DEEPWATER HORIZON OIL SPILL

LOUISIANA TRUSTEE IMPLEMENTATION GROUP FINAL RESTORATION PLAN AND ENVIRONMENTAL ASSESSMENT #6: RESTORE AND CONSERVE WETLANDS, COASTAL, AND NEARSHORE HABITATS

APRIL 2020

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EXECUTIVE SUMMARY

On April 20, 2010, the Deepwater Horizon (DWH) mobile drilling unit exploded, caught fire, and eventually sank in the Gulf of Mexico, resulting in a massive release of oil and other substances from BP Exploration and Production's (BP) 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 Gulf of Mexico. Approximately 3.19 million barrels (134 million gallons) of oil was released into the ocean (U.S. District Court for the Eastern District of Louisiana 2016). Oil spread from the deep ocean to the ocean surface and nearshore environment from Texas to Florida. The oil came in contact with, and injured, diverse natural resources such as deep-sea coral, fish and shellfish, productive wetland habitats, sandy beaches, birds, endangered sea turtles, and protected marine life. The oil spill prevented people from fishing, going to the beach, and enjoying typical recreational activities along the Gulf of Mexico. Extensive response actions, including cleanup activities and actions to try to prevent the oil from reaching sensitive resources, were undertaken to try 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. The oil and other substances released from the well in combination with the extensive response actions together make up the DWH Oil Spill.

As an oil pollution incident, the DWH Oil Spill is subject to the provisions of the Oil Pollution Act (OPA) of 1990, 33 United States Code 2701 et seq., which makes parties responsible for an oil spill liable for the costs of responding to and cleaning up the oil spill, as well as the costs of assessment and restoration needed to compensate for injuries to natural resources and the services they provide. OPA specifies that trustees responsible for representing the public's interest (in this case, state and federal agencies) must be designated to act on behalf of the public to assess the injuries and to address those injuries.

As required under OPA, the DWH Oil Spill Trustees (DWH Trustees) conducted a natural resource damage assessment (NRDA) and prepared the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS) (DWH Trustees 2016). The DWH Trustees conducted a NRDA to

- assess the impacts of the DWH Oil Spill on natural resources in the Gulf of Mexico and the services those resources provide, and
- determine the type and amount of restoration needed to compensate the public for these impacts.

Following the NRDA, the DWH Trustees determined that the injuries caused by the DWH Oil Spill could not be fully described at the level of a single species, a single habitat type, or a single region. Rather, the injuries affected such a wide array of linked resources over such an enormous area that the effects of the DWH Oil Spill must be described as constituting an ecosystem-level injury. Consequently, the DWH Trustees proposed a comprehensive, integrated ecosystem restoration plan with a portfolio of restoration types that addresses the diverse suite of injuries that occurred at both regional and local scales, based on the following five overarching goals:

1. Restore and conserve habitat
2. Restore water quality
3. Replenish and protect living coastal and marine resources
4. Provide and enhance recreational opportunities
5. Provide for monitoring, adaptive management, and administrative oversight to support restoration implementation

These five goals work both independently and together to benefit injured resources and services through the following restoration goals (DWH Trustees 2016: Sections 5.5.2 through 5.5.14):

- The goal of restoring a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf 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.
- The goal of restoring for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- The goal of acknowledging the existing distribution of habitats throughout the Gulf of Mexico; restoring habitats in appropriate combinations for any given geographic area while considering design factors, such as connectivity, size, and distance between projects; addressing injuries to the associated living coastal and marine resources; and restoring the ecological functions provided by those habitats.

LA TIG Restoration Plan and Environmental Assessment #6

This document, hereinafter referred to as the *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitats* and abbreviated as RP/EA, was prepared by the Louisiana Trustee Implementation Group (LA TIG) pursuant to OPA and is consistent with the DWH Trustees' findings in the Final PDARP/PEIS. The LA TIG comprises five Louisiana state trustee agencies and four federal trustee agencies:

- Louisiana Coastal Protection and Restoration Authority (CPRA)
- Louisiana Department of Natural Resources (LDNR)
- Louisiana Department of Environmental Quality (LDEQ)
- Louisiana Department of Wildlife and Fisheries (LDWF)
- Louisiana Oil Spill Coordinator's Office (LOSCO)
- National Oceanic and Atmospheric Administration (NOAA)
- U.S. Department of the Interior (DOI)
- U.S. Department of Agriculture (USDA)
- U.S. Environmental Protection Agency (EPA)

In accordance with 40 Code of Federal Regulations (CFR) 1508.12, the LA TIG designated EPA as the lead federal agency responsible for National Environmental Policy Act (NEPA) compliance for this RP/EA. The federal and state agencies of the LA TIG are acting as cooperating agencies for the purposes of compliance with NEPA in the development of this RP/EA. Each federal cooperating agency on the LA TIG adopts the NEPA analyses in this RP/EA. In accordance with 40 CFR 1506.3(a), each of the three federal cooperating agencies (DOI, NOAA, and USDA) participating on the LA TIG reviewed this final RP/EA for adequacy in meeting the standards set forth in its own specific NEPA implementing procedures and adopts the analysis in this RP/EA. Adoption of this RP/EA is complete via signature on the finding of no significant impact (FONSI).

The LA TIG has an allocation of $5 billion for restoration activities in the Louisiana Restoration Area, which includes Early Restoration projects approved prior to the settlement with BP in 2016. Because of the significant injury to the Gulf of Mexico ecosystem, where habitats are closely linked, as a result of the DWH Oil Spill, approximately $4 billion of these funds are dedicated to the Wetlands, Coastal, and Nearshore Habitats restoration type.

The focus of this RP/EA is implementation of the Final PDARP/PEIS restoration type, Wetlands, Coastal, and Nearshore Habitats. This restoration type is intended to restore and conserve wetlands, coastal, and nearshore habitats, which integrate and form a continuum within the nearshore ecosystem and contribute to an integrated, connected food web (Baillie et al. 2015; Boesch and Turner 1984; Boström et al. 2011; Deegan 1993; Deegan et al. 2000; Nelson et al. 2011; Nelson et al. 2013, as cited in DWH Trustees 2016) across the Gulf and address multiple ecosystem benefits through habitat restoration. Identifying opportunities to restore multiple habitats within one project, or to implement multiple projects within a given area, may accelerate recovery of injured ecosystem functions and achieve a more integrated restoration of the nearshore ecosystem and its service flows.

In developing this RP/EA's reasonable range of alternatives, the LA TIG considered the following:

- OPA screening criteria
- Specific goals identified in the Final PDARP/PEIS under the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type
- Other criteria identified by the DWH Trustees
- Input from the public
- The current and future availability of funds under the DWH Oil Spill NRDA settlement payment schedule

In total, the LA TIG identified four projects in the reasonable range of alternatives in addition to the No Action Alternative. These projects (hereinafter alternatives) are intended to restore or replace habitats, species, and services in the Louisiana Restoration Area to their baseline condition (primary restoration) and to compensate the public for interim losses from the time natural resources are injured until they recover to baseline conditions (compensatory restoration).

Restore and conserve habitat alternatives considered in this RP/EA would help create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beaches that were negatively impacted as a result of the DWH Oil Spill. After evaluating all four alternatives included in the reasonable range of alternatives, the LA TIG selects the three preferred alternatives for implementation. Table ES-1 identifies the alternatives evaluated in this RP/EA and which of those alternatives are preferred (selected) alternatives for implementation.

Table ES-1. Restore and Conserve Habitat Alternatives

Alternative	Location (Parish)	Preferred Alternative
West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	Yes
Golden Triangle Marsh Creation	Orleans and St. Bernard	Yes
Biloxi Marsh Living Shoreline	St. Bernard	Yes
Fifi Island Forested Ridge with Breakwater	Jefferson	No

The LA TIG has evaluated the environmental consequences of the alternatives comprising a reasonable range of alternatives consistent with NEPA, and following a 30-day public comment period, the findings indicate that no significant environmental impacts are anticipated. The LA TIG has prepared this final RP/EA and FONSI to inform the public about DWH NRDA restoration planning efforts in the Louisiana Restoration Area.

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Abbreviations

ACM	asbestos containing materials
APE	area of potential effect
AQS	air quality station
AST	aboveground storage tanks
BFE	base flood elevation
BGEPA	Bald and Golden Eagle Protection Act of 1940
BMPs	best management practices
BP	BP Exploration and Production, Inc.
BWW	Barataria Bay Waterway
CBRS	Coastal Barrier Resources System
CEC	Coastal Engineering Consultants, Inc.
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CPRA	Coastal Protection and Restoration Authority
CRMS	Coastwide Reference Monitoring System
CUP	Coastal Use Permit
CWPPRA	Coastal Wetlands Planning, Protection and Restoration Act
CZM	Coastal Zone Management
CZMA	Coastal Zone Management Act
DOI	U.S. Department of the Interior
DWH	Deepwater Horizon
DWH Trustees	DWH Oil Spill Trustees
E&D	engineering and design
EFH	essential fish habitat
EFHA	Essential Fish Habitat Areas Protected from Fishing
EMU	Environmental Management Unit
EO	executive order
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act of 1973
FEMA	Federal Emergency Management Agency
FONSI	finding of no significant impact
FWP	Fish and Wildlife Propagation
GEBF	Gulf Environmental Benefit Fund
GIWW	Gulf Intracoastal Waterway
GMFMC	Gulf of Mexico Fishery Management Council

h	horizontal
HAPC	Habitat Areas of Particular Concern
HET	Hydro-Environmental Technology
HTRW	hazardous, toxic, and radioactive waste
IHNC	Inner Harbor Navigation Canal
LA TIG	Louisiana Trustee Implementation Group
LAC	Louisiana Administrative Code
LDEQ	Louisiana Department of Environmental Quality
LDNR	Louisiana Department of Natural Resources
LDWF	Louisiana Department of Wildlife and Fisheries
LMRE	Lower Mississippi River Ecosystem
LOSCO	Louisiana Oil Spill Coordinator's Office
MAM	monitoring and adaptive management
MBTA	Migratory Bird Treaty Act of 1908
MCA	marsh creation areas
MCY	million cubic yards
MMPA	Marine Mammal Protection Act of 1972
MRGO	Mississippi River Gulf Outlet
NAAQS	National Ambient Air Quality Standard
NAVAIDS	Navigation Aids
NAVD88	North American Vertical Datum of 1988
NEPA	National Environmental Policy Act
NFWF	National Fish and Wildlife Foundation
NM	nautical miles
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOS	notice of solicitation
NRDA	natural resource damage assessment
NRHP	National Register of Historic Places
NWR	National Wildlife Refuge
OPA	Oil Pollution Act of 1990
OYS	Oyster Propagation
PCR	Primary Contact Recreation
PDARP	Programmatic Damage Assessment and Restoration Plan
PEIS	Programmatic Environmental Impact Statement
PM	particulate matter

REC	recognized environmental conditions
RECAP	Risk Evaluation/Corrective Action Program
RESTORE Act	Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012
RESTORE Council	Gulf Coast Ecosystem Restoration Council
ROD	record of decision
RP/EA	restoration plan/environmental assessment
RS	Louisiana Revised Statute
SAV	submerged aquatic vegetation
SCR	Secondary Contact Recreation
SFHA	Special Flood Hazard Areas
SHPO	State Historic Preservation Office
SOP	standard operating procedure
USACE	U.S. Army Corps of Engineers
USC	United States Code
USCG	U.S. Coast Guard
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UST	underground storage tank
v	vertical
WCA	water column associated
WMA	Wildlife Management Area

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1 INTRODUCTION

The Louisiana Trustee Implementation Group (LA TIG) prepared this restoration plan/environmental assessment, *Louisiana Trustee Implementation Group Final Restoration Plan and Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitats* (RP/EA), and finding of no significant impact (FONSI) to evaluate projects to create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beaches that were injured as a result of the Deepwater Horizon (DWH) Oil Spill. This RP/EA was prepared by the federal and state natural resource trustees for the LA TIG, which is responsible for restoring the natural resources and services within the Louisiana Restoration Area that were injured by the April 20, 2010, DWH Oil Spill. The Louisiana Restoration Area comprises the entire state of Louisiana.

The LA TIG comprises five Louisiana state trustee agencies and four federal trustee agencies: the Louisiana Coastal Protection and Restoration Authority (CPRA), Louisiana Department of Environmental Quality (LDEQ), Louisiana Department of Natural Resources (LDNR), Louisiana Department of Wildlife and Fisheries (LDWF), Louisiana Oil Spill Coordinator's Office (LOSCO), National Oceanic and Atmospheric Administration (NOAA), U.S. Department of the Interior (DOI), U.S. Department of Agriculture (USDA), and U.S. Environmental Protection Agency (EPA).

The LA TIG has prepared this RP/EA to inform the public about the DWH natural resource damage assessment (NRDA) restoration planning efforts. Public comment sought at the draft stage on the identified reasonable range of alternatives for completion of engineering and design (E&D) and construction (henceforth "implementation") was considered by the LA TIG and addressed in this document in Section 7. In this final RP/EA, the LA TIG identifies the selection of its preferred alternatives for implementation: West Grand Terre Beach Nourishment and Stabilization, Golden Triangle Marsh Creation, and Biloxi Marsh Living Shoreline.

Project-specific restoration activities are discussed in this RP/EA and on a broader, programmatic basis in the *Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement* (Final PDARP/PEIS) (DWH Oil Spill Trustees [DWH Trustees] 2016)[1], which analyzes many types of restoration activities that could be implemented with DWH NRDA funding. The purpose of restoration is to make the environment and the public whole for injuries resulting from the incident 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 (OPA) and associated NRDA regulations. The Final PDARP/PEIS and record of decision (ROD) can be found online at http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan (DWH Trustees 2016).

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, resulting in a massive release of oil and other substances from BP Exploration and Production, Inc.'s (BP's) Macondo well and causing loss of life and extensive natural resource injuries. The oil spill also prevented people from enjoying typical recreational activities, such as fishing and spending time on the beach, along the Gulf of Mexico. Extensive response actions, including cleanup activities and actions to try to prevent the oil from reaching sensitive resources, were undertaken to try to reduce harm to

[1] The Final PDARP/PEIS—*Deepwater Horizon Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement*—is referred to frequently throughout the RP/EA, and therefore the author-date citation is provided here at first mention only.

people and the environment. However, many of these response actions had collateral impacts on the environment and natural resource services. The oil and other substances released from the well, in combination with the extensive response actions, together make up the impacts of the DWH Oil Spill.

The DWH Oil Spill occurred within a northern Gulf of Mexico ecosystem where ecological resources and habitats are closely linked. Energy, nutrients, and organisms move between habitats in this region, such that injuries to one habitat or species can have cascading impacts across the entire ecosystem (see Section 3 of the Final PDARP/PEIS). As part of the injury assessment for the DWH Oil Spill, the DWH Trustees documented injuries to species including shrimp, fish, shellfish, birds, and marine mammals. These injuries ranged from decreased growth rates to reproductive effects and mortality. Many of these injured species depend on the nearshore marsh and estuarine habitats exemplified by those in Louisiana's Barataria Basin for one or more of their life stages.

On February 19, 2016, the DWH Trustees issued the Final PDARP/PEIS detailing a specific proposed plan to fund and implement restoration projects across the Gulf of Mexico region into the future as restoration funds become available. The Final PDARP/PEIS describes restoration types, approaches, and techniques that meet the Trustees' programmatic restoration goals. On March 29, 2016, in accordance with OPA and the National Environmental Policy Act (NEPA), the DWH Trustees issued a notice of availability of a ROD for the Final PDARP/PEIS in the *Federal Register* (NOAA Fisheries 2016). Based on the DWH Trustees' injury determination established in the Final PDARP/PEIS, the ROD sets forth the basis for the DWH Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative. As described in the PDARP/PEIS, "Alternative A is an integrated restoration portfolio that emphasizes the broad ecosystem benefits that can be realized through coastal habitat restoration in combination with resource-specific restoration in the ecologically interconnected northern Gulf of Mexico ecosystem" (DWH Trustees 2016: 5–17). The DWH Trustees' selection of Alternative A includes the funding allocations established in the Final PDARP/PEIS.

On April 4, 2016, the U.S. District Court for the Eastern District of Louisiana entered a Consent Decree resolving civil claims by the DWH Trustees against BP arising from the DWH Oil Spill. This historic settlement resolves the DWH Trustees' claims against BP for natural resources damages under OPA. Under the Consent Decree, BP agreed to pay, over a 15-year period, a total of $8.1 billion in natural resource damages (which includes BP's previously commitment to pay up to $1 billion for Early Restoration projects) and up to an additional $700 million (some of which is in the form of accrued interest) for adaptive management or to address injuries to natural resources that are presently unknown but may come to light in the future. Each restoration area has a specific monetary allocation to each of the 13 restoration types specified in the Consent Decree. The DWH settlement allocation for the LA TIG by restoration type is described in Section 5.10.2 of the Final PDARP/PEIS. Funds allocated to the Louisiana Restoration Area for the Wetlands, Coastal, and Nearshore Habitats restoration type are $4,009,062,700 (DWH Trustees 2019). These allocations do not include funds allocated for Early Restoration projects. More details on the background of the DWH Oil Spill, the impact of the spill on the Gulf of Mexico ecosystem, and additional context for the settlement and allocation of funds can be found in Chapter 2 of the Final PDARP/PEIS.

1.2 Deepwater Horizon Trustees, Trustee Council, and Trustee Implementation Group

The DWH Trustees are the entities authorized under OPA to act as trustees 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. DWH Trustees fulfill these responsibilities by developing restoration plans, providing the public with a meaningful opportunity to

submit restoration projects and to review and comment on proposed plans, implementing and monitoring restoration projects and activities, managing natural resource damage funds, and documenting trustee decisions through a public administrative record. The DWH Trustees are responsible for governance of restoration planning throughout the entire Gulf Coast.

As required under OPA, the DWH Trustees conducted a NRDA. To work collaboratively on the NRDA, the DWH Trustees organized a Trustee Council composed of Designated Natural Resource Trustee Officials, or their alternates, for each of the DWH Trustee agencies. The following federal and state agencies are the designated DWH Trustees under OPA for the DWH Oil Spill:

- NOAA, on behalf of the U.S. Department of Commerce
- DOI, as represented by the National Park Service, U.S. Fish and Wildlife Service (USFWS), and Bureau of Land Management
- EPA
- USDA
- The State of Alabama's Department of Conservation and Natural Resources and Geological Survey of Alabama
- The State of Florida's Department of Environmental Protection and Fish and Wildlife Conservation Commission
- The State of Louisiana's CPRA, LOSCO, LDEQ, LDWF, and LDNR
- The State of Mississippi's Department of Environmental Quality
- The State of Texas' Parks and Wildlife Department, General Land Office, and Commission on Environmental Quality

The DWH NRDA funds provided under the Consent Decree were distributed geographically to address the diverse suite of injuries that occurred at both regional and local scales. As specified in the Consent Decree and Final PDARP/PEIS, specific amounts of money were allocated to seven geographic areas: each of the five Gulf States (Texas, Louisiana, Mississippi, Alabama, and Florida), regionwide, and the open ocean. The funding distribution was based on the DWH Trustees' understanding and evaluation of exposure and injury to natural resources and services, as well as their evaluation of where restoration spending for the various restoration types would be most beneficial within the ecosystem-level restoration portfolio.

1.3 Authorities and Regulations

1.3.1 Oil Pollution Act Compliance

As an oil pollution incident, the DWH Oil Spill is subject to the provisions of OPA (33 United States Code [USC] 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. Under OPA, each party responsible for a vessel or facility from which oil is discharged, or which poses the substantial threat of a discharge, may be liable for, among other things, removal costs and damages for injury to, destruction of, loss, or loss of use of natural resources, including the reasonable cost of assessing the damage.

This process of injury assessment and restoration planning is referred to as NRDA. NRDA is described under Section 1006 of OPA (33 USC 2706 et seq.). Under OPA NRDA regulations (15 Code of Federal Regulations [CFR] 990 et seq.), the NRDA process consists of three phases: 1) pre-assessment, 2) restoration planning, and 3) restoration implementation. The DWH Trustees are currently in the

restoration planning and the restoration implementation phases of the NRDA. As part of the initiation of restoration implementation, this RP/EA identifies a reasonable range of alternatives; evaluates those alternatives under various criteria; and identifies a suite of preferred alternatives that would compensate the public for injuries to wetlands, coastal, and nearshore habitats in Louisiana caused by the DWH Oil Spill.

1.3.2 National Environmental Policy Act Compliance

Under OPA regulations, federal trustees must comply with NEPA, 42 USC 4321 et seq. and its regulations, 40 CFR 1500 et seq., and other applicable statutes and regulations when planning restoration projects. NEPA requires federal agencies to consider the potential environmental impacts of their proposed actions. NEPA provides a framework for federal agencies to determine if their proposed actions may have significant environmental effects and related social and economic effects, to consider these effects when choosing between alternatives, and to inform and involve the public in the environmental analysis and decision-making process.

