cover per species will be recorded at each plot. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots. Vegetation percent cover and composition will be simultaneously collected from the same plots.	Annual vegetation percent cover surveys will be conducted during the monitoring period near the end of the growing season. The monitoring period is expected to be 5 years or less and is dependent upon when the performance criteria are met. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.	Monitoring plots of 1- by 1-m (minimum of 24 plots per cell) will be established at 1-year post-construction or when the managers decide to remove berms and water control structures. Reference control plots (minimum of three) will be established in a nearby area of healthy marsh to be monitored with the restoration cell plots.	Vegetation composition should be similar to reference cell. No more than 5% coverage of the plant species present are exotic invasive plants.	Corrective actions could include replanting/reseeding, invasive species removal, and/or transplanting of native estuarine marsh plants species. The Texas TIG may extend monitoring for 5 years or until performance criteria are met. If the monitoring period is changed, the decision will be documented in annual MAM reports. If the monitoring will end prior to 5 years because the performance criteria have been met, it will be documented in the annual MAM report.

3 Adaptive Management

Adaptive management decisions may include how to improve the likelihood of achieving favorable project outcomes or selecting corrective actions in the event a project is not performing as expected and intended. Due to the nature of this Project and the use of standard restoration techniques that have been successfully implemented in similar projects, the Texas TIG does not anticipate the need for rigorous adaptive management of the Project. If assessment of Project monitoring data indicates that Project objectives are not being met, the Texas TIG may implement corrective actions as identified in Table 8-2 and/or identify corrective actions as necessary.

4 Evaluation

Project MAM includes planned evaluations of the selected parameters (see Table 2) throughout the Project's lifetime. By thoughtfully designing evaluation methods for the design and implementation of Project restoration activities, the Implementing Trustee can assess if the Project is meeting its restoration objectives and determine the need for adaptive management or corrective actions, as well as identify lessons learned, previously unrecognized uncertainties, and/or unanticipated events unrelated to the restoration project that potentially affected the monitoring results (e.g., extreme weather such as hurricanes). At a minimum and as part of the annual reporting of monitoring data (Section 7), annual evaluations of monitoring data will be conducted to determine if corrective actions are needed. Evaluations of monitoring data can occur more often as needed or as triggered by Project milestones such as completion of construction.

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Evaluations of MAM data are used to 1) determine whether the Project, once implemented, has met its objectives and 2) to inform the need for potential corrective actions (see Table 2).

6 Monitoring Schedule

The schedule for the Project monitoring activities is shown in Table 3 by monitoring parameter. The Project site includes multiple marsh restoration cells that may be constructed over multiple dredging events. Monitoring for each restoration cell will be initiated when a corresponding dredging event for that cell is identified.

Table 3 Monitoring Schedule

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Structural Integrity of Levees and Water Control Structures	N/A	X	X	X	X	X	X
Grade Elevation	X	X	X	X	X	X	X
Sediment Compaction	N/A	N/A	X	X	X	X	X
Area Restored	X	N/A	X	N/A	X	N/A	X
Percent Vegetation Cover	N/A	N/A	X	X	X	X	X

Monitoring Parameter	Preconstruction Monitoring	Construction Monitoring (As Built)	PM Year 1	PM Year 2	PM Year 3	PM Year 4	PM Year 5
Vegetation Composition	N/A	N/A	X	X	X	X	X

7 Data Management

Project data will be generated through site visits, topographic surveys, aerial imagery, ground photography, and vegetation surveys. Data collection will occur as shown in Table 2. Data will be managed in accordance with the DWH Trustee Council Standard Operating Procedures (SOPs; DWH NRDA Trustees 2021a) and guidance provided in the MAM Manual (DWH NRDA Trustees 2021b). Original data sheets will be scanned to *.pdf files, which will be retained by the Implementing Trustee for the time period specified by the SOPs following Project closeout. Compiled data and digital imagery will be stored in a secure, central or cloud-based system that is automatically backed up off site.

7.1 Data Description

Topographic survey data for latitude, longitude, and elevation will be collected and stored in digital formats, such as *.csv files or similar formats, and processed into digital elevation models as raster imagery format files, such as *.tif files. Aerial imagery will similarly be stored as a *.tif with ground photography produced as *.jpg or *.png file formats. Vegetation monitoring data will be collected either by electronic tablet into spreadsheets or Project data sheets. Geographic Information System (GIS) data will typically be in the form of *.shp shapefiles with supporting metadata. Engineering design documents will typically be in *.dwg computer aided design files. Data collected on hard copy forms will be scanned into *.pdf files or transcribed to digital spreadsheets.

7.2 Data Review and Clearance

Prior to being added to the DIVER Restoration Portal (NOAA 2024), all data will go through the appropriate quality assurance/quality control (QA/QC) process in accordance with the SOPs and DWH MAM Manual. Data will be verified to ensure that they are correctly entered and converted to a format compatible for DIVER.

GIS metadata will be verified for compliance with the Federal Geographic Data Committee (FGDC) and International Organization for Standardization (ISO) metadata standards, as well as any Implementing Trustee agency requirements. Appropriate metadata could include a data dictionary to define codes and fields used in the dataset; and/or a Readme file describing how data was collected, QA/QC procedures, other information about data such as meaning, relationships to other data, origin, usage, and format.