NEPA and its implementing regulations (40 CFR 1500–1508, together and with agency-specific NEPA regulations) outline the responsibilities of federal agencies in the NEPA process. In this RP/EA, the LA TIG addresses these requirements by using the environmental analyses conducted in the Final PDARP/PEIS, evaluating and refining existing analyses, and preparing environmental consequences analyses for projects (or alternatives considered in this RP/EA), as appropriate. See Chapter 6 of the Final PDARP/PEIS for more information on tiering, and incorporation by reference under NEPA, and how these processes apply to this RP/EA.

Consistent with 40 CFR 1508.16, the LA TIG designated EPA as the lead federal agency responsible for NEPA compliance for this RP/EA. The federal and state agencies of the LA TIG are acting as cooperating agencies for the purposes of NEPA in the development of this RP/EA. Each federal cooperating agency on the LA TIG complies with NEPA by adopting the analysis in this RP/EA. In accordance with 40 CFR 1506.3(a), each of the three federal cooperating agencies (DOI, NOAA, and USDA) participating in the LA TIG reviewed and adopts this RP/EA for adequacy in meeting the standards set forth in its own NEPA implementing procedures. Adoption of the EA is complete via signatures on the FONSI.

More information about OPA and NEPA, as well as their application to DWH Oil Spill restoration planning, can be found in Chapters 5 and 6 of the Final PDARP/PEIS.

1.3.3 Standard Operating Procedures Compliance

Another document that guides restoration planning is the *Trustee Council Standard Operating Procedures for Implementation of the Natural Resource Restoration for the DWH Oil Spill* (Trustee Council 2016). The Trustee Council developed the standard operating procedures (SOPs) for administration, implementation, and long-term management of restoration under the Final PDARP/PEIS. It should be noted that SOPs are currently being revised. The Trustee Council SOP documents the overall structure, roles, and decision-making responsibilities of the Trustee Council and provides the common procedures to be used by all TIGs. The Trustee Council SOP addresses, among other issues, the following topics: decision-making and delegation of authority, funding, administrative procedures, project reporting, monitoring and adaptive management (MAM), consultation opportunities among the DWH Trustees, public participation, and the administrative record.

The Trustee Council SOP is available online through the NOAA Restoration Portal at http://www.gulfspillrestoration.noaa.gov/ (Trustee Council 2016). The Trustee Council SOP was developed and approved by consensus of the Trustee Council and may be amended as needed. The division of responsibilities among the Trustee Council, TIGs, and individual trustee agencies is summarized in Table 7.2-1 of the Final PDARP/PEIS.

1.3.4 Final PDARP/PEIS Record of Decision

Given the potential magnitude and breadth of restoration for injuries resulting from the DWH Oil Spill, the DWH Trustees prepared a PDARP/PEIS under OPA and NEPA to analyze alternative approaches to implementing restoration and guiding restoration decisions. Based on the DWH Trustees' assessment of impacts to the Gulf of Mexico's natural resources, a comprehensive, integrated ecosystem restoration approach for restoration implementation was proposed. On February 19, 2016, the DWH Trustee Council issued a Final PDARP/PEIS which is intended to help guide DWH restoration implementation and the TIGs on a programmatic level. On March 29, 2016, in accordance with OPA and NEPA, the DWH Trustees published a notice of availability of a ROD for the Final PDARP/PEIS in the *Federal Register* (NOAA Fisheries 2016). Based on the DWH Trustees' injury determination established in the Final PDARP/PEIS, the ROD set forth the basis for the DWH Trustees' decision to select Alternative A: Comprehensive Integrated Ecosystem Alternative. The DWH Trustees' selection of Alternative A includes the funding allocations outlined in the Final PDARP/PEIS. More information about Alternative A can be found in Sections 5.5 and 5.10 of the Final PDARP/PEIS.

1.3.5 Relationship of this RP/EA to the Final PDARP/PEIS

As a programmatic restoration plan, the Final PDARP/PEIS provides direction and guidance for identifying, evaluating, and selecting future restoration projects to be carried out by the TIGs (see Section 5.10.4 and Chapter 7 of the Final PDARP/PEIS). The DWH Trustees elected to prepare a PEIS to support analysis of the environmental consequences of the selected restoration types, to consider the many related actions that may occur because of restoration planning efforts, and to allow for a better analysis of cumulative impacts of potential actions. The programmatic approach was taken to assist the TIGs in their development and evaluation and to assist the public in its review of future restoration projects. The Final PDARP/PEIS was also developed to support a tiered analysis and decision-making with the anticipation that certain future restoration actions could be undertaken without additional NEPA review, whereas others might proceed based on more focused tiered EAs or EISs. The programmatic approach was taken to assist the DWH Trustees in their development and evaluation of future restoration projects and to assist the public in its review of future restoration projects.

For the Final PDARP/PEIS, the DWH Trustees developed a set of restoration types for inclusion in programmatic alternatives, consistent with the desire to seek a diverse set of projects providing benefits to a broad array of injured natural resources and services. Ultimately, this process resulted in the inclusion of 13 restoration types in five major restoration goals: 1) restore and conserve habitat; 2) restore water quality; 3) replenish and protect living coastal and marine resources; 4) provide and enhance recreational opportunities; and 5) provide for monitoring, adaptive management, and administrative oversight to support restoration implementation (DWH Trustees 2016):

1. Wetlands, Coastal, and Nearshore Habitats
2. Habitat Projects on Federally Managed Lands
3. Nutrient Reduction (Nonpoint Source)
4. Water Quality (e.g., Stormwater Treatments, Hydrologic Restoration, Reduction of Sedimentation, etc.)
5. Fish and Water Column Invertebrates
6. Sturgeon
7. Submerged Aquatic Vegetation
8. Oysters

9. Sea Turtles
10. Marine Mammals
11. Birds
12. Mesophotic and Deep Benthic Communities
13. Provide and Enhance Recreational Opportunities

As mentioned above, the Final PDARP/PEIS was intended to be used to tier the NEPA analysis in the subsequent restoration plans prepared by the TIGs (40 CFR 1502.20; see Chapter 6 of the Final PDARP/PEIS). A tiered environmental analysis is a project-specific analysis that focuses on project-specific issues and summarizes or references (rather than repeats) the broader issues discussed in the Final PDARP/PEIS. This RP/EA is consistent with the Final PDARP/PEIS and ROD and provides a NEPA analysis for each alternative, tiering from the Final PDARP/PEIS where applicable. For this RP/EA, the DWH Trustees considered the extent to which additional NEPA analyses may be necessary for the alternatives that tier their NEPA analyses from the Final PDARP/PEIS. These considerations include whether the analyses of relevant conditions and environmental effects described in the Final PDARP/PEIS are still valid and whether impacts under the alternatives have already been fully analyzed in the Final PDARP/PEIS. The applicable sections of the Final PDARP/PEIS are incorporated by reference into this plan (40 CFR 1502.21).

Section 2 of this RP/EA summarizes the screening process used to develop a reasonable range of alternatives, which is consistent with the DWH Trustees' selected programmatic alternative in the Final PDARP/PEIS, the Consent Decree, and OPA. The LA TIG also prepared a NEPA environmental consequences analysis for the reasonable range of alternatives in this RP/EA (see Section 4), which tiers from the Final PDARP/PEIS programmatic NEPA analysis. The LA TIG used the direction and the guidance of the Final PDARP/PEIS to consider and evaluate alternatives within Wetlands, Coastal, and Nearshore Habitats restoration type.

Chapter 5 of the Final PDARP/PEIS analyzes different restoration approaches to address resource injuries for each restoration type. The alternatives evaluated in this RP/EA are consistent with the restoration approaches described in the PDARP/PEIS for the Wetlands, Coastal, and Nearshore Habitats restoration type.

1.3.5.1 WETLANDS, COASTAL, AND NEARSHORE HABITATS

The Wetlands, Coastal, and Nearshore Habitats restoration type is described in Section 5.5.2.2 of the Final PDARP/PEIS. Of the seven restoration approaches identified in this restoration type in the Final PDARP/PEIS, the following four are addressed in this RP/EA:

- **Create, restore, and enhance coastal wetlands.** This restoration approach provides opportunities for coastal habitat restoration to compensate for injuries resulting from the DWH incident. This restoration approach would be implemented to achieve multiple ecosystem benefits and to maximize habitat benefits and may not correspond to specific areas that were directly oiled. Restoration of these habitats at a large scale can provide benefits across the northern Gulf of Mexico ecosystem, which suffered injuries from the spill and associated response activities. Opportunities to restore these habitats and benefit associated resources and services are located throughout the Gulf of Mexico. This restoration approach also emphasizes restoration of wetland complexes for the wide range of ecological functions they provide (see Section 5.5.2 of the Final PDARP/PEIS).
- **Restore oyster reef habitat.** This restoration approach focuses on restoration, creation, and enhancement of oyster (specifically eastern oyster [*Crassostrea virginica*]) reef habitat; resilient oyster populations; and diverse benthic and fish communities. Oysters are considered "ecosystem

engineers" for their role in creating reefs that modify, through their physical presence, the surrounding environment while also providing habitat, refuge, and foraging areas for many other species including benthic organisms and fish (Coen and Luckenbach 2000; Powers et al. 2009; VanderKooy 2012; Wong et al. 2011, as cited in Appendix 5.D of the Final PDARP/PEIS). Multiple restoration techniques are available for use, either individually or in combination, as potential restoration projects including the following approaches: restoring or creating oyster reefs through placement of cultch in nearshore and subtidal areas; constructing living shorelines; enhancing oyster reef productivity through spawning stock enhancement projects such as planting hatchery raised oysters, relocating wild oysters to restoration sites, oyster gardening programs, and other similar projects; and developing a network of oyster reef spawning reserves.

- **Create, restore, and enhance barrier and coastal islands and headlands.** This restoration approach focuses on the broad ecological and socioeconomic benefits of many resources that barrier shorelines sustain. Restoring beach areas would improve food and nutrient exchange with aquatic habitats and provide important resting or loafing areas for birds. Back-barrier marshes can provide foraging and refuge habitat for fish, shellfish, and birds, and, additionally, reduce erosion and storm surges, thus benefiting oyster populations and seagrass beds by reducing excessive sedimentation in nearshore waters (Wilber and Clarke 2001, as cited in Section 5.5.2 of the Final PDARP/PEIS).
- **Restore and enhance dunes and beaches.** This restoration approach focuses on the potential to reduce the effects of future storm surges on nearshore wetlands and associated brackish-water resources, particularly where existing dunes have been damaged by prior hurricanes. Dune restoration would help maintain suitable habitat for sea turtle and bird nesting in the face of losses to sea level rise and development along the coasts (see Section 5.5.2 of the Final PDARP/PEIS).

1.3.6 Summary of Injuries Addressed in this RP/EA

According to OPA regulations, injury is "[a]n observable or measurable adverse change in a natural resource or impairment of a natural resource service. Injury may occur directly or indirectly to a natural resource and/or service" (15 CFR 990.30). Types of injuries can include adverse changes in survival, growth, and reproduction; in health, physiology, and biological condition; in behavior; in community composition; in ecological processes and functions; in physical and chemical habitat quality or structure; and in public services.

For the Final PDARP/PEIS, the DWH Trustees conducted an injury assessment under the authority of and in accordance with OPA regulations (33 USC 2701 et seq.; see Chapter 4 of the Final PDARP/PEIS). The injury assessment establishes the nature, degree, and extent of injuries from the DWH incident to both natural resources and the services they provide. Injury assessment results were used to inform restoration planning so that restoration would address the nature, degree, and extent of the injuries. The injury assessment provided in the Final PDARP/PEIS was used to identify restoration goals and subsequent restoration types that addresses the injuries.

A number of different resource categories were evaluated, including injuries to nearshore and shoreline resources, to estuarine coastal wetland complexes, and to sand beaches and also to the services they provide. Section 5.5.2 of the Final PDARP/PEIS provides more detail about the injuries affecting these resources. Injuries were detected over a range of species, communities, and habitats and affected a variety of ecosystem components over many hundreds of miles in the northern Gulf of Mexico. Injuries to nearshore resources have cascading impacts throughout the ecosystem that influence the overall health and productivity of the Gulf of Mexico (see Section 4.6.9 of the Final PDARP/PEIS). These resources include fish and aquatic invertebrates, such as crustaceans and planktonic plants and animals that were exposed to oil in the water column.

Almost all types of nearshore ecosystem habitats in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, including coastal wetlands. In addition to direct impacts caused by oil in the water column, marsh edge habitats were also affected. 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 floods 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 MC252 oil demonstrates that polycyclic aromatic hydrocarbons concentrations found in oiled marsh areas are toxic to many marsh species (Morris et al. 2015, as cited in the Final PDARP/PEIS). The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species and life stages (see Section 4.6 of the Final PDARP/PEIS). Populations of long-lived species (e.g., periwinkle snails, sturgeon) take years to recover normal age and size distributions, even after environmental conditions are no longer toxic. Overall, both direct and indirect impacts to the productivity of wetland, coastal, and nearshore habitats through ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes were experienced.

Coastal Louisiana sustained the most shoreline oiling associated with the DWH incident and is also experiencing substantive ongoing wetland loss in the region (Barras et al. 2008; Couvillion et al. 2011, as cited in the Final PDARP/PEIS). Therefore, the DWH Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the PDARP/PEIS. Further, because the approach to assessing nearshore impacts focused on injury to accessible habitats and species over a limited area and time period, the total injury to the nearshore ecosystem is almost certain to be larger than the sum of the studied components. The DWH Trustees determined it was most appropriate to develop an integrated restoration portfolio, taking into account the important linkages among habitat types and between habitats and injured resources.

1.4 Restoration Purpose and Need

The LA TIG has undertaken this restoration effort to meet the purpose of restoring those natural resources and services injured in the Louisiana Restoration Area as a result of the DWH Oil Spill. Restoration activities are intended to restore or replace habitats, species, and services to their baseline condition (primary restoration) and to compensate the public for interim losses from the time natural resources are injured until they recover to baseline conditions (compensatory restoration). This RP/EA 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 five DWH Trustee programmatic restoration goals work independently and together to benefit injured resources and services. This RP/EA focuses on the restoration of injuries to Louisiana's natural resources and services, with restoration to wetlands, coastal, and nearshore habitats. The alternatives evaluated in this RP/EA address one of the five Trustee programmatic restoration goals: 1) restore and conserve habitat.

Consistent with the Trustee programmatic restoration goals, the Final PDARP/PEIS also identifies goals for each restoration type (see Sections 5.5.2 through 5.5.14 of the Final PDARP/PEIS). These restoration type–specific goals help to guide restoration planning and project selection for each restoration type. To help meet these goals, implementation of this RP/EA would address the Wetlands, Coastal, and Nearshore Habitats restoration type, using the following restoration approaches in the Louisiana Restoration Area: create, restore, and enhance coastal wetlands; restore oyster reef habitat; create, restore, and enhance barrier and coastal islands and headlands; and restore and enhance dunes and beach.

Restoring wetlands, costal, and nearshore habitats includes the following restoration goals:

- Restore a variety of interspersed and ecologically connected coastal habitats in each of the five Gulf 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.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- 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.

The DWH Trustees seek to implement coastal and nearshore wetlands habitat restoration in ways that achieve multiple ecosystem benefits for the large-scale restoration goals. For example, coastal wetlands could be enhanced for juvenile shrimp, crabs, oysters, and some fishes by incorporating open water and marsh edge into the marsh complex (Baltz et al. 1993; Minello et al. 2008; Minello and Rozas 2002; Neahr et al. 2010; Rozas and Minello 2015; Zimmerman et al. 2000, as cited in Section 5.2 of the Final PDARP/PEIS). Benefits could also be maximized by implementing habitat complexes through combining multiple restoration approaches, such as incorporating construction of nearshore oyster reefs or living shorelines into the design of marsh creation projects (Baillie et al. 2015; Boström et al. 2011; Dorenbosch et al. 2004; Grabowski et al. 2005; Hitt et al. 2011; Hosack et al. 2006; Irlandi and Crawford 1997; Micheli and Peterson 1999, as cited in Chapter 5.2 of the Final PDARP/PEIS).

Coastal and nearshore habitats integrate and form a continuum within the nearshore ecosystem and contribute to an integrated, connected food web (Baillie et al. 2015; Boesch and Turner 1984; Boström et al. 2011; Deegan 1993; Deegan et al. 2000; Nelson et al. 2011; Nelson et al. 2013, as cited in the Final PDARP/PEIS). Because this critical role was disrupted by injuries to these habitats and their associated resources, this restoration approach is intended to be implemented across the Gulf and address multiple ecosystem benefits through habitat restoration. The DWH Trustees have indicated that identifying opportunities to restore multiple habitats within one project, or to implement multiple projects within a given area, may accelerate recovery of injured ecosystem functions and achieve a more integrated restoration of the nearshore ecosystem and its service flows.

1.5 Proposed Action: Implementation of the LA TIG Restoration Plan and Environmental Assessment #6

To address the DWH Trustees' programmatic and restoration type goals described in the Final PDARP/PEIS, the LA TIG proposed in the draft RP/EA to undertake the planning and implementation of the three projects identified as preferred alternatives in the draft RP/EA to restore wetlands, coastal, and nearshore habitats in Louisiana using funds made available through the DWH Consent Decree. Pursuant to OPA NRDA regulations, in this final RP/EA, the LA TIG selects their preferred alternatives for implementation (Table 1.6-1). A detailed description of each of the alternatives considered in this RP/EA is provided in Section 3.

1.6 Alternatives Considered in the Restoration Plan and Environmental Assessment

In total, the LA TIG evaluated four different action alternatives and a No Action Alternative as the reasonable range of alternatives in this RP/EA. These alternatives are intended to contribute to restoration and conservation of wetlands, coastal, and nearshore habitats in the Louisiana Restoration Area. Through the alternative evaluation process described in the remainder of this document, the LA TIG identified three projects as preferred alternatives. Table 1.6-1 presents the alternatives evaluated and which of those alternatives are preferred for implementation. The locations of the reasonable range of alternatives are shown in Figure 1.6-1.

Table 1.6-1. Alternatives Considered in this Restoration Plan and Environmental Assessment

Alternative	Parish	Summary	Preferred Alternative
West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	Create and restore beach habitat, dune habitat, and intertidal marsh habitat and protect shoreline along Barataria Pass and Barataria Bay on the western side of West Grand Terre Island.	Yes
Golden Triangle Marsh Creation	Orleans and St. Bernard	Create or restore broken marsh and open water through construction of containment dikes to help buffer surge barrier and provide estuarine habitat for Lake Borgne.	Yes
Biloxi Marsh Living Shoreline	St. Bernard	Create oyster barrier reef along eastern shore of Biloxi Marsh to provide oyster habitat, reduce erosion, and prevent further marsh deterioration.	Yes
Fifi Island Forested Ridge with Breakwater	Jefferson	Create coastal forested ridge to provide critical habitat and protect Barrier Islands from storm surges.	No

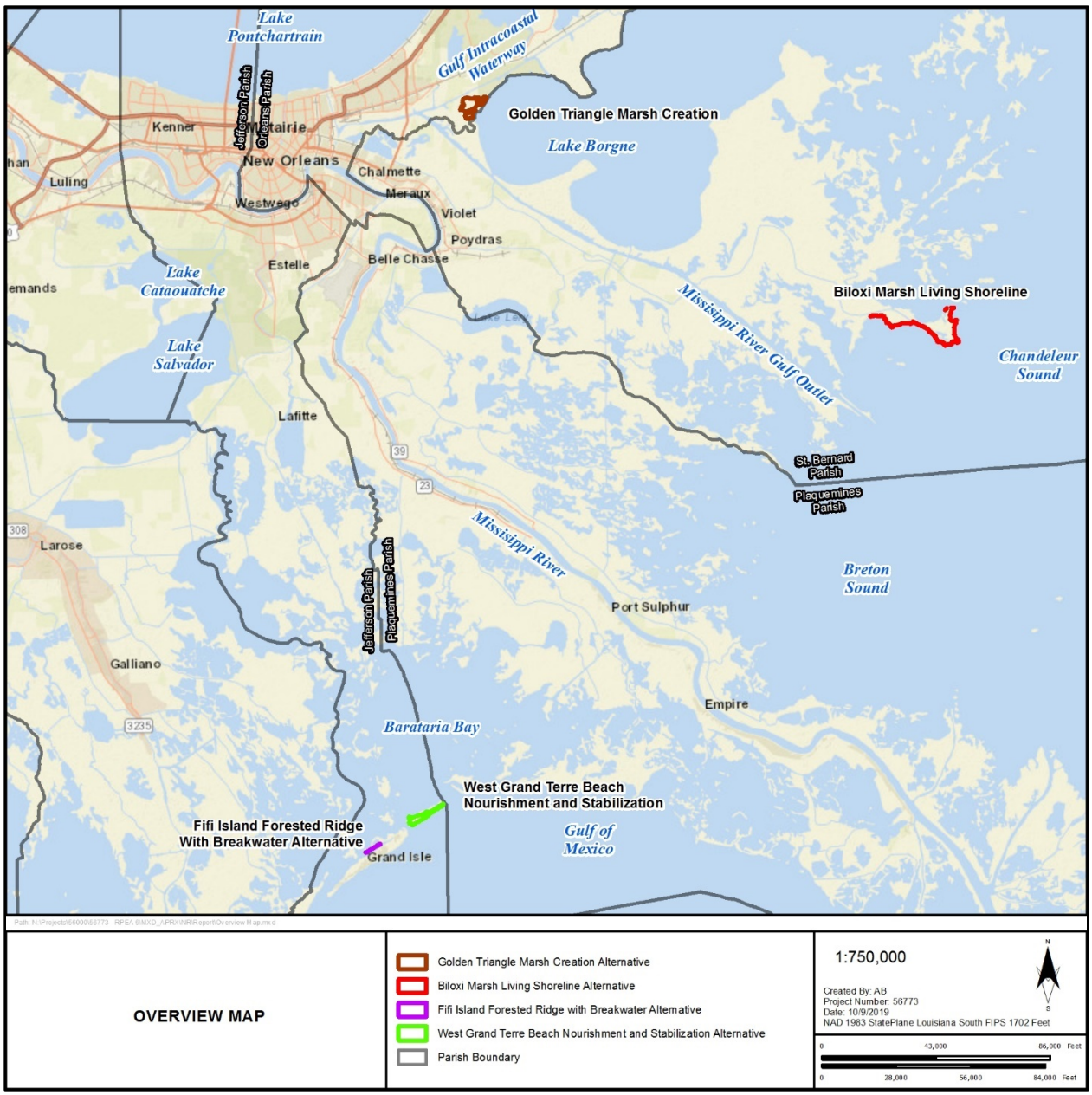

Figure 1.6-1. Alternatives overview.

1.7 Severability of Projects

In this RP/EA, the LA TIG proposes to select three preferred restoration alternatives with a total funding of approximately $209,798,020 million. The restoration alternatives are independent of each other and may be selected independently for implementation in this and/or future restoration plans by the LA TIG.

1.8 Relationship to Other Plans, Policy, or Actions

Because of the magnitude of the DWH Oil Spill, the DWH Trustees began planning for and implementing Early Restoration projects with funding from BP before the oil spill's injury assessment was complete and before the entry of the Consent Decree. Early Restoration occurred in five separate phases, during which Early Restoration plans were prepared and associated NEPA compliance was completed. These Early Restoration activities are a subset of the extensive, continuing effort needed to address complete restoration of injuries to natural resources resulting from the DWH Oil Spill.

To date, the LA TIG has released the following restoration plans to the public:

1. *LA TIG Final Restoration Plan #1: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; and Birds*, which selects six restoration alternatives for E&D: two bird island projects (Queen Bess and Rabbit Island Restoration), three coastal wetlands projects (Terrebonne Basin Ridge and Marsh Creation Project: Bayou Terrebonne Increment; Barataria Basin Ridge and Marsh Creation Project: Spanish Pass Increment; and Lake Borgne Marsh Creation Project: Increment One), and one habitat project on federally managed lands (Shoreline Protection and Jean Lafitte National Park and Preserve) (LA TIG 2017).
2. *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities*, reallocated the Early Restoration funds earmarked for Louisiana Marine Fisheries Enhancement, Research, and Science Center to four projects intended to provide and enhance recreational use (LA TIG 2018a).
3. *LA TIG Final Strategic Restoration Plan and Environmental Assessment #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in Barataria Basin, Louisiana* was prepared to identify a restoration strategy that will help prioritize future decisions regarding project selection and funding in Barataria Basin, Louisiana (LA TIG 2018b).
4. *Louisiana Trustee Implementation Group Final Restoration Plan/Environmental Assessment #4: Nutrient Reduction (Nonpoint Source) and Recreational Use* was prepared to improve water quality by reducing nutrients from nonpoint sources to and compensate for recreational use services lost as a result of DWH Oil Spill (LA TIG 2018c).
5. *Louisiana Trustee Implementation Group Supplemental Restoration Plan and Environmental Assessment for the Elmer's Island Access Project Modification* (LA TIG 2018d) was prepared to assess the environmental impacts from the modification to the originally proposed Elmer's Island Access project, which was included in the *Draft Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities* (LA TIG 2018e).
6. *Louisiana Trustee Implementation Group Final Phase 2 Restoration Plan and Environmental Assessment #1.1: Queen Bess Island Restoration* was prepared to restore habitat for birds injured by the DWH Oil Spill by providing suitable colonial waterbird nesting and brood-rearing habitat on Queen Bess Island (LA TIG 2019a).
7. *Louisiana Trustee Implementation Group Final Supplemental Restoration Plan and Environmental Assessment for the Lake Charles Science Center and Educational Complex Project Modification* (LA TIG 2019b) was prepared to assess the environmental impacts from modifications to the Lake Charles Science Center and Educational Complex project that was originally selected in the *Final Restoration Plan/Environmental Assessment #2: Provide and Enhance Recreational Opportunities* (LA TIG 2018a).

8. *Louisiana Trustee Implementation Group Draft Phase 2 Restoration Plan and Environmental Assessment #1.2: Spanish Pass Ridge and Marsh Project and Lake Borgne Marsh Creation Project* (LA TIG 2019c) was prepared to analyze design options for alternatives for restoration of wetlands, coastal, and nearshore habitats that were originally selected in *LA TIG Final Restoration Plan #1: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; and Birds* (LA TIG 2017).
9. *Louisiana Trustee Implementation Group Final Phase 2 Restoration Plan and Environmental Assessment #1.3: Rabbit Island & Shoreline Protection at Jean Lafitte National Historical Park and Preserve Project* (LA TIG 2019d) was prepared to analyze design options for alternatives for restoration of wetlands, coastal, and nearshore habitats that were originally selected in *LA TIG Final Restoration Plan #1: Restoration of Wetlands, Coastal, and Nearshore Habitats; Habitat Projects on Federally Managed Lands; and Birds* (LA TIG 2017).
10. *Louisiana Trustee Implementation Group Final Supplemental Restoration Plan and Environmental Assessment for the Wetlands Center Project Modification* (LA TIG 2019e) was prepared to assess the environmental impacts from modifications to the Wetlands Center project that was originally selected in the *Final Restoration Plan/Environmental Assessment #4: Nutrient Reduction (Nonpoint Source) and Recreational Use* (LA TIG 2018c).
11. *Louisiana Trustee Implementation Group Draft Supplemental EA for the Pointe-Aux-Chenes Wildlife Management Area (PACWMA) Recreational Use Enhancement Project* (LA TIG 2020a) was prepared to assess the environmental impacts from modifications to the PACWMA Enhancement Project that was originally selected in the *Final Restoration Plan/Environmental Assessment #4: Nutrient Reduction (Nonpoint Source) and Recreational Use* (LA TIG 2018c).
12. *Louisiana Trustee Implementation Group Draft Phase 2 Large-Scale Barataria Marsh Creation: Upper Barataria Component Restoration Plan #3.3* (LA TIG 2020b) was prepared to contribute to the restoration of wetland, coastal, and nearshore habitat resources and services injured by the DWH Oil Spill, specifically in Barataria Basin, Louisiana. This plan tiers from the *Final Strategic Restoration Plan and Environmental Assessment #3* (LA TIG 2018b).
13. *Louisiana Trustee Implementation Group Draft Restoration Plan/Environmental Assessment (RP/EA) #5: Living Coastal and Marine Resources - Marine Mammals and Oysters* (LA TIG 2020c) was prepared for the restoration of marine mammals and oysters.

In addition to NRDA-funded restoration, there are two other funding sources specifically intended to address DWH restoration on the Gulf Coast: 1) the Resources and Ecosystems Sustainability, Tourism Opportunities, and Revived Economy of the Gulf Coast Act of 2011 (RESTORE Act) and 2) the National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund (GEBF).

In 2016, the Gulf Coast Ecosystem Restoration Council (RESTORE Council) released its 2016 comprehensive plan update, which prioritizes "Large-scale projects and programs that are projected to substantially contribute to restoring and protecting the natural resources, ecosystems, fisheries, marine and wildlife habitats, beaches, and coastal wetlands of the Gulf Coast ecosystem" (RESTORE Council 2016: 15). The RESTORE Council believes advancing large-scale solutions at the regional scale can be optimized through the synergy of multiple connected projects or a single large project or program and facilitated through collaboration with NRDA, NFWF, and/or other federal funding programs.

The GEBF funds projects benefiting the natural resources of the Gulf Coast that were impacted by the spill and has directed a total of $2.544 billion to be spent over a 5-year period, with $625 million allocated for projects in the State of Louisiana thus far. NFWF prioritizes projects in accordance with plea agreements that came out of the DWH Oil Spill settlement that are designed to "remedy harm and eliminate or reduce the risk of future harm to Gulf Coast natural resources" (NFWF 2014). The five Gulf

Coast states have submitted various proposals to NFWF for GEBF awards. NFWF is responsible for evaluating and determining that project proposals align with GEBF funding priorities that should contribute significantly to the following natural resource outcomes (NFWF 2014):

- Restore and maintain the ecological functions of landscape-scale coastal habitats, including barrier islands, beaches, and coastal marshes, and ensure their viability and resilience against existing and future threats, such as sea level rise
- Restore and maintain the ecological integrity of priority coastal bays and estuaries
- Replenish and protect living resources, including oysters, red snapper and other reef fishes; Gulf Coast bird populations; and sea turtles and marine mammals

In Louisiana, the plea agreements required that the funds be allocated solely to barrier island restoration projects and river diversion projects along the Mississippi and Atchafalaya Rivers (CPRA 2013).

1.9 Louisiana Trustee Implementation Group Public Participation

The LA TIG issued a notice of solicitation (NOS) to the public on June 7, 2019, to request submission of project ideas through July 5, 2019 (Appendix A). On July 19, 2019, the LA TIG issued a notice of intent informing the public that it was initiating the drafting of a restoration plan to restore and conserve wetlands, coastal, and nearshore habitats caused by the DWH Oil Spill. Project ideas were considered and evaluated through a project screening process, and a reasonable range was developed as a result of that process.

1.9.1 Comment Period and Public Webinar Information

The public was encouraged to review and comment on this RP/EA. Following public notice, this RP/EA was available to the public for a 30-day comment period.

During the public comment period, the LA TIG received seven non-duplicate submissions from private citizens; businesses; federal, state, and local agencies; and non-governmental organizations. These submissions were received during the public meeting, submitted via a web-based application, sent via email, and sent by postal mail.

After the comment period closed, the LA TIG considered all comments received and revised this RP/EA as appropriate. A summary of comments received and the LA TIG's response are included in Section 7 of this Final RP/EA.

1.9.2 Decision to be Made

The intent of this RP/EA is to provide the public and decision makers with the information and analysis needed to enable meaningful review and comment on the LA TIG's proposal to proceed with the selection and implementation of one or more of the alternatives proposed in this plan. Projects not identified for inclusion in the Final RP/EA may be considered for inclusion in future restoration plans.

1.9.3 Administrative Record

The DWH Trustees opened a publicly available administrative record for the NRDA for the DWH Oil Spill, including restoration planning activities, concurrently with publication of the 2010 N notice of intent (pursuant to 15 CFR 990.45). DOI is the federal trustee that maintains the administrative record, which can be found online at http://www.doi.gov/deepwaterhorizon/adminrecord (DOI 2020). This administrative record site is also used by the LA TIG for DWH restoration planning.

Information about restoration project implementation is provided to the public through the administrative record and other outreach efforts, including online at http://www.gulfspillrestoration.noaa.gov.

1.10 Document Organization

This section describes the organization of this RP/EA, which consists of Sections 1 through 9 and six appendices.

- Section 1 (Introduction): Introductory information and context for this RP/EA, background on the NRDA restoration planning process, summary of injuries to resources resulting from the DWH Oil Spill addressed in this RP/EA
- Section 2 (Restoration Planning Process): Identification and evaluation of alternatives to restore and conserve wetlands, coastal, and nearshore habitats
- Section 3 (Oil Pollution Act Evaluation of Alternatives): Evaluation of the alternatives proposed for NRDA restoration against criteria set forth in OPA, and proposal of a suite of preferred restoration alternatives
- Section 4 (Environmental Assessment): Description of the affected environment and the environmental consequences for each of the alternatives evaluated in this RP/EA
- Section 5 (Cumulative Impacts): Description of the cumulative impacts of the alternatives when added to other past, present, and reasonably foreseeable future actions
- Section 6 (Compliance with Other Laws and Regulations): Identification and description of other federal and state laws, in addition to the requirements of OPA and NEPA, that may apply to the preferred alternatives in this RP/EA
- Section 7 (Response to Public Comment): review of public comments received on this RP/EA
- Section 8 (List of Preparers and Reviewers): Identification of individuals who substantively contributed to the development of this RP/EA
- Section 9 (List of Repositories): A list of facilities that received copies of this RP/EA for review by the public
- Section 10 (Literature Cited): A list of references used to write and support the analysis in this RP/EA

2 RESTORATION PLANNING PROCESS

The restoration planning process started prior to the DWH Oil Spill settlement with BP and issuance of the Final PDARP/PEIS, and this RP/EA represents a continuation of that restoration planning process. Previous steps taken in this process included assessing the injury from the DWH Oil Spill, developing restoration projects as part of the Early Restoration program undertaken jointly by the DWH Trustees and BP, and planning for programmatic restoration as part of the Final PDARP/PEIS. Upon completion of the settlement with BP, the DWH Trustees created the LA TIG to implement comprehensive DWH restoration planning in Louisiana.

NRDA restoration under OPA is a process that includes evaluating injuries to natural resources and their services to determine the type and extent of restoration needed to address those injuries. Restoration activities need to produce benefits that are related to or have a nexus to the natural resources or their services impacted by an oil spill. Under the OPA NRDA regulations (15 CFR 990.54), trustees are to identify and evaluate a reasonable range of alternatives based on criteria outlined within that subsection. The OPA NRDA regulations provide criteria for use by trustees to evaluate projects designed to compensate the public for injuries caused by oil spills. In accordance with the OPA NRDA regulations (15 CFR 990.53), the LA TIG developed a screening process to identify a reasonable range of alternatives to be further evaluated in this plan.

This section describes the screening process used by the LA TIG to identify the reasonable range of alternatives in this RP/EA under the OPA NRDA regulations (15 CFR 990.53). The reasonable range of alternatives is consistent with the PDARP/PEIS (described in Section 1). This section summarizes the restoration decisions stated in the PDARP/PEIS and ROD, the relationship of the PDARP/PEIS to this RP/EA, injuries addressed, and the projects considered in the reasonable range of alternatives. The restoration planning process was conducted in accordance with OPA, NEPA, Consent Decree, Trustee SOPs, and the OPA NRDA and NEPA regulations.

2.1 Project Screening and Reasonable Range of Alternatives

The goal of the LA TIG's screening process was to identify a reasonable range of alternatives suitable for addressing injuries to natural resources and their services in Louisiana caused by the DWH Oil Spill. In developing a reasonable range of alternatives suitable for addressing the injuries caused by the incident, the LA TIG reviewed the DWH Trustees' programmatic restoration goals and restoration type–specific goals specified in the Final PDARP/PEIS (see Section 1.3.5.1 of this RP/EA). The LA TIG also considered other criteria identified in the Final PDARP/PEIS, including screening factors in the OPA regulations (15 CFR 990.54), input from the public, the current and future availability of funds under the DWH NRDA settlement payment schedule, as well as projects already fully funded or proposed to be fully funded by the other DWH restoration funding sources (NFWF GEBF and the RESTORE Act) and other non-DWH restoration funding sources and applicant-matching funds.

2.2 Summary of Alternatives Considered but not Carried Forward for Further Evaluation in this RP/EA

The LA TIG issued an NOS to the public on June 7, 2019, to request submission of project ideas through July 5, 2019 (see Appendix A) to either of the following:

- Trustee Portal, available at: https://www.gulfspillrestoration.noaa.gov/restoration/give-us-your-ideas/suggest-a-restoration-project)
- State of Louisiana Portal (State Portal), available at: https://la-dwh.com/project-submission/

In all, six projects were submitted to the portals in response to the NOS.

The NOS also provided the following:

- Information on the geographic locations where restoration activities would be considered: Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, and St. Bernard Parishes in Louisiana
- Four restoration approaches to address the Wetlands, Coastal, and Nearshore Habitats restoration type in this RP/EA:
  - Create, restore, and enhance coastal wetlands
  - Restore oyster reef habitat
  - Create, restore, and enhance barrier and coastal islands and headlands
  - Restore and enhance dunes and beach
- Criteria on project readiness:
  - Request that project proposals be ready for construction within 12 to 18 months of issuance of the NOS on June 7, 2019
  - Request that project readiness include consideration of environmental compliance and/or E&D that is already underway

The LA TIG also queried existing projects that had been uploaded by the public to both the Trustee and State Portals to identify projects that could be eligible for consideration in this RP/EA and to ensure that a reasonable range of alternatives would be analyzed. All project ideas submitted to the Trustee and State Portals and by various state and federal agencies (herein referred to as the Project Universe) were reviewed and screened for eligibility using the following criteria:

- Projects must be located in the Louisiana Restoration Area.
- Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill.
- Project must not be identified for or receiving complete project funding relative to the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.

2.2.1 Project Universe

Based on the query output from the Trustee and State Portals as well as responses to the NOS, the LA TIG assembled an initial list of project alternatives for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type. The project alternative universe (i.e., the project universe) comprised 380 projects that underwent a four-step screening as part of the restoration planning process. Appendix B lists the comprehensive project universe for this restoration type, and Table 2.2-1 lists and describes the four screening steps and criteria.

Table 2.2-1. Screening Criteria Applied to the Project Universe

Screening Step	Criteria	Screening Notes
Step 1: Eligibility Screening	1. Projects must be located in the Louisiana Restoration Area. 2. Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill. 3. Projects must not be identified form or receiving complete project funding relative tom the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.	Many projects considered under Step 1 did not meet all of the Step 1 criteria and were removed from further consideration. This included projects that were uploaded to the portals in the wrong restoration type (i.e., they were not in the Wetlands, Coastal, and Nearshore Habitats restoration type), duplicate projects, or projects that did not meet the definition of *project* as described in the Final PDARP/PEIS.
Step 2: NOS Initial Screening	1. Projects must be located in the Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, or St. Bernard Parishes. 2. Projects must meet at least one of the restoration approaches outlined in the NOS: • Create, restore, and enhance coastal wetlands • Restore oyster reef habitat • Create, restore, and enhance barrier and coastal islands and headlands • Restore and enhance dunes and beach 3. Projects must be ready for construction within 12 to 18 months of the projects' submission to the Trustee or State Portal. 4. Projects must have environmental compliance and E&D that are already complete or underway.	Projects that moved from Step 1 to Step 2 screening had to meet all four Step 2 NOS screening criteria to be eligible for consideration in Step 3. Many projects met the geographic location criteria and were the correct restoration type, but many of those did not meet the project construction readiness or environmental compliance criteria.
Step 3: OPA Screening Criteria	1. Is the cost to carry out the project reasonable? 2. Is the project expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses? 3. Is the project likely to succeed? 4. Will the project prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative? 5. Will the project benefit more than one natural resource and/or service? 6. Will the project benefit, and avoid collateral injury on, public health and safety?	Projects that moved to Step 3 were then screened using the six OPA criteria questions. Projects at this step required an affirmative response to all six questions to move to Step 4 screening.
Step 4: Specific Screening Considerations of the LA TIG	1. Is the project consistent with the goals and objectives in Louisiana's coastal master plan (CPRA 2017a)? 2. Is the project complementary to other restoration projects in the region/area? 3. To what extent does the project protect or restore a complex of habitats (e.g., project restores for multiple types of habitat, such as beach, dune, and marshes) within the nearshore ecosystem and therefore contribute to an integrated, connected food web? 4. Will the project contribute to habitat protection or near other projects proposed for selection in this plan, thereby achieving a greater overall benefit to nearshore habitats? 5. Is the project adjacent to land uses that would pose a threat to the benefits of the restoration project? 6. Are there other funds that can be leveraged in conjunction with NRDA funds to allow for implementation? 7. Are there any other impediments to carrying the project forward as part of the reasonable range of alternatives designated for more detailed OPA and NEPA analysis (e.g., compliance issues)?	Projects that were evaluated at Step 4 received scores (1 = yes and 0 = no) for all yes/no questions 1, 4, 5, 6, and 7. For the more involved questions 2 and 3, projects were scored on a 1–5 basis: 1 = no; 2 = uncertain; 3 = somewhat; 4 = moderately; 5 = very.