Project data that are handwritten will be transcribed into a standard digital format and verified by one or more reviewers. For QA/QC procedures, generated electronic data sheets will be verified against the original hard copy, and any validation and transcription errors will be corrected as appropriate before data are used for any analyses or published to the DIVER Restoration Portal.

Implementing Trustees will verify and validate MAM data and information and will ensure that all data are entered or converted into a commonly used digital format and labeled with metadata to the extent practicable and in accordance with FGDC, ISO, and Implementing Trustee agency standards. The Implementing Trustee will give the other Texas TIG members time to review the data before making such information publicly available in DIVER. The Implementing Trustee is responsible for ensuring that the data submitted to DIVER are consistent with the data standards.

7.3 Data Storage and Accessibility

stored in a secure location in such a way that accessibility is guaranteed for as long as the agency requires. The DIVER Restoration Portal is the centralized data storage repository for informing the public of Project details, but not all Project data are required to be uploaded to DIVER. Original hard copy data, digital data, and photographs will be retained by the Implementing Trustee. Digital data and scanned hard copy photographs and forms will be stored on the NOAA-supported TIG SharePoint site. An explanation of data storage on the TIG SharePoint site, as well as a description of the long-term management and archiving procedures of that database, will be provided in the DIVER Restoration Portal (NOAA 2024).

After data has been verified by QA/QC procedures, it will be stored on DIVER and, where applicable, on Implementing Trustee databases, in accordance with DWH reporting requirements (e.g., within one year of collection).

7.4 Data Sharing

Implementing Trustees will ensure data sharing will follow standards and protocols set forth in the Open Data Policy of the DWH SOPs (Section 11.4 of SOPs; DWH NRDA Trustees 2021a). Data will be made publicly available, in accordance with the federal Open Data Policy (Executive Order 13642, May 4, 2013), through the DIVER Restoration Portal. Prior to being made publicly available, any personal identifiable information will be redacted. Some MAM data may be exempt from the Open Data Policy due to protection from public disclosure under other regulatory requirements. No data release can occur if it is contrary to other federal or state laws.

The Implementing Trustee will provide MAM data and information to the DIVER Restoration Portal. If the data are stored in the DIVER Restoration Portal, it can be shared to the public by publishing the data to the Trustee Council website (Section 10.6.6 of SOPs; DWH NRDA Trustees 2021a). For further instructions on this process, see the DIVER Restoration Portal Manual.

8 Reporting

Project monitoring information, including a summary of monitoring information and decision of potential corrective actions, will be prepared and uploaded to DIVER annually. The Implementing Trustee will develop a final, high-level summary report prior to Project closeout.

9 Roles and Responsibilities

Implementing Trustees for this Project will be identified in the Implementing Trustee Resolution and will be responsible for execution of the MAM Plan, oversight of any contractors used to perform MAM tasks, annual and final reporting to the DIVER Restoration Portal, and informing the Texas TIG of Project details, including the need for potential corrective action as needed. Other Texas TIG members may assist with monitoring data collection, data verification, draft project report review and editing, and providing technical support to the Implementing Trustee. The decision to implement corrective action will be determined by Texas TIG consensus.

10 Monitoring and Adaptive Management Budget

The budget for this Project includes support for the full range of monitoring and adaptive management activities described above, including field sampling, data management and analysis, report writing, and adaptive management.

11 References

Deepwater Horizon Natural Resource Damage Assessment Trustees (DWH NRDA Trustees), 2016. Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. February 2016. Accessed August 3, 2024. Available at: http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan

DWH NRDA Trustees, 2021a. Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the Deepwater Horizon (DWH) Oil Spill. Revised August 2, 2021. Accessed September 14, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/2021-08-02-final-revised-sop-clean-copy-30pdf

DWH NRDA Trustees, 2021b. Monitoring and Adaptive Management Procedures and Guidelines Manual Version 2.0. Appendix to the Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill. Revised December 2021. Accessed November 1, 2024. Available at: https://gulfspillrestoration.noaa.gov/media/document/2021-12-tc-monitoring-and-adaptive-management-procedures-and-guidelines-manual

Exec. Order No. 13642, 78 Fed. Reg. 28111 (May 14, 2013). Accessed August 6, 2024. Available at: https://www.govinfo.gov/content/pkg/DCPD-201300318/pdf/DCPD-201300318.pdf

National Oceanic and Atmospheric Administration, 2024. “DIVER Restoration Portal.” NOAA Natural Resource Damage Assessment & Restoration: Data & Visualization. Accessed: August 3, 2024. Available at: https://www.diver.orr.noaa.gov/

Texas Trustee Implementation Group, 2017. Deepwater Horizon Oil Spill Natural Resource Damage Assessment, Texas Trustee Implementation Group, Final 2017 Restoration Plan/Environmental Assessment: Restoration of Wetlands, Coastal, and Nearshore Habitats; and Oysters. Accessed August 6, 2024. Available at: https://www.gulfspillrestoration.noaa.gov/media/document/dwh-arz000631pdf

12 MAM Plan Revision History

Old Version #	Revision Date	Reason for Change	New Version #