2.3 Reasonable Range of Alternatives

The LA TIG's decisions to advance projects to the reasonable range of alternatives were based on applying the criteria that were developed and approved by the LA TIG (see Table 2.2-1). The criteria were carefully developed to ensure that projects that could be advanced would provide the greatest benefits to the specific resources injured along the Louisianan Gulf Coast in the DWH Oil Spill identified in the NOS. In other words, the LA TIG identified the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type as the focus of the restoration plan and developed screening criteria with that in mind. Alternatives carried forward in the reasonable range showed they could meet this restoration type focus effectively and in a timely fashion. The LA TIG developed the screening criteria to select projects that would provide the greatest benefits to the Louisiana Restoration Area. Table 2.3-1 indicates the number of projects screened at each step. It should be noted that projects screened out at any step remain in the Trustee and State Portals and would be eligible as applicable for future restoration planning efforts.

Table 2.3-1. Number of Projects Screened

Screening Step	Number of Projects Screened	Number of Projects Moved to Next Step
Step 1: Eligibility Screening	380	104
Step 2: NOS Initial Screening	104	7
Step 3: OPA Screening Criteria	7	7
Step 4: Specific Screening Considerations of the LA TIG	7	4

2.3.1 Step 1: Eligibility Screening

The Step 1 screening process looked at all projects that had been uploaded by the public to both the Trustee and State Portals, including those projects submitted with the June 7, 2019, NOS.

Projects in Step 1 had to meet the following criteria:

- Projects must be located in the Louisiana Restoration Area.
- Projects must meet at least one of the goals outlined in the PDARP to compensate for wetlands, coastal, and nearshore habitat injury resulting from the DWH Oil Spill.
- Projects must not be identified for or receiving complete project funding relative to the scope proposed for the LA TIG funding. Leverage of other funding sources for previous phases (e.g., E&D), subsequent work (e.g., MAM), or other aspects of construction is expressly permitted.

In all, 380 projects were identified and carried forward for the initial screening in Step 1. Many projects considered under Step 1 did not meet all of the Step 1 criteria and were removed from further consideration. This included projects that were uploaded to portal in the wrong restoration type (i.e., they were not in the Wetlands, Coastal, and Nearshore Habitats restoration type), duplicate projects, or projects that did not meet the definition of *project* as described in the Final PDARP/PEIS. Projects uploaded to the wrong project category remain in the portals and would turn up in queries conducted for future restoration plan development.

2.3.2 Step 2: NOS Initial Screening

Projects brought forward to Step 2 had to meet the following criteria:

- Projects must be located in the Terrebonne, Lafourche, Jefferson, Orleans, Plaquemines, or St. Bernard Parishes.
- Projects must meet at least one of the restoration approaches outlined in the NOS:
  - Create, restore, and enhance coastal wetlands
  - Restore oyster reef habitat
  - Create, restore, and enhance barrier and coastal islands and headlands
  - Restore and enhance dunes and beach
- Projects must be ready for construction within 12 to 18 months of the projects' submission to the Trustee or State Portal.
- Projects must have environmental compliance and E&D that are already complete or underway.

Projects that moved from Step 1 to Step 2 screening had to meet all four Step 2 criteria to be eligible for consideration in Step 3. Of the 104 projects that were carried over to Step 2, 94 did not meet three or more criteria and were excluded from further screening. In all, 25 projects did not meet two or more criteria and were excluded from further screening. In all, 20 projects were excluded based on not meeting only one of the criteria, but in order to go on to Step 3, all four criteria questions required a score of (or yes to the question posed). Most projects were excluded based on project readiness for construction; 21 projects were excluded based on geographic location criteria, another six were excluded based on not meeting restoration type criteria and the remainder (70) were excluded due either to project readiness or environmental compliance issues.

2.3.3 Step 3 OPA Screening Criteria

Step 3 asked the following six questions of the projects brought forward from Step 2:

1. Is the cost to carry out the project reasonable?
2. Is the project expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses?
3. Is the project likely to succeed?
4. Will the project prevent future injury as a result of the incident and avoid collateral injury as a result of implementing the alternative?
5. Will the project benefit more than one natural resource and/or service?
6. Will the project benefit, and avoid collateral injury on, public health and safety?

Projects that moved to Step 3 were then screened using the six OPA criteria questions. Projects at this step required an affirmative response to all six questions to move to Step 4.

2.3.4 Step 4: Specific Screening Considerations of the LA TIG

Step 4 asked the following seven questions from the projects brought forward from Step 3:

1. Is the project consistent with the goals and objectives in Louisiana's coastal master plan (CPRA 2017a)?
2. Is the project complementary to other restoration projects in the region/area?
3. To what extent does the project protect or restore a complex of habitats (e.g., project restores for multiple types of habitat, such as beach, dune, and marshes) within the nearshore ecosystem and therefore contribute to an integrated, connected food web?
4. Will the project contribute to habitat protection or near other projects proposed for selection in this plan, thereby achieving a greater overall benefit to nearshore habitats?
5. Is the project adjacent to land uses that would pose a threat to the benefits of the restoration project?
6. Are there other funds that can be leveraged in conjunction with NRDA funds to allow for implementation?
7. Are there any other impediments to carrying the project forward as part of the reasonable range of alternatives designated for more detailed OPA and NEPA analysis (e.g., compliance issues)?

Projects that were evaluated at Step 4 received scores (1 = yes and 0 = no) for all yes/no questions 1, 4, 5, 6, and 7. For the more involved questions 2 and 3, projects were scored on a 1–5 basis: 1 = no; 2 = uncertain; 3 = somewhat; 4 = moderately; 5 = very. Table 2.3-2 depicts the restoration projects that were carried forward for screening under Step 4.

Table 2.3-2. Alternatives Carried Forward to Step 4

Project Proponent	Alternative	Parish	Screening Evaluation
CPRA	Barataria Bay Rim Marsh Creation	Jefferson and Plaquemines	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.
CPRA	West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines	This project and the Biloxi Marsh Living Shoreline project received the highest score (total of 15) of all seven projects that were carried forward to Step 4. Only these two projects received a score of 5 for question 3 and contribute substantively to a continuum of habitats.
Lafourche Parish Government	Bayou Lafourche Marsh Creation	Lafourche	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.
CPRA	Golden Triangle Marsh Creation	Orleans and St. Bernard	This project received a 1 (yes) for all yes/no questions. It received a score of 3 for Question 3 regarding its ability to contribute substantively to a continuum of habitats and a total score of 13.
St. Bernard Parish	Lake Lery Marsh Creation	St. Bernard	This project received a 1 (yes) for all yes/no questions, except for question 4, because the project is not near any other projects that were carried forward in Step 4 for this RP/EA. The evaluation deemed this project as meeting all other criteria to at least some degree, and it received a total score of 12.

Project Proponent	Alternative	Parish	Screening Evaluation
CPRA	Biloxi Marsh Living Shoreline	St. Bernard	This project and the West Grand Terre Beach Nourishment and Stabilization project received the highest score (total of 15) of all seven projects that were carried forward to Step 4. Only these two projects received a score of 5 for question 3 and contribute substantively to a continuum of habitats.
Jefferson Parish	Fifi Island Forested Ridge with Breakwater	Jefferson	This project received a 1 (yes) for all yes/no questions. It received a score of 3 for question 3 regarding its ability to contribute substantively to a continuum of habitats and a total score of 13.

The four highest-scoring projects (alternatives) were carried forward to represent the reasonable range of alternatives for this RP/EA (Table 2.3-3). These projects all received a score of 13 or higher and represent the reasonable range of alternatives for this RP/EA.

Table 2.3-3. Reasonable Range of Alternatives Carried Forward in this RP/EA

Project Proponent	Alternative	Parish
CPRA	West Grand Terre Beach Nourishment and Stabilization	Jefferson and Plaquemines
CPRA	Golden Triangle Marsh Creation	Orleans and St. Bernard
CPRA	Biloxi Marsh Living Shoreline	St. Bernard
Jefferson Parish	Fifi Island Forested Ridge with Breakwater	Jefferson

2.4 Natural Recovery/No Action Alternative

As required by OPA regulations, the Final PDARP/PEIS considers a "natural recovery alternative in which no human intervention would be taken to directly restore injured natural resources and services to baseline" (15 CFR 990.53[b][2]). Under a natural recovery alternative, no additional restoration would be done by the Trustees to accelerate the recovery of injured natural resources or to compensate for lost services. The Trustees would allow natural recovery processes to occur, which could result in one of four outcomes for injured resources: 1) gradual recovery, 2) partial recovery, 3) no recovery, or 4) further deterioration. Although injured resources could presumably recover to baseline or near-baseline conditions under this scenario, recovery would take much longer compared to a scenario in which restoration actions are undertaken. The Final PDARP/PEIS (DWH Trustees 2016: 5-92) notes that interim losses of natural resources, and the services natural resources provide, would not be compensated under a natural recovery alternative. Given that technically feasible restoration approaches are available to compensate for interim natural resource and service losses, the Trustees rejected this alternative from further OPA evaluation within the Final PDARP/PEIS. Based on this determination, tiering this RP/EA from the Final PDARP/PEIS, and incorporating that analysis by reference, the LA TIG did not evaluate natural recovery as a viable alternative under OPA. Natural recovery is not considered further in this RP/EA. For these reasons, the LA TIG rejects the natural recovery/no action alternative as a viable means of compensating the public for the lost recreational use and water quality injuries caused by the DWH Oil Spill.

NEPA requires consideration of a no action alternative as a basis for comparison of potential environmental consequences of the action alternative(s). Therefore, a no action alternative is evaluated within the EA portion of this RP/EA. The no project (no action) analysis presents the conditions that would result if the LA TIG did not undertake any additional restoration for injured natural resources or to compensate for lost services at this time. The environmental consequences of such an alternative are evaluated in Section 4.7 for comparison with the remaining alternatives.

3 OIL POLLUTION ACT EVALUATION OF ALTERNATIVES

3.1 Introduction

According to the NRDA regulations under OPA, trustees are responsible for identifying a reasonable range of alternatives (15 CFR 990.53[a][2]) that can be evaluated based on the OPA evaluation standards (15 CFR 990.54). Section 2 describes the screening and identification of a reasonable range of alternatives for evaluation under OPA. Once a reasonable range of alternatives is developed, the OPA NRDA regulations (15 CFR 990.54) require trustees to identify preferred restoration alternatives based on the following criteria:

- **Project costs:** The cost to carry out the alternative
- **Trustee restoration goals and objectives:** The extent to which each alternative is expected to meet the DWH Trustees' goals and objectives in returning the injured natural resources and services to baseline and/or compensating for interim losses (the ability of the alternative to provide comparable resources and services; that is, the nexus between the project and the injury)
- **Likelihood of success:** The likelihood of success of each alternative
- **Prevent future injury and avoid collateral injury:** The extent to which each alternative will prevent future injury as a result of the incident, and avoid collateral injury as a result of implementing the alternative
- **Benefits to multiple resources:** The extent to which each alternative benefits more than one natural resource and/or service
- **Public health and safety:** The effect of each alternative on public health and safety

If the DWH Trustees conclude that two or more alternatives are equally preferable, the most cost-effective alternative must be chosen (15 CFR 990.54(b)).

The following section describes the considerations the LA TIG included when performing the OPA evaluation of these alternatives. This evaluation process follows the OPA criteria found in 15 CFR 990.54(a), as well as the Final PDARP/PEIS and public comments. This evaluation is separate from the Step 3 preliminary OPA screening process detailed in Section 2.3 that was used to develop the reasonable range of alternatives. For each alternative, the OPA criteria are evaluated independently, and a determination is made on how well the alternative meets that element. The LA TIG applied each of the OPA criteria to the reasonable range of alternatives in this section to provide 1) a summary explanation of the types of questions and analysis raised under each of the OPA criteria, and 2) a narrative summary of each alternative's evaluation with respect to those criteria.

3.1.1 Summary of Oil Pollution Act Evaluation Criteria

3.1.1.1 PROJECT COSTS

The following questions were asked in the evaluation of each alternative as it pertains to cost effectiveness:

- Is there a description of the anticipated costs of the alternative?
- Are the costs of the alternative (including land acquisition, design, construction, management, monitoring, and maintenance) reasonable, appropriate, and comparable to other equivalent restoration projects?

The cost provided for each alternative is the estimated NRDA-funded cost to implement the alternative. This cost reflects current cost estimates developed from the most current designs and information available to the LA TIG at the time of drafting this RP/EA. The estimated cost could include provisions for planning, E&D, construction, monitoring, trustee oversight, and contingencies.

3.1.1.2 TRUSTEE RESTORATION GOALS AND OBJECTIVES

The LA TIG analyzed the extent to which each alternative is expected to meet the following three restoration goals for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type as described in the Final PDARP/PEIS:

- Restore a variety of interspersed and ecologically connected coastal habitats.
- Restore for injuries to habitats in the geographic areas where the injuries occurred, while considering approaches that provide resiliency and sustainability.
- Restore habitats in appropriate combinations for any given geographic area.

To complete this analysis, the LA TIG evaluated the nature, magnitude, and distribution of benefits expected to be provided to the public by each alternative. At the current stage of development of alternatives considered in this RP/EA, the LA TIG does not have detailed modeling for benefits associated with food web dynamics and nutrient cycling. Therefore, the LA TIG used the amount of habitat created and sustained as the primary measure of benefit for each alternative, following the methods used in *Strategic RP/EA #3: Restoration of Wetlands, Coastal, and Nearshore Habitats in the Barataria Basin* (LA TIG 2018b). Measures of the nature of benefits include the type of habitat created; measures of magnitude of benefits can include number of acres of habitat created by the individual project examples within each alternative.

3.1.1.3 LIKELIHOOD OF SUCCESS

The likelihood of success for each alternative was analyzed using a series of questions:

- Does the alternative propose restoration approaches or techniques that have been previously executed successfully?
- Has the alternative been modeled using best available science?
- For novel or new techniques, has the LA TIG incorporated any measures to minimize risk?
- Has the LA TIG considered the uncertainties influencing success and any adaptive management approaches that would address those uncertainties?
- Will the alternative be resilient to environmental change?

3.1.1.4 PREVENT FUTURE INJURY AND AVOID COLLATERAL INJURY

The extent to which each alternative would prevent future injury (a result of the incident) and avoid collateral injury (a result of implementing the alternative) was analyzed using the following question:

- Does the restoration alternative have direct or indirect collateral environmental impacts?

These considerations are included in the following analysis of alternatives. A more detailed impact analysis is included in the affected environment and environmental consequences sections of this RP/EA (Section 4).

3.1.1.5 BENEFITS TO MULTIPLE RESOURCES

Although each alternative is funded exclusively from one restoration type allocation, the LA TIG considered the importance of multiple resource benefits. This is done by evaluating whether alternatives convey multiple ecosystem service benefits (in addition to restoration of wetlands, coastal, and nearshore habitats) that make them more valuable to the public (e.g., non-use [ecological] values, storm-protection benefits, and habitat and resource improvements that may benefit ecological resources injured by the DWH Oil Spill).

Restoration of coastal marsh provides benefits to the extensive network of natural resources that depend on coastal marshes for all or part of their lifecycle. At the current stage of development of most individual projects considered in this RP/EA, the LA TIG does not have the benefit of detailed modeling for benefits associated with food web dynamics and nutrient cycling. Therefore, the LA TIG used the type(s) and amount of habitat created and sustained as the primary measure of benefit for each alternative, which will benefit the natural resources that depend on these habitats, such as estuarine-dependent water-column resources, and contribute to the overall health of the northern Gulf of Mexico ecosystem. Projects that provided two or more coastal or nearshore habitat and created greater amounts of habitat were scored higher during the alternatives screening process. Projects with the highest evaluation scores were selected for further analysis in this RP/EA.

3.1.1.6 PUBLIC HEALTH AND SAFETY

The LA TIG considered whether there are any aspects of each alternative that could adversely affect public health and safety that cannot be mitigated.

3.1.2 Considerations for all Alternatives

For all alternatives,

- best management practices (BMPs) are discussed in Section 4 as they are relevant to avoiding adverse impacts to the physical, biological, and/or socioeconomic environment, and these BMPs are included as Appendix C;
- MAM plans for the alternatives are in Appendix D; and
- construction schedule(s) are included in this section; however, estimated construction timeframes may be refined during final alternative design.

3.2 Oil Pollution Act Evaluation of Reasonable Range of Alternatives

3.2.1 West Grand Terre Beach Nourishment and Stabilization Alternative

3.2.1.1 ALTERNATIVE DESCRIPTION

Overview

The West Grand Terre Beach Nourishment and Stabilization alternative (hereinafter the *alternative* or the *West Grand Terre alternative*) is in Jefferson Parish and Plaquemines Parish, Louisiana (Figure 3.2-1). West Grand Terre Island is approximately 47 miles south of New Orleans, Louisiana. It is flanked by Grand Isle to the west and East Grand Terre Island to the east. West Grand Terre Island is part of a larger barrier shoreline chain that separates Barataria Bay from the Gulf of Mexico.

The goals of the alternative are as follows:

1. Restore the beach by adding sand to widen the existing beach.
2. Restore the dune system and plant native vegetation to help retain sand on the dune.
3. Create a back-barrier marsh on the west end of the West Grand Terre Island to serve as a rollover platform and capture overwash sediments during episodic events. The marsh would complement the existing marsh on the east end of the island.
4. Protect the beach nourishment and shoreline stabilization restoration efforts by constructing a rock revetment feature along Barataria Pass and Barataria Bay.

The alternative includes the restoration area on West Grand Terre Island, a borrow area in the Gulf of Mexico southeast of the island in state waters, an overburden disposal area, and conveyance corridors connecting the borrow area to the island and to the overburden disposal area (see Figure 3.2-1).

Between the Draft RP/EA and this Final RP/EA, the LA TIG reevaluated the maximum restoration potential on West Grand Terre Island to include the dredged material recently placed by the U.S. Army Corps of Engineers (USACE) and the +1.5-foot tolerance acreage discussed below. The revised alternative would create or restore up to 371 acres of beach and dune habitat, create or restore approximately 160 acres of intertidal marsh habitat, and protect approximately 14,000 linear feet of shoreline on West Grand Terre Island.

Gulf Beach-Dune Fill

The Gulf beach-dune fill area consists of a dune feature with a crown width of 290 feet and a target elevation of +8.0 feet North American Vertical Datum of 1988 (NAVD88), from Stations 60+00 to 145+00. The dune side slopes are projected at a 1 vertical (V) to 30 horizontal (H) degree gradient extending downward from the dune crown on the Gulf side to the beach platform and on the north side to grade forming the dune-marsh interface. The beach platform of the Gulf beach-dune fill area resides on the Gulf side of the dune and is 65 feet wide with a target elevation of +6.0 feet NAVD88. The beach slope is projected seaward at a 1V:40H gradient extending to the seafloor. The east beach fill area consists of a beach platform with a crown width of 230 feet and a target elevation of +8.0 feet NAVD88, from Stations 4+00 to 60+00. The east beach fill side slopes are consistent with that of the dune feature at 1V:30H, which includes, based on the preliminary results of the geotechnical analysis, settlement of a +1.5-foot tolerance.

The dune platform would be planted immediately following construction. The vegetative plantings would include a mixture of some or all of the following herbaceous species: bitter panicgrass (*Panicum amarum* var. *amarum* 'Fourchon'), seashore paspalum (*Paspalum vaginatum* 'Brazoria'), seacoast bluestem (*Schizachyrium maritimum* 'Timbalier'), seashore dropseed (*Sporobolus virginicus*), sea oats (*Uniola paniculata* 'Caminada'), saltmeadow-marshhay cordgrass (*Spartina patens* 'Gulf Coast'), and Gulf cordgrass (*Spartina spartinae*). Woody species would be planted landward of the restored dune and supratidal back berm area, at a planting density of 15% to mimic the sparsely vegetated native vegetative assembly that typically occurs in this area. Woody species for the dune and supratidal areas would primarily be matrimony vine (*Lycium barbarum*).

Back-barrier Marsh

The marsh fill area extends along the western half of the island, north of the Gulf beach-dune fill area, from Stations 80+00 to 150+00. The marsh fill area is approximately 7,000 feet long and ranges from 485 to 1,300 feet wide. The target elevation of the marsh fill area is +2.0 feet NAVD88. After construction and consolidation, the newly created marsh platform would be planted with smooth cordgrass (*Spartina alterniflora* var. 'Vermilion') and other appropriate species.

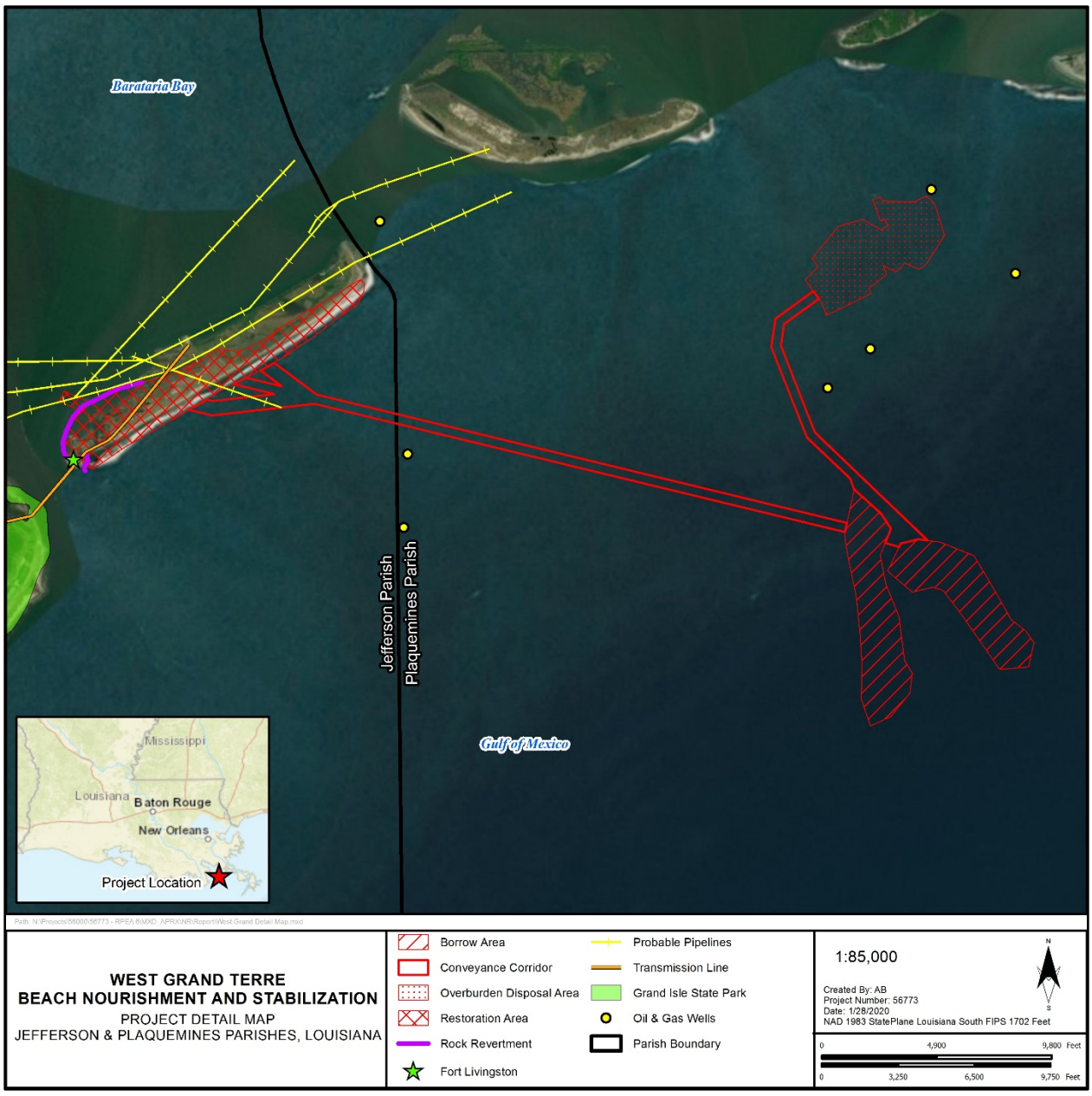

Figure 3.2-1. Location of the West Grand Terre Beach Nourishment and Stabilization alternative.

Rock Revetment

The rock revetment feature along Barataria Pass would begin at the northwest end of the Fort Livingston breakwater and continue around the bayside of the island along the 2-foot contour where it would tie into the edge of the Chevron Pipeline Canal. The rock revetment would be designed in three segments:

1. Segment A would extend approximately 1,200 feet from the existing northwest end of the Fort Livingston breakwater around the marsh fill area and would terminate midway along the revetment alignment to the LDWF access channel. Typical features on this segment include an elevation of +6.5 feet NAVD88 and bench to elevation +3.0 feet NAVD88.

2. Segment B would extend approximately 1,370 feet around the marsh fill area from the end of Segment A ending at the LDWF access channel.
3. Segment C would extend the remaining distance around the marsh fill area of approximately 2,590 feet from the LDWF access channel and would tie into an existing marsh area south of the Chevron Pipeline Canal.

Both Segments B and C would include a crest width of 10 feet with Segment B at an elevation of +4.5 feet NACD88 and Segment C at an elevation of +2.5 feet NAVD88. The bayside slopes would be set equal to 1V:3H, and marsh side slopes would be set equal to 1V:2H for Segments B and C, respectively. All three segments would be underlain by a geotextile fabric and include core stone and armor stone layers.

A 540-foot segment of the Gulf-side rocks surrounding Fort Livingston would be restored and extended north to the current shoreline. Furthermore, a 180-foot rock revetment spur would extend southeast from the current Fort Livingston rock alignment to capture sand transported by longshore currents. The spur would be sited along the historical shoreline alignments.

Borrow Area

The borrow area would be approximately 4.6 nautical miles (NM) east-southeast of the center of West Grand Terre Island in state waters. Based on extensive geophysical, geotechnical, hazards, and archaeological studies, potential oil and gas infrastructure were avoided in the layout of the borrow area. Seafloor elevations in the borrow area range from -28 feet NAVD88 to -34 feet NAVD88.

The borrow area would be subdivided into two subsections, Borrow Area West and Borrow Area East. In general, subsections are approximately rectangular in form. The stratigraphy for the borrow area subsections is generally characterized by two layers, an overburden layer comprising silts, clays, and fine sand and a sand layer comprising fine sand with silt and clay lenses.

The overburden layer thicknesses would range from 10 to 18 feet. A 50-foot bench was included between the bottom of cut for the overburden layer and top of cut for the sand layer to account for slope adjustment between sediment layers. The sand layer thicknesses would range from 10 to 30 feet. Cut depths would range from -56.0 feet to -70.0 feet NAVD88. The overburden would be disposed of in the previously excavated borrow areas S1 and D1 of the Chenier Ronquille Barrier Shoreline Restoration project (BA-76).

The borrow area subsections were designed based on suitable sediment availability and efficient dredge cut patterns derived from the detailed design-level geophysical and geotechnical surveys. Estimates of the average percent sand and grain size computed from vibracores taken within the subsections equaled 91% and 0.16 millimeters (mm), respectively. The estimated available volumes of suitable restoration sediment and overburden are 4.0 million cubic yards (MCY), and 2.9 MCY, respectively.

Conveyance Corridors

Two conveyance corridors have been designed for the alternative (see Figure 3.2-1). One conveyance corridor connects the two borrow area subsections and extends to the island to transport sediment to the restoration area. The overburden disposal conveyance corridor connects the borrow area subsections to the overburden disposal area. The south end of the overburden disposal conveyance corridor bifurcates to connect the Borrow Area West and Borrow Area East subsections.

The conveyance corridor between the borrow areas and the island was sited based on a review of the NOAA Nautical Chart No. 11358 (NOAA 2014), and historical pipeline/infrastructure databases. The alignment of the conveyance corridor originates in the borrow areas and progresses northwest to the

restoration area for approximately 5.1 NM. The conveyance corridor would be 400 feet wide with a 200-foot allowable anchor area on each side. Water depths along the alignment vary from approximately -31 feet NAVD88 to 0 feet NAVD88 at the Island. A review of the data indicated that the alignment would not cross any oil and gas pipelines from the borrow areas to the alternative.

Similarly, the alignment of the overburden disposal conveyance corridor originates at the borrow area subsections, progresses north-northwest through the prior Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35) borrow area, then turns north and enters the prior East Grand Terre Island Restoration (BA-30) and Chenier Ronquille Barrier Shoreline Restoration (BA-76) borrow areas. The overburden disposal conveyance corridor would be 400 feet wide with a 200-foot allowable anchor area on each side and would be approximately 2.4 NM long. Water depths along the alignment vary from approximately -31 feet NAVD88 to approximately -10 feet NAVD88. A review of the data indicated that the alignment would not cross any oil and gas pipelines from the borrow area subsections to the overburden disposal area.

Current and Historical Conditions

West Grand Terre Island, like all other coastal barrier islands in Louisiana, is low lying and comprises three primary physical features: the beach, dune, and back-barrier marsh. These coastal barrier islands are an integral part of the state's biologically productive and economically valuable coastline. The purpose of the alternative is to restore West Grand Terre Island's geomorphic form and ecological function and to provide a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on the interior estuary and wetlands. The alternative would also enhance protection of Fort Livingston.

The alternative is needed because for more than a century, West Grand Terre Island has experienced persistent degradation and erosion. As detailed in the preliminary design report (Coastal Engineering Consultants, Inc. [CEC] 2018a), the overall shoreline change rate (1884–2016) was -6.6 feet per year, with the near-term rate of shoreline change between 1996 and 2016 estimated at -13.4 feet per year (CEC 2018a). This includes multiple USACE dredge disposal projects between 1996 and 2020 in which material dredged from maintenance dredging of the Barataria Waterway was placed along the West Grand Terre Island beach shoreline (USACE n.d. [2014]; CPRA 2020). The largest of these maintenance projects included placing 688,000 cubic yards of material along the shore (CEC 2018a). It is also worth noting that the Final PDARP/PEIS identifies coastal wetland oiling as a contributing factor for increased coastal wetland erosion because of the loss in vegetative cover along the nearshore environment (DWH Trustees 2016: 4-327).

Restored Coastal Habitats

The objectives of the alternative are to restore and enhance dune and back-barrier marsh habitat. Barrier islands in Louisiana are typically low lying and comprise three primary physical features: the beach, dune, and back-barrier marsh. Barrier islands act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands. To restore their geomorphic form and ecological function and to provide this buffer involve 1) reinforcing the shoreline through beach and dune restoration, and 2) providing a marsh platform to capture overwash sediments during episodic events (i.e., sediment that would otherwise be carried into the back-bay areas to form shoals or be lost into deeper waters). The marsh would also serve as a rollover platform as the island migrates landward. Restoration of the geomorphic form and ecological function includes vegetating both the restored dunes and back-barrier marsh platforms with native plants to 1) provide wetland habitat for a diverse number of plant and animal species and 2) help retain sediment on the island.

Construction Methodology and Schedule

Construction methods for the alternative would involve using a hydraulic cutterhead dredge at the borrow area to loosen sand and transport the sand slurry to the restoration area using booster pumps and a submerged sediment pipeline. Once the sand slurry reaches the restoration area, a shore-based construction crew would shape and grade the sediment using bulldozers and similar equipment in the Gulf beach-dune fill area, the back-barrier marsh area, and for the placement of rock revetment segments. The overburden that is dredged from the borrow area would be conveyed via a submerged pipeline to the overburden disposal area.

Installation and operation of the submerged sediment pipeline would require cranes, barges, welding machines, and air compressors. Other construction machinery would include work boats and crew boats, quarters barge generators, and miscellaneous vehicles.

Access channels would be excavated using barge-mounted bucket excavators and associated crews. Separation and marsh containment dikes would be constructed using a marsh buggy and associated operator.

Following fill placement, sand fencing and vegetative plantings would be installed. The sand fences are porous barriers that reduce wind speed along the coast such that sand being transported by the wind accumulates on the downwind side of the fence. The sand fences promote deposition of windblown sand, create dune features, reduce trampling of existing dunes by beach visitors, and protect vegetative plantings. Following construction, vegetative plantings would commence for the dune and supratidal platform followed a year later by the marsh vegetative plantings. Sand fencing and vegetative planting unit costs were derived from review of recent construction contract bids.

The total estimated construction time for the alternative is 16 months. Project scheduling assumes dredging would be continuous, i.e., 24 hours per day and 7 days per week (CEC 2019).

Monitoring Requirements

Monitoring of the alternative for achievement of applicable performance criteria is described in the alternative's attached MAM plan (see Appendix D).

3.2.1.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

The West Grand Terre alternative has been 95% designed, and all E&D costs are covered from the RESTORE grant this alternative received. Construction and implementation of this alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication of June 7, 2019). A portion of the terrestrial alternative is on state-owned land and managed by LDWF to support marine research activities. The LDWF-owned land on the southwest portion of the island near Fort Livingston includes several buildings and structures that made up the Lyle St. Amant Marine Research Laboratory (hereinafter referred to as *LDWF lab*), which was closed in 2008 following Hurricane Gustav. The borrow area and offshore portions of the conveyance corridors are located within state waters. CPRA would obtain servitude agreements from the private landowners, and no payment would be made for acquiring these rights.

E&D, land rights, permitting, and early adaptive management (Phase 1) for the West Grand Terre alternative was funded with RESTORE Act monies. The total estimated cost for all remaining restoration implementation components of the alternative is $92,500,000 (NRDA funds) (Table 3.2-1). This includes construction, construction administration, construction supervision, inspection, operations and maintenance, post-construction monitoring, and contingencies. The estimated cost represents a very close approximation given the 95% design status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-1. Construction Cost Estimate for the West Grand Terre Beach Nourishment and Stabilization Alternative

Description	Cost
Construction	$85,600,000
Operations and maintenance	$5,800,000
MAM	$1,100,000
Total (NRDA funds)*	**$92,500,000**

* Including contingency.

The cost to implement the alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The West Grand Terre alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes. Direct and indirect impacts from the oil spill also led to the injury and degradation of sandy beach and dune habitats along shorelines and barrier islands across the northern Gulf of Mexico, which were also impacted as a result of oil spill response activities. Coastal wetland oiling from the DWH Oil Spill is a contributing factor for increased coastal wetland erosion due to the loss in vegetative cover along the nearshore environment (DWH Trustees 2016: 4-327).

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the DWH Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is in the Barataria Basin, the coastal wetlands of which provide foundational habitat for the Barataria Basin ecosystem, support resources within the Barataria Basin and throughout the Gulf of Mexico, and were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through beach, dune, and intertidal marsh habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat; accelerate recovery of injured ecosystem functions; and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating or restoring up to 371 acres of beach and dune habitat and approximately 160 acres of intertidal marsh habitat and protecting and stabilization of approximately 14,000 linear feet of shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The DWH Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- East Grand Terre project (BA-30; 2010; Plaquemines Parish) in which appropriately 621 acres of land was created by restoring 2.8 miles of barrier shoreline through construction of a 6-foot-high dune, 165 acres of beach habitat, and 456 acres of marsh platform using sand and mixed sediment from two offshore borrow areas (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).
- Caminada Headland Beach and Dune Restoration (BA-45; 2013–2015; Lafourche Parish), which restored and maintained headland through the creation of dunes and beach habitat. The project placed 3.3 MCY of sand from the South Pelto Blocks 12 and 13 borrow area to restore approximately 6 miles of shoreline by constructing a 7-foot-high and approximately 290-foot-wide dune and a 4.5-foot-high and 65-foot-wide beach over a surface area of approximately 303 acres (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).
- Pass Chaland to Grand Bayou Pass Barrier Shoreline Restoration (BA-35; 2009; Plaquemines Parish), which consists of the following elements: approximately 350 acres of total fill area, including a marsh platform approximately 1,000 feet wide contiguous with the northern side of the gulf shoreline of Bay Joe Wise; a dune built to an elevation of 6 feet with a dune crest width of approximately 110 feet; approximately 3 MCY of sediment dredged from the Pas la Mer, Pass Chaland, and Grand Pass ebb delta; construction of approximately 10,000 feet of 4-foot-wide, 2-foot-deep water exchange channels to enhance surface hydrology; and immediate post-construction aerial seeding for plant cover (Applied Coastal Research and Engineering in Cooperation with CDM Smith 2018).

This documented experience and the successful completion of previous marsh creation with shoreline and beach and dune enhancement projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can begin construction within the timeframe indicated in the NOS (12–18 months from NOS publication of June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. The alternative is estimated to protect approximately 50% of the West Grand Terre Island over the next 20 years (CEC 2018a).

Prevention of Future Injury and Avoid Collateral Injury

Marsh creation projects help prevent future injuries to marsh vegetation and soils, as well as to estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The shoreline protection that would be provided by the West Grand Terre alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of surrounding marsh. Further, beach and

dune creation and enhancement can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review of this alternative is described in Section 4.2 and indicates that adverse effects to wildlife or protected species (such as the West Indian manatee [*Trichechus manatus*] and sea turtles), including turbidity, noise and other disturbances in the water column, habitat disturbance (SAV, benthic, and EFH), and behavioral changes, would largely be minor, localized, and short term. Potential long-term adverse effects would be limited to disturbances to unknown cultural resources from construction activities. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of marsh, beach, and dune habitats with shoreline protection restores important linkages among and between wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the West Grand Terre alternative includes creating or restoring up to 371 acres of beach and dune habitat and approximately 160 acres of intertidal marsh habitat and protecting and stabilization of approximately 14,000 linear feet of shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

This West Grand Terre alternative would not affect public health and safety. Creation of marsh habitats with shoreline protection and beach and dune creation included in the alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.1.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the West Grand Terre alternative. The OPA analysis indicates that the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because its implementation would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and other such measures to avoid or minimize adverse impacts would be implemented in the design and implementation of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.2 Golden Triangle Marsh Creation Alternative

3.2.2.1 ALTERNATIVE DESCRIPTION

Overview

The Golden Triangle Marsh Creation alternative (hereinafter the *alternative* or the *Golden Triangle alternative*) is in the eastern portion of the Golden Triangle Marsh and is adjacent to New Orleans, Louisiana, and the surrounding communities in Orleans Parish and St. Bernard Parish (Figure 3.2-2). The Golden Triangle Marsh, which is a narrow band of brackish marsh, is directly east of New Orleans between Lake Borgne and the confluence of the Mississippi River Gulf Outlet (MRGO) and the Gulf Intracoastal Waterway (GIWW). The northern portion of the marsh falls within the Bayou Sauvage National Wildlife Refuge (NWR), which is one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018).

The goals of the alternative are as follows:

1. Restore approximately 800 acres of brackish marsh.
2. Restore and protect wetland, fish, and wildlife habitats.
3. Restore degraded marsh and reduce wave/wake erosion.
4. Maintain landscape integrity and enhance community resilience.
5. Promote natural resource stewardship and environmental education and outreach.

The alternative includes the restoration area in the Golden Triangle Marsh; a borrow area east of the marsh in Lake Borgne; a dredged sediment pipeline corridor connecting the borrow area to the restoration site; and an access corridor from Chef Menteur Pass, northeast of the marsh, to the borrow area (see Figure 3.2-2).

The alternative would create or restore approximately 774 acres of broken marsh and open water, which comprises the restoration of 694 acres of degraded marsh and nourishment of 80 acres of marsh, through the construction of approximately 44,000 linear feet of containment dikes. This marsh restoration would provide 494 acres of intertidal habitat and 263 acres of subtidal habitat. The alternative would help buffer the surge barrier, which would increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne.

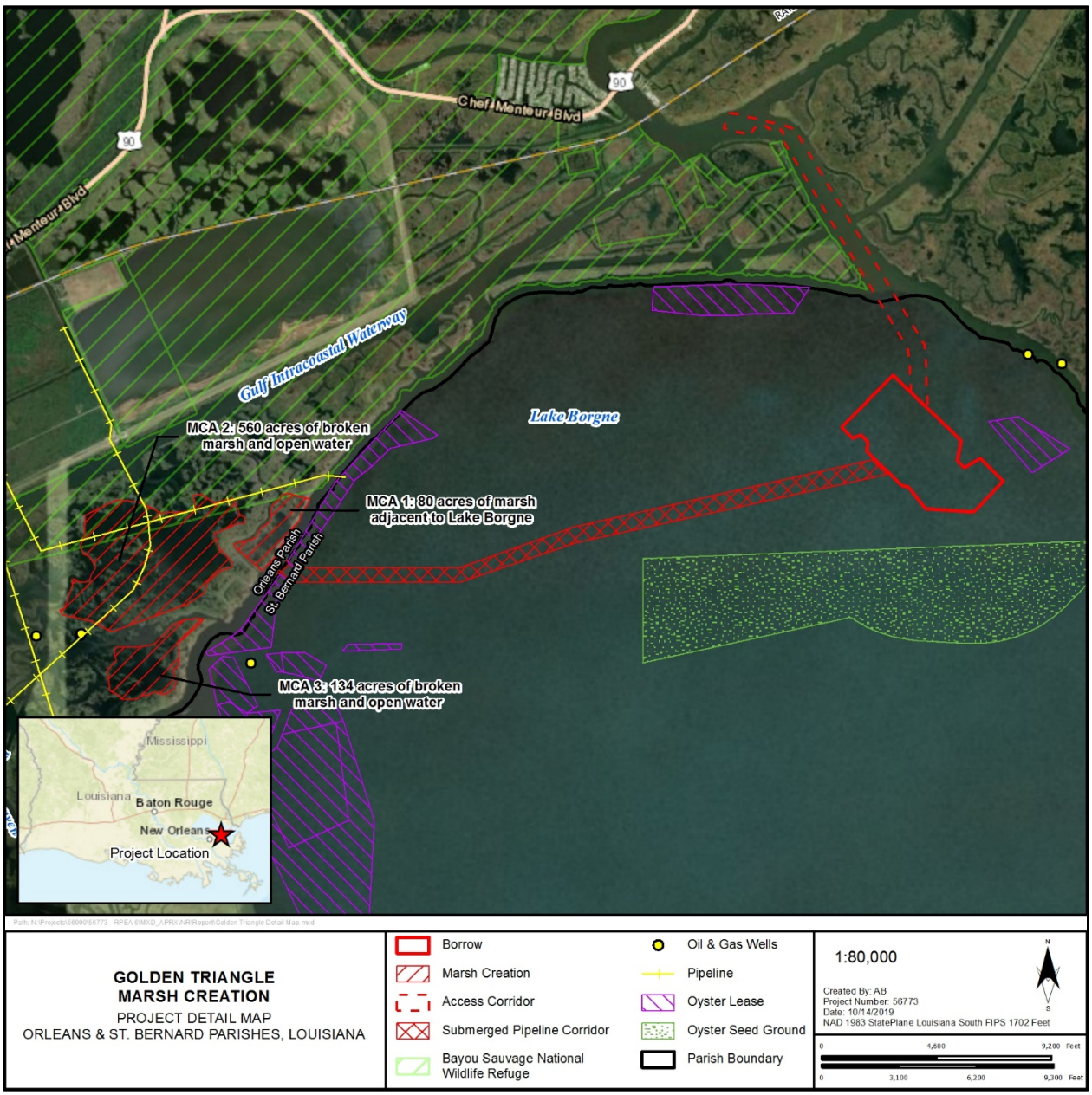

Figure 3.2-2. Location of the Golden Triangle Marsh Creation alternative.

Marsh Creation Areas

Three marsh creation areas (MCAs) are proposed under the Golden Triangle alternative:

- MCA 1: 80 acres of broken marsh and open water
- MCA 2: 560 acres of broken marsh and open water
- MCA 3: 134 acres of marsh adjacent to Lake Borgne

Each of the MCAs would be constructed to an elevation of +2.5 feet NAVD88 with material pumped from the borrow area in Lake Borgne to maximize the time that the marsh elevation is in the intertidal range (where *intertidal* is referring to the water level between local mean high water and mean low water elevations). An estimated 6,700,000 cubic yards of marsh compatible sediments would be required to meet the elevation goals in the three MCAs. The total marsh fill footprint is approximately 774 acres.

Approximately 44,930 linear feet of earthen containment dikes would be constructed along the perimeter of the MCAs to contain the marsh fill material. These dikes would be constructed using in-situ material excavated within the boundaries of the fill area so that the excavated area is refilled during construction.

Following fill and dike construction activities, the earthen containment dikes would be gapped after the fill material has settled to allow for the restoration of natural tidal exchange. Vegetation would be planted throughout the MCAs and along containment dike slopes to support marsh restoration. These vegetation plantings would consist of saltmeadow-marshhay cordgrass and common brackish marsh species found in the area.

Borrow Area

Marsh fill material used to construct the MCAs would be dredged hydraulically from a 78-acre borrow area approximately 5.3 miles east-northeast of the alternative within Lake Borgne. The borrow area contains a mixture of soft to very soft clays, with fine sand and/or silts, which is compatible material for marsh creation. The borrow area design consists of one dredge cut to -24.0 feet NAVD88, with approximately 10,000,000 cubic yards of available marsh compatible fill material. Approximately 6,700,000 cubic yards of marsh compatible sediments from Lake Borgne would be dredged to fill the three MCAs.

One booster pump would be installed within the pipeline corridor to facilitate efficient hydraulic dredging and placement of marsh fill. A maximum area of 200 × 50 feet would be excavated to a maximum elevation of -10.0 feet NAV88 to accommodate the booster pump. All excavated material would be sidecast into the temporary sidecast disposal area designated within the pipeline corridor and graded to within 0.5 foot of pre-construction elevation upon demobilization.

Pipeline Corridor

A 361-acre pipeline corridor would be used to transport fill from the borrow area to the restoration site through a submerged pipeline. The pipeline corridor would run from east to west from the borrow area to MCA 2. The pipeline corridor would pass through a 500-foot-wide area adjacent to the northwest shoreline of Lake Borgne that had been previously cleared of oyster leases (APTIM 2018a). The pipeline corridor would be 100 feet wide. A booster pump would be installed in a dredged area within the conveyance corridor.

The average pipeline distance would be 31,933 linear feet, with the longest pumping distance being from the borrow area to the central fill area (32,600 linear feet). All dredge pipe/subline installed within the corridor would be submerged, and navigation lights would be affixed to buoys every 500 feet, or per U.S. Coast Guard (USCG) regulations, to notify marine traffic of the submerged pipeline. Bathymetry within Lake Borgne varies from approximately -6.0 feet NAVD88 to -12.0 feet NAVD88. It is assumed that these depths would be sufficient for floating equipment to install the subline.

Access Corridor

A 210-acre access corridor from Chef Menteur Pass into Lake Borgne would be designated as the dredge access corridor to the Golden Triangle borrow area. Equipment would enter the access area via the GIWW and into Lake Borgne via the Pass. Bathymetric surveys show that this access corridor may allow for navigation of equipment to access the borrow area without the need for access dredging.

Current and Historical Conditions

The New Orleans region has experienced substantive modification over the last 300 years of human occupation along the Mississippi River. The Golden Triangle alternative is near the confluence of two major navigation and shipping channels: the MRGO and the GIWW. The construction of these projects has significantly altered the hydrology of the region, resulting in accelerated land loss rates, including wetlands and habitats, and increased susceptibility to severe weather events (USACE 2012). The MRGO channel alone has contributed to an estimated 19,400 acres of wetlands conversions and 4,750 acres of shallow open water converted to deep water or dredge material banks (USACE 1999, 2012).

The MRGO was deauthorized in 2008 following severe shoaling in the MRGO channel from Hurricane Katrina in August 2005. In 2008, the USACE constructed the Inner Harbor Navigation Canal (IHNC) Lake Borgne Surge Barrier at the confluence of the GIWW and the MRGO, which is located approximately 12 miles east of downtown New Orleans. A rock closure structure was also constructed across the MRGO near the Bayou La Loutre Ridge in St. Bernard Parish, Louisiana, in 2009 (USACE 2012). However, levee and revetment construction, dredging activities, and pipeline construction efforts continue to alter the natural environment in the Golden Triangle area. High rates of land loss in the area can also be attributed to natural subsidence as well as accelerated subsidence due to oil and gas exploration and saltwater intrusion.

The concept of the Golden Triangle alternative was introduced in the 2012 coastal master plan (CPRA 2012) to mitigate the effects of saltwater intrusion and land degradation the area has experienced. The alternative is bounded to the southeast by Lake Borgne, to the southwest by Bayou Bienvenue, to the north by the GIWW, and to the west by the IHNC. A series of pipeline canals and interconnected bayous run throughout the Golden Triangle marsh.

Restored Coastal Habitats

The objectives of the proposed Golden Triangle alternative are to restore degraded brackish marsh. These marshes act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands, thereby helping restore and protect wetland, fish, and wildlife habitats. The alternative would help buffer the surge barrier, which would increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne. As a result, the alternative would help maintain landscape integrity, enhance community resilience, and promote natural resource stewardship and environmental education and outreach.

Construction Methodology and Schedule

Construction methods for the Golden Triangle alternative would involve use of a hydraulic cutterhead suction dredge to excavate marsh fill material in the borrow area. A booster pump would be installed if needed to help pump material to the fill sites. Marsh buggies would be used to construct earthen dikes. A staging area would be located near the shoreline of Lake Borgne between the three MCAs and along the pipeline corridor.

The earthen dike fill source would be excavated from the area adjacent to the earthen dike, within the MCAs. The earthen containment dikes would be constructed to a crest elevation of +4.0 feet NAVD88 with a minimum crest width of 5 feet. In areas where the dike crosses portions of existing marsh, the dike would be built on top of the existing marsh platform. Additional training dikes may be constructed within the marsh footprint to control the fill at the discretion of the construction contractor. Dewatering would occur in up to six locations around the MCAs within the containment dike boundary to allow excess water to drain from the fill areas.

Marsh fill material would be pumped hydraulically to the alternative site area via a submerged pipeline. The submerged pipeline would be transported to the site on pontoons in approximately 500-foot sections. Once in the alternative site, the various sections of submerged pipeline would be joined together using ball joints into lengths of up to 2,500 feet and then sank into position within the pipeline corridor. A floating pipeline would be attached to the submerged pipeline at the borrow area end while the opposite end of the submerged line is managed ashore. Once the submerged line is in place, the dredge would be connected to the floating line and would traverse the borrow area to mine sediments. Shore pipe would be added as needed to advance the end of the discharge pipe as the MCAs are filled, and flexible HDPE pipe is typically used to distribute the marsh fill material due to self-weight and maneuverability. Marsh buggies would be used to move the end of the discharge to uniformly fill the marsh area. The construction contractor may opt to construct secondary dikes within the marsh platform to assist with controlling the placement of the material.

The total estimated construction time is approximately 14 to 15 months, and this schedule assumes the following:

- A 60-day period for mobilization and pre-construction surveys.
- A production rate of 300 linear feet/day per marsh buggy for construction of the containment dikes and 1-week closure periods for the containment dikes in MCAs 1 and 3, resulting in approximately 123 days to create MCAs 1–3. This may be decreased to 93 days if the construction contractor begins dredging prior to the completion of construction of the containment dike.
- A marsh fill production rate of 70,000 cubic yards/day, resulting in a total of 142 days to complete marsh fill activities.
- A 70-day demobilization period that includes a 30-day waiting period to begin final marsh platform elevation surveys.
- 60 days of flexibility to account for weather and other uncontrollable events.

Following 1 or 2 years after construction of containment dikes and fill of MCAs, vegetation would be planted within the MCAs and remaining containment dikes. This schedule provides time for the marsh material to consolidate to facilitate accessibility and for natural vegetation to take hold.

Monitoring Requirements

Monitoring of the Golden Triangle alternative is described in the attached MAM plan (see Appendix D).

3.2.2.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

The alternative is 95% designed, and all E&D costs are covered from the RESTORE grant this alternative received. Construction and implementation of this alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). All portions of the alternative are within

Lake Borgne and shore-fringing marsh areas. Some of the land within the boundaries of the alternative is privately owned, and coordination with private landowners is underway (APTIM 2018a). No new rights-of-way or in-fee land acquisitions would be required.

E&D, land rights, permitting, and early adaptive management (Phase 1) for the Golden Triangle alternative was funded with RESTORE Act monies. The total estimated cost for all remaining restoration components of the Golden Triangle alternative is $50,000,000 (NRDA funds) (Table 3.2-2). This includes construction, construction administration, construction supervision, inspection, post-construction monitoring, and contingencies. The estimated cost represents a very close approximation given the 95% design status and is comparable with the costs of similar projects of this size and scope.

Table 3.2-2. Construction Cost Estimate for the Golden Triangle Marsh Creation Alternative

Description	Cost
Construction	$47,000,000
Operations and maintenance	$2,000,000
MAM	$1,000,000
Total (NRDA funds)*	**$50,000,000**

* Including contingency.

The cost to implement the Golden Triangle alternative is reasonable, appropriate, and comparable to other equivalent restoration projects. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Golden Triangle alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Pontchartrain Basin, within which the coastal wetlands provide foundational habitat for the Pontchartrain Basin ecosystem, support resources within the Pontchartrain Basin, and are interconnected with other resources throughout the Gulf of Mexico that were among the most heavily oiled parts of the Gulf Coast

shoreline. The alternative provides multiple ecosystem benefits through intertidal and subtidal marsh habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat, accelerate recovery of injured ecosystem functions, and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Golden Triangle alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating or restoring approximately 694 acres of degraded marsh and nourishment of 80 acres of marsh, thereby providing 494 acres of intertidal habitat and 263 acres of subtidal habitat. The benefits from the Golden Triangle alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- Lake Hermitage Marsh Creation – NRDA Early Restoration Project (BA-42; 2015; Plaquemines Parish), which created approximately 104 acres of brackish marsh (Deepwater Horizon Restoration Project Report 2018).
- Grand Liard Marsh and Ridge Restoration (BA-68; 2014–2015; Plaquemines Parish), which created and nourished 450 acres of marsh and restored 15,484 linear feet of ridge on the east bank of Bayou Grand Liard (Louisiana Coastal Wetlands Conservation and Restoration Task Force 2019).
- Oyster Bayou Marsh Restoration (CS-59; 2017; Cameron Parish), which encompasses four MCAs totaling 740 acres using sediment dredged approximately 3.2 miles offshore and transported via pipeline to the project site. In addition to the MCAs, twenty 450-foot-long terraces are being constructed in the northeast section of the project to further reduce wave erosion. Tidal creeks and ponds were also constructed prior to placement of dredged material within the MCAs to facilitate formation of these features post-construction (CPRA 2017b).

This documented experience and the successful completion of previous marsh creation projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. It is estimated that the alternative will have a 20-year design life (APTIM 2018a).

Prevention of Future Injury and Avoid Collateral Injury

- Marsh creation projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The marsh areas that would be provided by the Golden Triangle alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of the marsh and

surrounding wetlands. Further, marsh creation and enhancement can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources.

A thorough environmental review of this alterative is described in Section 4.3 and indicates that adverse effects to wildlife or protected species (such Gulf sturgeon [*Acipenser oxyrinchus desotoi*] and West Indian manatee), including turbidity, noise and other disturbances in the water column, habitat disturbance (SAV, benthic, EFH, and critical habitat), and behavioral changes, would largely be minor, localized, and often short term. Potential long-term adverse effects would be limited to disturbances to unknown cultural resources from construction activities. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. Because the alternative is within Gulf sturgeon designated critical habitat, consultation under Section 7 of the Endangered Species Act of 1973 (ESA) with the NMFS and USFWS is ongoing. Through this consultation, any additional measures or terms and conditions necessary to avoid adverse modification of Gulf sturgeon critical habitat will be identified and incorporated into the alternative. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of marsh habitats with marsh protection restores important linkages among wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the Golden Triangle alternative includes creating or restoring approximately 694 acres of degraded marsh and nourishment of 80 acres of marsh, thereby providing 494 acres of intertidal habitat and 263 acres of subtidal habitat. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

The Golden Triangle alternative would not affect public health and safety. Creation of marsh habitats with marsh protection included in the alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.2.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Golden Triangle alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and

improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design and implementation of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.3 Biloxi Marsh Living Shoreline Alternative

3.2.3.1 ALTERNATIVE DESCRIPTION

Overview

The Biloxi Marsh Living Shoreline alternative (hereinafter the *alternative* or the *Biloxi Marsh alternative*) is in southeast St. Bernard Parish, Louisiana, along the shoreline of Bayou La Loutre (Figure 3.2-3). The alternative extends from Eloi Bay to Morgan Harbor on the north side of the peninsula and is open to the Chandeleur and Breton Sound. The area is characterized by low marshes with an erosional shoreline.

The purpose of the alternative is to create bioengineered, marsh-fringing oyster reefs to promote the formation of self-sustaining living shoreline protection structures. The goal of the alternative is to install 9 to 11 miles (and no more than 12.5 miles) of oyster barrier reef along the eastern shoreline of the Biloxi Marsh, which would provide oyster habitat, reduce wave erosion, and prevent further marsh degradation.

The goals of the alternative are as follows:

1. Provide shoreline protection by using living shoreline products to attenuate wave energy.
2. Stimulate oyster growth in the immediate area.

Eastern oysters (*Crassostrea virginica*) are vital to Louisiana's coastal ecosystems because they provide aquatic habitat as well as filter large volumes of water during feeding. In general, physical environmental needs for oyster growth include appropriate salinity, tidal influence, and hydrographic circulation, which allow oyster larvae to remain near an existing reef but with enough exchange to maintain good food supply and near-neutral silt balance on the oyster reef/beds (NOAA Fisheries Eastern Oyster Biological Review Team 2007). With these elements in place, oysters need only a hard surface on which to attach.

The Biloxi Marsh alternative is a coastal restoration project designed to create bioengineered, marsh-fringing oyster reefs to promote the formation of self-sustaining living shoreline protection structures. Bioengineered oyster reefs would be created by placing a manufactured product or products off the shoreline to establish a living breakwater structure. Approximately 9 to 11 miles (and no more than 12.5 miles) of reef breakwaters, marine mattresses, and/or rock revetments would be constructed under the alternative. More information about the potential construction bidding process for the alternative is discussed below under Construction Methodology and Schedule section.

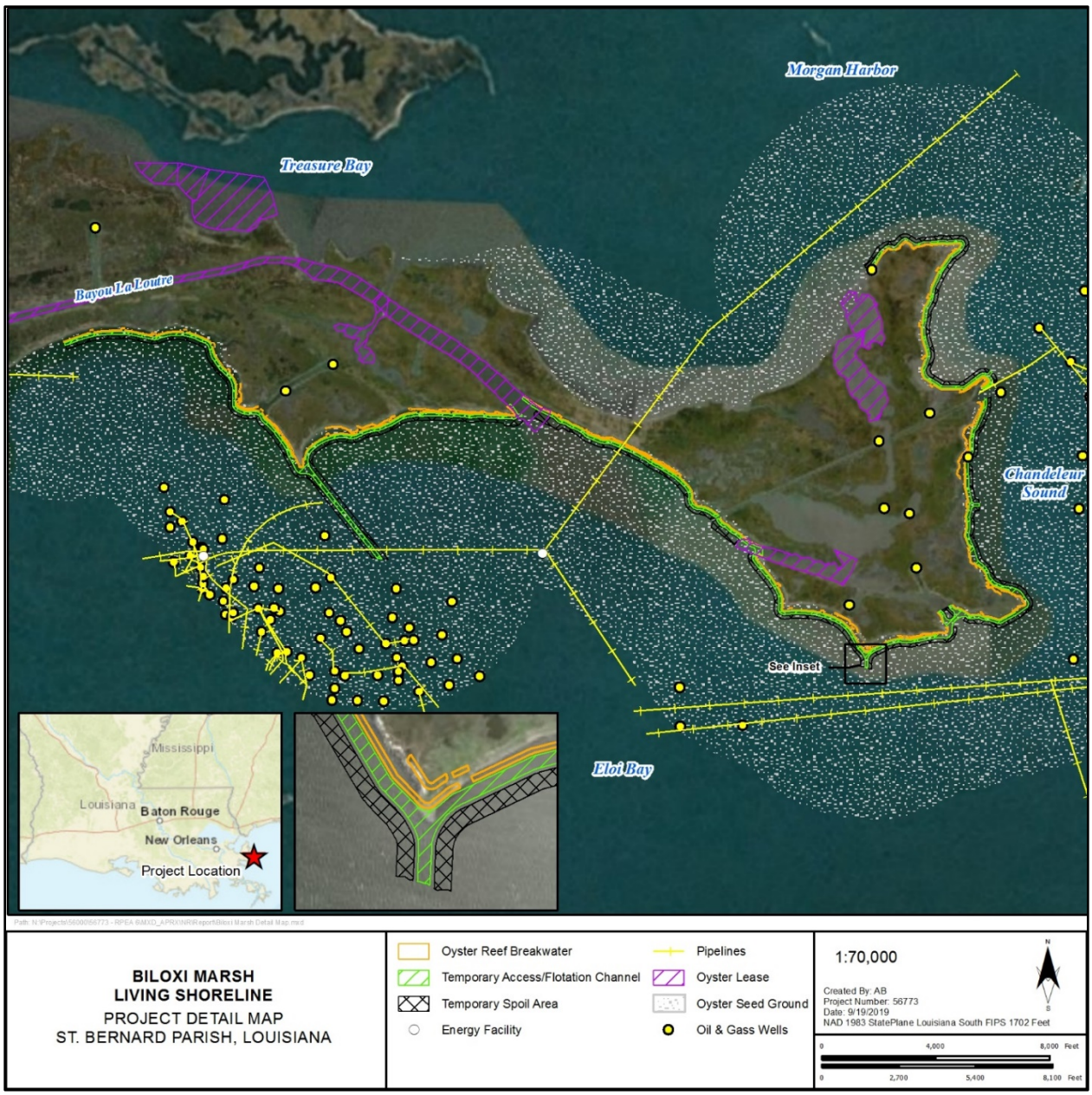

Figure 3.2-3. Location of the Biloxi Marsh Living Shoreline alternative.

Oyster reef breakwaters would be constructed from materials such as concrete, steel, mesh, geogrid, rock, floating platforms, oyster shell, or similar materials. The oyster reef breakwater would be constructed on the edge (approximately 0–400 feet) off the existing shoreline. The oyster reef breakwater would range from 8 to 35 feet wide at the base of the breakwater. The height of the breakwater would ultimately be determined so that it maximizes project performance over the 9 to 11 miles (and no more than 12.5 miles) of living shoreline structures. USCG-approved Navigation Aids (NAVAIDS) would be permanently installed in key locations using pile driving. To facilitate construction of the breakwater, a temporary access channel may be dredged approximately 20 feet from the breakwater on the seaward side along the length of the alternative.

Based on modeling conducted for preliminary engineering analysis, the alternative is estimated to reduce land loss by more than 50% where the reef breakwater structures are placed which would reduce the average shoreline erosion rate to -5.5 feet annually. Once met, the alternative would save approximately 6.0 to 7.3 acres per year over the 9 to 11 miles (and no more than 12.5 miles) of breakwater structure constructed (Mott MacDonald 2019).

Current and Historical Conditions

The Biloxi Marsh consists of approximately 189 square miles (49,000 hectares) of brackish and salt marshes that have been greatly impacted by shoreline erosion from wind-driven waves, with shoreline retreat rates ranging from 1 to 4 meters (m) per year (CPRA 2014a).

These marshes represent an important storm buffer to the city of New Orleans and are also productive habitats for many fish and wildlife species, as evidenced by the approximately 56 square miles (14,400 hectares) incorporated into the Biloxi Wildlife Management Area (WMA). The water bottoms around the Biloxi Marsh contain extensive areas of a low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). Spawning oysters from these grounds and nearby oyster seed grounds and bioengineered oyster reef projects (e.g., The Nature Conservancy's Lake Fortuna and Eloi Bay reefs and CPRA's completed Living Shoreline Protection Demonstration project) should provide ample larvae to facilitate development of the Biloxi Marsh alternative. Once established, the alternative could enhance the productivity of local oyster stocks. This is particularly important considering the Biloxi Marsh area is less prone to Mississippi River flooding events that impact oyster grounds in nearby Breton Sound (Soniat et al. 2013). The Biloxi Marsh reefs, therefore, could supply recruits to expedite recovery of flood-damaged oyster grounds, as well as other nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole.

Restored Coastal Habitats

Approximately 9 to 11 miles of living shoreline structures would be installed along the alternative. These shoreline protection features would serve as an important first line of defense for coastal marshes, functioning to help sustain the lower Biloxi Marsh (an important landbridge separating the Gulf of Mexico from Lake Borgne) by helping to prevent and/or reduce the rate of erosion of the marshes and shorelines along the shores of Eloi Bay.

Construction Methodology and Schedule

CPRA has engaged in a pre-bid Request for Information process to help drive competition and achieve cost savings and cost effectiveness in the implementation of the alternative. In February 2019, CPRA issued a Request for Information to solicit information from artificial reef manufacturers to develop a list of approved equivalent product configurations for potential use in the construction of the Biloxi Marsh alternative. CPRA evaluated the information received through the Request for Information, supplemented the information with engineering analyses conducted by the CPRA project design team, and determined the applicability of each product for use at the alternative. The final list of approved equivalent products is currently under development by CPRA. All products listed on the final list of approved equivalent products must be able to be installed by a third-party construction contractor.

If the alternative is selected for NRDA funding by the LA TIG, CPRA would include the final list of approved equivalent products in the *For Bid* documents for public bidding by prospective construction contractors. The *For Bid* documents are anticipated to include design details within the plans and a comprehensive technical specification for each product or product configuration (as applicable). It is anticipated that the *For Bid* plans would delineate the alternative shoreline into discrete segments with

multiple product configurations eligible for installation to maximize performance of the restoration alternative and adapt to the variation in site conditions. Ultimately, it would be the contractor's sole decision to select the product configuration he/she wishes to install from the eligible list for each delineated segment of Biloxi Marsh shoreline. Not all product configurations are anticipated to be included for each delineated segment. Inclusion on the final list of approved equivalent products and *For Bid* documents does not guarantee selection of a particular artificial reef project by the contractor. One construction contract is anticipated to be awarded. It should be noted that even if certain product are not selected as an approved equivalent product configuration for this alternative, this would not preclude those manufacturers from participating in other CPRA projects.

Construction methods for the Biloxi Marsh alternative would involve using an excavator, crane, or similar equipment to place oyster reef breakwaters along the shoreline. Where tree stumps are present within the placement area, the stumps would likely be removed/excavated individually, and the void would be backfilled with granular fill. Geotextile fabric would be installed prior to oyster reef breakwater placement. Oyster reef breakwaters would be constructed from materials such as concrete, steel, mesh, geogrid, rock, floating platforms, oyster shell, or similar materials.

There is no upland access to the restoration area. Access would be obtained from a navigable waterway such as Breton Sound via the Mississippi River. To facilitate construction of the breakwater, a temporary access channel may be dredged approximately 20 feet from the oyster reef breakwater along the length of the alternative along the seaward side of the breakwater. The temporary access channel would be excavated using barge-mounted bucket excavators and associated crews. All excavated material would be placed into a designated location for temporary spoils, approximately 20 feet from the temporary access channel on the seaward side of the access channel. The temporary spoils would be backfilled into the temporary access channel at the completion of the alternative.

Marsh buggy and other track equipment would be limited to 18 feet wide and confined to the alternative footprint. All equipment would be mobilized and demobilized by barge. Fully loaded drafts of all vessels would not exceed 7 feet at the lowest point on all vessels. Other construction machinery would include work boats and crew boats, quarters barge generators, welding machines, and miscellaneous vehicles.

Oyster lease areas would be buffered by 150 feet to avoid impacts during construction. If unfeasible, oyster leases within the 150-foot buffer would be acquired and extinguished prior to construction. CPRA is the only entity with the authority to extinguish oyster leases. The oyster lease extinguishment process is discussed in greater detail in Section 4.4.3.6.

The total estimated construction duration is 25 months.

Monitoring Requirements

Monitoring of the Biloxi Marsh alternative is described in the attached MAM plan (see Appendix D).

3.2.3.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

Additional E&D is underway and is being funded entirely by the RESTORE Act grant this alternative received alternative. No additional E&D costs are needed for implementation of the alternative, and construction and implementation can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). All portions of the alternative are located within shore-fringing marsh areas in offshore state waters. No new rights-of-way or in-fee land acquisitions would be required. The alternative may include the construction of a marine mattress if it is determined that artificial reef

breakwaters are not appropriate for some areas of high erosion or where additional shoreline protection is needed. The use of a marine mattress would require a land rights agreement with a private landowner. The artificial reef breakwaters would be placed offshore with permission of the Louisiana Office of State Lands.

E&D, land rights, due diligence, permitting activities, and early adaptive management (Phase 1) for the Biloxi Marsh alternative were funded with RESTORE Act monies. The total estimated cost for all restoration components of the Biloxi Marsh alternative is $66,600,000 (NRDA funds) (Table 3.2-3). This includes construction, construction administration, construction supervision, operations and maintenance, post-construction monitoring, contingencies monitoring, and contingencies. The estimated cost represents a close approximation given the current E&D status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-3. Construction Cost Estimate for the Biloxi Marsh Living Shoreline Alternative

Description	Cost
Construction	$54,300,000
Operation and maintenance	$10,300,000
MAM	$2,000,000
Total (NRDA funds)*	**$66,600,000**

* Including contingency.

The cost to implement the Biloxi Marsh alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by CPRA.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Biloxi Marsh alternative is intended to address and restore the important linkages among wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Pontchartrain Basin, within which the coastal wetlands provide foundational habitat for the Pontchartrain

Basin ecosystem, support resources within the Pontchartrain Basin, and are interconnected with other resources throughout the Gulf of Mexico that were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through oyster reef habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitats; accelerate recovery of injured ecosystem functions; and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Biloxi Marsh alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating 9 to 11 miles of marsh-fringing oyster barrier reef to provide protection as a self-sustaining living shoreline. The benefits from the Biloxi Marsh alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative as described in the following examples:

- Living Shoreline Demonstration Project (PO-148; 2017; St. Bernard Parish), which provides approximately 3 miles of reef breakwater structure along the shoreline of Eloi Point (Mott MacDonald 2017).
- Terrebonne Bay Shore Protection Demonstration (TE-0045; 2007; Terrebonne Parish) is a demonstration project to demonstrate the cost and effectiveness of alternative shore protection methods, including artificial oyster reefs. The project evaluates three fabricated structures placed along the shore for their effectiveness in abating shoreline erosion, and for their ability to develop and sustain an oyster reef. In this project, each protection measure was installed to provide wave protection (Melancon et al. 2013).

This documented experience and the successful completion of previous living shoreline projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas. It is estimated that the alternative would have a 20-year design life (Mott MacDonald 2017).

Prevention of Future Injury and Avoid Collateral Injury

Living shoreline projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The marsh-fringing oyster reefs that would be provided by the Biloxi Marsh alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of the Biloxi Marsh and surrounding wetlands. Further, shoreline creation and enhancement can help reduce future coastal land

loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review of this alternative is described in Section 4.4 and indicates that adverse effects to wildlife or protected species (such as Gulf Sturgeon and West Indian manatee), including turbidity, noise and other disturbances in the water column, habitat disturbance (SAV, benthic, EFH), and behavioral changes, would largely be minor, localized, and often short term. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of oyster reef habitat and shoreline protection restore important linkages among wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the alternative includes creating 9 to 11 miles (and no more than 12.5 miles) of marsh-fringing oyster barrier reef to provide protection as a self-sustaining living shoreline. The benefits from the alternative would extend to multiple resources injured both directly and indirectly.

Public Health and Safety

The alternative would not affect public health and safety. Creation of oyster reefs included in this restoration alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.3.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Biloxi Marsh alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the Biloxi Marsh alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.4 Fifi Island Forested Ridge with Breakwater Alternative

3.2.4.1 ALTERNATIVE DESCRIPTION

Overview

The Fifi Island Forested Ridge with Breakwater alternative (hereinafter the *alternative* or the *Fifi Island alternative*) is in Jefferson Parish, Louisiana, along the southwestern shoreline of Fifi Island along Bayou Rigaud (Figure 3.2-4). The area is immediately adjacent to breakwaters constructed by the Grand Isle Independent Levee District in 2015.

Figure 3.2-4. Location of the Fifi Island Forested Ridge with Breakwater alternative.

The alternative would create habitat on Fifi Island and protect Grand Isle and the nearby barrier islands from storm surges and wave action through the construction of approximately 22 acres of forested ridge and approximately 1,200 linear feet of rock breakwater. An approximately 6,000-foot forested, coastal ridge would be constructed along the north bank of Bayou Rigaud behind existing rock breakwaters.

The goals of the alternative are as follows:

1. Restore habitats within the Barataria Basin.
2. Protect resources, habitat, and other nearby restoration efforts on Fifi Island and Grand Isle.

Rock Breakwater

Approximately 1,200 linear feet of new rock breakwater would be constructed on the southwest end of the island to extend the existing breakwater system around the island. The new rock breakwater would generally match the size of the existing breakwater, with an approximate base width of 80 feet and height of 8 feet above mean sea level. Composite geosynthetic material would be placed as the foundation of the breakwater, with stone and rock used as the primary construction material for the breakwater. The toe of both slopes (front and back) would be armored with additional rock to provide scour protection and prevent erosion of the structure.

Forested Ridge

The ridge would be constructed of approximately 92,000 cubic yards of sediment dredged for access to the site and supplemented from sediment from a local borrow area. The specific borrow area for the Fifi Island alternative has not been identified. Borrow areas that could be used for construction of the alternative are Bayou Rigaud, Barataria Waterway Bar Channel, and Barataria Waterway Bay, all of which have been subject to environmental review and approved for use as borrow areas (Averill 2019). One or more of these borrow areas would be used to construct the ridge. The sediment would be placed on the protected (or inland) side of the newly constructed and existing rock breakwater (described above). The ridge would be approximately 6,000 feet long, 160 feet wide at the base, and 5 feet above mean sea level. The base of the ridge is estimated to be approximately 5 feet below the water line, and the total height would be approximately 10 feet.

The forested ridge would be planted to restore coastal live oak-hackberry forest, which is rated as critically imperiled and imperiled in Louisiana because of rarity (LDWF 2005a). The coastal ridge habitat would provide important habitat to migratory birds and other species. The ridge would also function as a barrier to further protect against impacts on Louisiana's only accessible and inhabited barrier island by reducing storm surge in Caminada Bay. Previous storms have demonstrated that a forested ridge on Fifi Island would protect infrastructure on Grand Isle during a storm, especially when winds and surge come from the north.

Current and Historical Conditions

Fifi Island and Grand Isle are two of many barrier islands that emerged from receding Mississippi River Delta lobes. Numerous hurricanes and the DWH Oil Spill demonstrated the advantage of robust barrier islands in providing shoreline resilience and reducing hurricane damage reduction. Louisiana's barrier islands protect inland populations from wind and wave action as well as storm surges generated by tropical storms and hurricanes. In addition, barrier shorelines are unique habitats that represent the foundation for complex and productive coastal ecosystems.

The restoration of barrier islands, including Grand Isle and Fifi Island, is part Louisiana's coastal master plan (CPRA 2017a) as well as a priority for other funding sources such as the RESTORE Act; the Coastal Wetlands Planning, Protection and Restoration Act (CWPPRA); Coastal Impact Assistance Program; and NRDA. The alternative would expand upon and enhance multiple shoreline protection projects that have already been constructed or are planned around Grand Isle, Fifi Island, and Cheniere Caminada, including the following:

- **Grand Isle Bayside Segmented Rock Breakwater Project and Habitat Enhancements**: Construction of sixteen 350-foot bayside nearshore segmented breakwaters on the bay side of Grand Isle to bridge the existing gap in bayside breakwaters previously constructed to provide storm surge protection.
- **Grand Isle Beach Stabilization:** Restoration and shoreline protection of approximately 1 mile of Grand Isle beach and dune system.
- **Grand Isle and Vicinity Breakwater:** Stabilization of the western portion of beach and dune in Grand Isle by constructing beach, dune, and segmented rock breakwaters.
- **Grand Isle State Park Improvements:** Improvement of fishing and recreational use of the state park and protection of coastal, nearshore marine habitats and inland infrastructure. Upgrades to the existing fishing pier, extension of the rock jetty on the east shore of the park, and extension of the jetty on the north end of the park.
- **Caminada Headland Beach and Dune Restoration Increment 2:** Restoration and protection of 489 acres of beach and dune habitat across the Caminada Headland through the placement of approximately 5.4 MCY of sandy material from Ship Shoal (an offshore borrow source).
- **Grand Isle and Vicinity Hurricane Protection Project:** Construction of an approximately 7.5-mile vegetated sand dune extending the length of Grand Isle's Gulf shore, a jetty to stabilize the western end of the island at Caminada Pass, and an offshore breakwater system.

Restored Coastal Habitats

Approximately 22 acres and 6,000 linear feet of forested ridge on Fifi Island would be created by the alternative. These shoreline protection features would provide important habitat for migratory bird species and species and types of habitat that were directly impacted by the DWH. The breakwater and forested ridge would also serve as a barrier to further protect against impacts to Grand Isle, Louisiana's only accessible and inhabited barrier island, by reducing storm surge in Caminada Bay.

Construction Methodology and Schedule

Construction methods for the Fifi Island alternative would involve using an excavator to either excavate or backfill the footprint of the rock breakwater with rock gravel. Geotextile fabric would be placed over the fill prior to placing the breakwater. To facilitate construction of the breakwater, a temporary access channel would be dredged several meters off the shoreline along the length of the alternative because there is no upland access to the restoration area. The temporary access channel would be excavated using barge-mounted bucket excavators and associated crews. All excavated material would be placed behind the proposed and existing breakwaters to build the ridge, approximately 20 feet on the inland side of the breakwater.

The ridge would be constructed adjacent to a buried 20-inch oil or gas pipeline, which follows the length of the proposed ridge location. The design of the alternative would allow for gaps in the breakwater (Averill 2019). This pipeline is estimated to be at least 6 feet below the water line and would be protected during construction with matting (Averill 2019).

Marsh buggy and other track equipment would be confined to the alternative footprint. All equipment would be mobilized and demobilized by barge. Other construction machinery would include work boats and crew boats, quarters barge generators, welding machines, and miscellaneous vehicles. Silt curtains would be temporarily placed on all sides of the construction area to minimize turbidity and movement of sediment into the surrounding water. The total estimated construction time is 12 months.

Monitoring Requirements

Monitoring of the Fifi Island alternative would be conducted by the proponent in accordance with the mitigation plan required in the Coastal Use Permit (CUP)/Consistency Determination (P20140028). Jefferson Parish is currently seeking a modification to the CUP permit to cover the Fifi Island alternative.

3.2.4.2 OIL POLLUTION ACT EVALUATION

Cost Effectiveness

Additional E&D would be needed for implementation of the alternative. Construction of the alternative can begin within the timeframe indicated in the NOS (12–18 months from NOS publication on June 7, 2019). The onshore portion is on state-owned land, and the offshore portions of are within state-owned water bottoms. No new rights-of-way or in-fee land acquisitions would be required.

The total estimated cost for all restoration components of the Fifi Island alternative is $7,437,000 (NRDA funds) (Table 3.2-4). This includes construction, construction administration, construction supervision, inspection, and post-construction monitoring. The estimated cost represents an approximation given the current E&D status and is comparable with the costs of similar alternatives of this size and scope.

Table 3.2-4. Construction Cost Estimate for the Fifi Island Forested Ridge with Breakwater Alternative

Description	Cost
E&D	$531,000
Construction	$6,906,000
Total (NRDA funds)*	**$7,437,000**

* The proponent of this alternative is not requesting funds for operations and maintenance or for monitoring.

The cost to implement the Fifi Island alternative is reasonable, appropriate, and comparable to other equivalent restoration alternatives. All work on the alternative would be awarded in compliance with Louisiana's public bid laws and regulations, ensuring that the alternative is constructed at current market rates. Projections of operating costs and use were based on other similar projects managed by Jefferson Parish.

Trustee Restoration Goals and Objectives

The alternative has a strong nexus to the DWH injuries to wetland, coastal, and nearshore habitats. As discussed in Section 1, almost all types of nearshore ecosystem habitats, including coastal wetlands and marshes, in the northern Gulf of Mexico were oiled and injured as a result of the DWH Oil Spill, with coastal Louisiana sustaining the most shoreline oiling.

The DWH Oil Spill resulted in oil in the water column that caused direct and indirect impacts on the productivity of wetland, coastal, and nearshore habitats through degradation of marsh edge habitats; injury to animals using marsh edge for refuge and forage; and changes in ecological and physical relationships such as food-web dynamics, organism movements, nutrient and sediment transport and cycling, and other fundamental ecosystem processes.

The Final PDARP/PEIS determined that injuries to marsh flora and fauna can persist until oil concentrations in marsh soils fall below levels that are toxic to the most sensitive prey species (DWH Trustees 2016). It also determined that life stages and long-lived species can take years to recover. As a result, the Trustees placed particular emphasis on coastal and nearshore habitat restoration in the historic Mississippi River Delta plain in the Final PDARP/PEIS. The Trustees further identified approaches and techniques for wetlands, coastal, and nearshore habitat restoration that should be prioritized to allow the most efficient use of restoration funding (LA TIG 2018b).

The Fifi Island alternative is intended to address and restore the important linkages among and between wetland, coastal, and nearshore habitats that were disrupted by DWH injuries. The alternative is located within the Barataria Basin, the coastal wetlands of which provide foundational habitat for the Barataria Basin ecosystem, support resources within the Barataria Basin and throughout the Gulf of Mexico, and were among the most heavily oiled parts of the Gulf Coast shoreline. The alternative provides multiple ecosystem benefits through forested ridge habitat restoration and the opportunity as indicated by the Trustees to restore multiple habitats through one project. The alternative also supports the Trustees' implementation of multiple projects within a given area to reestablish linkages between wetland, coastal, and nearshore habitat, accelerate recovery of injured ecosystem functions, and achieve a more integrated restoration of the nearshore ecosystem and its service flows. The restoration activities included under the alternative are included in the Trustees' selection of approaches and techniques to be prioritized for efficient use of restoration funding (LA TIG 2018b).

The Fifi Island alternative represents in-place, in-kind restoration to wetland complexes and nearshore habitats and is fully consistent with OPA objectives for compensatory restoration. The alternative's location and restoration benefits are within the geographical footprint of the DWH injury to wetland, coastal, and nearshore habitats. The Trustees emphasized restoration of wetland complexes because of their role in providing a wide range of ecological functions and services including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils. The scope of the alternative includes creating approximately 22 acres of forested ridge habitat and approximately 1,200 linear feet of rock breakwaters. The benefits from the Fifi Island alternative would extend to multiple resources injured both directly and indirectly.

Likelihood of Success

The Trustees have successfully implemented projects similar to the alternative. This documented experience and the successful completion of previous ridge creation and breakwater projects demonstrate that the alternative would have a high likelihood of success. The alternative is technically feasible, uses proven techniques with established methods and documented results, and can be implemented with minimal delay after E&D completion. The restoration and protection elements of the alternative would be resilient to future environmental change and would also increase the resiliency of nearby coastal areas.

Prevention of Future Injury and Avoid Collateral Injury

Ridge creation and breakwater projects help prevent future injuries to marsh vegetation and soils, as well as estuarine-dependent resources, such as fish, crustaceans, and marsh birds. The ridge and breakwaters that would be provided by the Fifi Island alternative would help prevent future injury to estuarine-dependent resources by increasing the longevity and self-sustainability of surrounding marshes and wetlands. Further, ridge creation and breakwaters can help reduce future coastal land loss. Implementing the alternative would not result in collateral injury to resources. A thorough environmental review of this alternative is described in Section 4.5 and indicates that adverse effects to wildlife or protected species (such as the West Indian manatee and sea turtles), including turbidity, noise and other disturbances in the water column, habitat disturbance (SAV, benthic, and EFH), and behavioral changes, would largely be minor, localized, and often

short term. The BMPs and measures to avoid or minimize impacts (as described in Appendix C and Section 6, Appendix A of the Final PDARP/PEIS) would be implemented. As a result, collateral injury would be avoided and minimized during implementation of the alternative.

Benefits to Multiple Resources

Creation of ridge habitat and breakwater shoreline protection restore important linkages among and between wetland, coastal, and nearshore habitats. Restoration of wetland complexes can achieve multiple ecosystem benefits, because they provide a wide range of ecological functions and services, including providing important habitat for fish and wildlife species, improving water quality, stabilizing shorelines, reducing storm-surge risk, and capturing and storing carbon in organic soils, thereby achieving a more integrated restoration of the nearshore ecosystem and its service flows. The scope of the alternative includes creating approximately 22 acres of forested ridge habitat and approximately 1,200 linear feet of rock breakwaters. The benefits from the Fifi Island alternative would extend to multiple resources injured both directly and indirectly in the alternative's footprint.

Public Health and Safety

The alternative would not affect public health and safety. Creation of the ridge included in this restoration alternative would benefit health and safety by restoring and protecting an estuarine wetland system, reducing coastal land loss, and improving flooding and shoreline protections.

3.2.4.3 ALTERNATIVE EVALUATION SUMMARY

The LA TIG has completed its OPA evaluation of the Fifi Island alternative. The OPA analysis indicates the alternative would provide benefits to wetland, coastal, and nearshore habitats with a strong nexus to the injuries caused by the DWH Oil Spill. The alternative would occur in the Louisiana Restoration Area.

The alternative has a clear nexus to the injuries described in the Final PDARP/PEIS because implementation of the Fifi Island alternative would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternative would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternative would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

BMPs and measures to avoid or minimize adverse impacts would be implemented in the design of the alternative. Implementation of the alternative would prevent future injury and avoid and minimize potential collateral injury. There would be no adverse impact on public health and safety.

3.2.5 Natural Recovery/No Action Alternative

The OPA regulations require that "Trustees must consider a 'natural recovery alternative' in which no human intervention would be taken to directly restore injured natural resources and services to baseline" (40 CFR 990.53[b][2]). This natural recovery alternative is synonymous with the "no action" alternative evaluated under NEPA. Under the natural recovery/no action alternative, the Trustees would not prepare a restoration plan nor implement future restoration projects under NRDA, other than those already

approved through the Early Restoration process. The Trustees would allow the natural recovery process to occur, which could result in one of the four outcomes for injured resources: 1) gradual recovery, 2) partial recovery, 3) no recovery, or 4) further deterioration.

The Final PDARP/PEIS notes that interim losses of natural resources and the services natural resources provide would not be compensated under a natural recovery/no action alternative (DWH Trustees 2016: 5–92). Given that technically feasible restoration approaches are available to compensate for interim natural resource and service losses, the Trustees rejected this alternative from further OPA evaluation within the Final PDARP/PEIS. Based on this determination, tiering this RP/EA from the Final PDARP/PEIS, and incorporating that analysis by reference, the LA TIG did not evaluate natural recovery as a viable alternative under OPA in this RP/EA. For these reasons, the LA TIG rejects the natural recovery/no action alternative as a viable means of compensating the public for injuries to wetlands, coastal, and nearshore habitats caused by the DWH Oil Spill.

3.3 Oil Pollution Act Evaluation Conclusions

The LA TIG has completed its OPA evaluation of four restoration alternatives. The OPA analysis indicates that each of these would provide benefits to wetlands, coastal, and nearshore habitats with a strong nexus to injuries caused by the DWH Oil Spill. The alternatives would all occur in the Louisiana Restoration Area.

Each of the restoration alternatives has a clear nexus to the injuries described in the Final PDARP/PEIS because creation of marshes, oyster reefs, and breakwaters, and creation or enhancement of shorelines, dunes, and ridges would restore a variety of interspersed and ecologically connected coastal habitats; restore for injuries to habitats, while including approaches that provide resiliency and sustainability; and restore habitats in combinations appropriate for the geographic area.

The alternatives would be technically feasible, would use proven approaches or techniques with established methods and documented results, and would be resilient to expected future environmental change. Multiple ecosystem service benefits would accrue from increased ecological values, stabilized substrates, improved water quality, increased storm and flood protection, improved air quality, improved and expanded habitats and habitat resources, increased expenditures, improved recreational resources, and improved aesthetic and visual resources. These benefits would be widespread and would occur over an extended timeframe. The alternatives would be implemented at a cost that is reasonable, appropriate, and comparable or equivalent to other restoration alternatives.

For all alternatives, the restoration approaches would ensure that any collateral damage to the environment is minor and minor and mitigated. Furthermore, no adverse impacts to public health are anticipated from any of the alternatives.

Based on the analysis above, all four alternatives would achieve restoration goals associated with the Wetlands, Coastal, and Nearshore Habitats restoration type. However, three of the alternatives, West Grande Terre, Golden Triangle, and Biloxi Marsh, do so on a much larger scale. The size of the Fifi Island alternative is small in scale (22 acres) compared to the other alternatives carried forward from the screening process; therefore, the net benefits are also smaller in scale. For these reasons, the LA TIG has determined that West Grande Terre, Golden Triangle, and Biloxi Marsh are the preferred alternatives for this RP/EA. The Fifi Island alternative could be considered in future restoration plans.

4 ENVIRONMENTAL ASSESSMENT

4.1 Introduction

Under NEPA, federal agencies must consider the environmental effects of their actions that include impacts on social, cultural, economic, and natural resources. The Final PDARP/PEIS evaluates a range of restoration approaches, thus enabling narrower NEPA analyses for subsequent restoration plans, such as this RP/EA. Subsequent restoration plans typically include project-specific actions (programmatic actions may also be tiered to the PDARP/PEIS), which are presented in this RP/EA as the proposed alternatives. Consistent with 15 CFR 990.23, this section presents the NEPA evaluation of the suite of reasonable alternatives as determined by the OPA evaluation in Section 3.

This RP/EA tiers from the Final PDARP/PEIS, and for this reason, the NEPA analysis herein refocuses from the programmatic scale of the Final PDARP/PEIS to this subsequent project-specific restoration plan prepared by the LA TIG (40 CFR 1502.4(b); 40 CFR 1508.28; 40 CFR 1502.20; see Chapter 6 of the Final PDARP/PEIS). As a tiered NEPA document, this RP/EA incorporates by reference relevant evaluations of the Final PDARP/PEIS's Chapter 3 (Ecosystem Setting) and environmental consequences from the Final PDARP/PEIS's Section 6.4.1 (Restoration Type: Wetlands, Coastal and Nearshore Habitats). This RP/EA is consistent with the Final PDARP/PEIS and ROD and provides a NEPA analysis for each proposed alternative, including whether the analyses of relevant conditions and environmental effects described in the Final PDARP/PEIS are still valid and whether impacts from the alternatives have already been fully analyzed in the Final PDARP/PEIS.

To determine whether an alternative has the potential to result in significant impacts, the context and intensity of the action must be considered. *Context* refers to area of impacts (local, statewide, etc.) and their duration (e.g., whether they are short- or long-term impacts). *Intensity* refers to the severity of impact and could include the timing of the action (more intense impacts would occur during critical periods like high visitation or wildlife breeding/rearing, etc.). *Intensity* is also described in terms of whether the impact would be beneficial or adverse. For purposes of this document, impacts are characterized as minor, moderate, or major, and short term or long term. The definition of these characterizations is consistent with Section 6 of the Final PDARP/PEIS (Appendix E).

The environmental consequences sections of this RP/EA analyze the beneficial and adverse impacts that would result from the implementation of any of the alternatives considered in this RP/EA.

Adverse is used in this section only to describe the federal Trustees' evaluation under NEPA. This term is defined and applied differently in consultations conducted pursuant to the ESA and other protected resource statutes. Accordingly, in the Protected Species sections below, there may be adverse impacts identified under NEPA; however, this does not necessarily mean that an action would result in a likely to adversely affect determination for that species under protected resources statutes. The results of any completed protected resource consultations are included in the administrative record.

4.1.1 Best Management Practices and Conservation Measures

Section 6, Appendix A of the Final PDARP/PEIS contains BMPs to avoid or minimize impacts protected and listed species and their habitats and are relied upon in the foregoing environmental consequences analysis for protected species. Additional BMPs that may be implemented as part of an alternative generally include design criteria, lessons learned, expert advice, and tips from the field. The environmental consequences described in Section 4.2 through Section 4.5 are presented largely without factoring in BMPs that could avoid or minimize the potential adverse impacts from an alternative, unless the BMPs are explicitly included in the environmental impacts analysis. However, BMPs that may be implemented to reduce potential impacts and would be established during project planning and implementation by the Trustees are provided in Appendix C.

4.2 West Grand Terre Beach Nourishment and Stabilization Alternative

4.2.1 Physical Resources

4.2.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The West Grand Terre alternative encompasses West Grand Terre Island, which is the most southeastern point of land in Jefferson Parish and Plaquemines Parish, Louisiana. West Grand Terre Island is on the Mississippi River Delta plain in the Barataria Basin, which is bounded by the Mississippi River on the east and the Bayou Lafourche on the west. West Grand Terre Island was part of a larger area, Grand Terre, which was formed through a process of delta lobes prograding and subsiding into the Gulf of Mexico that created beach ridges. Over time, Grand Terre was divided through wave action, storms, and sea level rise to form East and West Grand Terre Islands. West Grand Terre Island is accessible only by boat and includes undeveloped coastal land with a beach and dunes, marshland, and intertidal wetlands. Other features of the West Grand Terre alternative, including conveyance corridors, disposal areas, and a borrow area, extend off the island into Plaquemines Parish and the coastal waters of Barataria Basin.

The Barataria Basin is an interdistributary basin composed of poorly sorted sediments that are largely influenced by subsidence rates and transported sediment deposits (Roberts 1986: 435). The coastal marsh geology of West Grand Terre Island is characterized by Holocene back-barrier marsh and mangroves comprising fine sand and clay deposited over surface sandy washover deposits. The Gulfward edge of the island is characterized by Holocene beach sand comprising sand and shelly sand (Louisiana Geological Survey 2014). Surface soils on West Grand Terre Island are part of the Scatlake series, which comprises soils that are very poorly drained and semi-fluid soils with slopes less than 0.5% and elevations of approximately 1 foot about sea level (Matthews 1982: 53). These soils, which are found in saline marshes that are primarily ponded or flooded and surrounded by small ponds and perennial streams, are formed in unconsolidated saline clayey and organic sediments. Beach sediments on the island contain an average of 96.8% sand and 4.8% silt, with an average grain size of 0.167 mm. Borrow area sediments contain an average of 91.5% sand and 8.5% silt, with an average grain size of 0.157 mm. Substrates in the restoration area are primarily Scatlake muck that comprise soft muck and clay.

West Grand Terre Island has experienced persistent degradation and erosion. Sediments dredged during maintenance of Barataria Waterway by USACE were deposited on West Grand Terre between 1996 and 2020 (1999 [618,000 cubic yards], 2002 [126,000 cubic yards], 2006 [688,000 cubic yards], 2009 [480,000 cubic yards], and 2020 [approximately 175,000 cubic yards]), helping to create up to 111 acres of marsh and 36 acres of beach (USACE n.d. [2014], CPRA 2020). Despite these beneficial sediment deposits, the island has experienced shoreline and land changes due to subsidence and sea level rise, resulting in an overall sediment gain on the marsh side of the island and overall sediment loss on the shoreline of the island.

Environmental Consequences

The West Grand Terre alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

The use of onshore staging areas and construction activities on West Grand Terre Island would disturb substrate materials. Offshore activities, including anchoring of vessels and the use of equipment on the shoreline and on barges, marsh buggies, or other vessels to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of dredging disturbance in the borrow area would range from -56.0 feet to -70.0 feet NAV88.

The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to geologic changes. Sand fencing and vegetation would be installed in the dune and MCAs to prevent exposure of soils and sediments and reduce erosion.

The installation of the rock revetment and the placement of dredged materials in the restoration areas and overburden disposal area would result in compaction and sediment disturbance that would lead to localized changes to substrates and may affect sediment dynamics over the life of the alternative. Where the constructed rock revetment segments overlap with shoreline or land, existing substrates and geology would be permanently covered to protect the area from shoreline erosion.

Locating the overburden disposal area in an area where disturbance has previously occurred would reduce the overall area and intensity of disturbance that would contribute to erosion and would avoid changes to geology and substrate characteristics. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by controlling erosion. Adverse impacts from construction and implementation of the alternative would be short term and minor.

Once completed, the restoration and enhancement of the Gulf beach, dune system, and marsh would provide long-term benefits to geology and substrates. The depositions of sediments in the MCAs and beach and dune systems would raise substrate elevations affected by subsidence and sea level rise, thereby helping to increase the resilience of the coastal wetlands. Restoration of the marshes and beach and dune areas would increase protection of the coastline from sea level rise and reduce shoreline erosion, and the rock revetment would reduce wave energies and currents on the shoreline of West Grand Terre. These, long-term benefits to geology and substrates from implementation of the alternative help restore and support natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

4.2.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

Basins and Impaired Waterbodies

The West Grand Terre alternative is in the Barataria Basin, between the Mississippi River to the north and east, the Bayou Lafourche to the west, and the Gulf of Mexico to the south. The topography of the Barataria Basin is marked by lakes, lacustrine deltas, distributary channels, crevasse splays, natural levees, drainage channels, and extensive swamps and marshes. The upstream portions of the basin are narrow and heavily influenced by freshwater, whereas the downstream portions range from open water to saltwater of the Gulf of Mexico that intrude marshes and lakes (Roberts 1986).

Open bodies of water in Barataria Basin include bays, lakes, and drainage channels that vary in size. The size of the waterbodies in the basin typically increases from north to south until the waterbodies merge into interdistributary bays, including Barataria Bay. Flows within the basin are variable throughout the year, with maximum and minimum flows usually occurring in the spring and fall, respectively. Barataria Bay, which is at the southern end of the basin on the north side of West Grand Terre Island, is a shallow, brackish waterbody with a mean depth of approximately 5 feet (3.1 m).

There are no fresh surface waterbodies on West Grand Terre Island. The waters around the island and in which the corridors, borrow area, and overburden disposal area would be located include Barataria Bay (subsegment 021101) and coastal bays and Gulf waters within the state 3-mile limit (subsegment 021102) (LDEQ 2014). There are no aquifers underlying West Grand Terre Island; the closest aquifer is the Mississippi River alluvial aquifer, approximately 40 miles north of the island (LDEQ 1988). Water levels in the alternative vary with storm surges and tides. Offshore water depths gradually increase seaward, reaching a depth of 18 feet (11.2 m) approximately 1.8 mile (3 km) from shore. Water depths along the corridor alignments vary from approximately -31 feet NAVD88 to 0 feet NAVD88 at the island.

The water quality of Barataria Basin is influenced by freshwater inputs (primarily rainfall) to the watershed and outflows from the Mississippi River. The waters surrounding the island (subsegment 021101) are listed as fully supporting Primary Contact Recreation (PCR), Secondary Contact Recreation (SCR), Fish and Wildlife Propagation (FWP), and Oyster Propagation (OYS) (LDEQ 2019a). The coastal bays and Gulf waters to southeast of the island (subsegment 021102) fully support PCR, SCR, and OP; however, this subsegment does not fully support FWP because of naturally occurring low dissolved oxygen levels, in addition to atmospheric deposition and unknown sources of mercury that have led to fish consumption advisories (LDEQ 2019a). Despite fish consumption advisories, fishing remains a popular activity around the island. Because of the lack of freshwater and the distance from significant pollutant sources, the island is not at risk of fecal coliform contamination.

Wetlands and Floodplains

Small islands of intertidal vegetated and coastal wetlands are scattered throughout Barataria Bay on the northside of West Grand Terre Island. These wetlands, and other wetlands along Louisiana's coast, are major sources of carbon sequestration. Wetlands in the region have been deteriorating from subsidence and sea level rise, which have resulted in the conversion of uplands and wetlands to open water. A 2017 U.S. Geological Survey (USGS) report summarized wetland loss estimates published in the early 1990s for the Barataria Basin (USGS 2017). These estimates ranged between 5,200 acres per year (Dunbar et al. 1992) and 7,100 acres per year (Barras et al. 1994). USGS (2017) estimated another fifth of the basin's wetlands could be converted to open water by 2045.

The western and eastern portions of West Grand Terre Island and surrounding waters are identified as Coastal Barrier Resources System Areas and Otherwise Protected Areas, respectively, which are located within or adjacent to Special Flood Hazard Areas (SFHAs) subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone) (Federal Emergency Management Agency [FEMA] 2018). The area surrounding the island that includes the alternative and a portion of the western extent of the conveyance corridor is SFHA Zone VE, which is a coastal flood zone with wave action hazards and a base flood elevation (BFE) of 11 feet. The area south of the island that captures the remaining extent of the conveyance corridor and the entire overburden disposal area and borrow area extents is SFHZ Zone V, which is also a coastal flood zone with wave action hazards but does not have a determined BFE.

Barataria Pass, separating West Grand Terre Island from Grand Isle to the west, provides tidal flow between Barataria Bay and the Gulf. Lunar tidal range is typically approximately 1.1 feet (0.34 m) but can be highly influenced by frequent wind tides and tidal currents. Tidal currents have scoured a deep natural channel in Barataria Pass between West Grand Terre Island and Grand Isle, where the pass is approximately 0.6 mile (1 km) wide and water levels fluctuate between 60 and 160 feet (18.2 and 48.8 m). Ebb and flood tidal deltas have formed at both ends of the scoured channel (Conatser 1971). The saline marshes on and around West Grand Terre Island are often ponded or flooded, and the shallow sea floor approaching the island facilitates storm surge flooding of coastal areas.

Following Hurricane Katrina, USACE constructed a system of barriers, sector gates, floodwalls, floodgates, and levees as part of the Hurricane and Storm Damage Risk Reduction System, which is managed by the state's flood protection authority (Southeast Louisiana Flood Protection Authority – East 2017a). As part of this system, 28 miles of levees/floodwalls, 730 acres of levee turn maintenance areas, and 12 land-based flood gates were constructed by Jefferson levee districts.

Environmental Consequences

Construction and implementation of the West Grand Terre alternative would result in short-term, minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

The disturbance of soils and sediments and increases in erosion during construction could lead to increased turbidity and sedimentation in nearby wetlands and waterbodies, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards. Sand fencing and vegetation would be installed in the dune and MCAs to reduce erosion and contribution of turbidity.

The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize impacts on hydrology, water quality, and wetlands by minimizing sediment and pollutant loads into waterbodies and controlling stormwater runoff. Therefore, construction and implementation of the West Grand Terre alternative would result in short-term minor adverse effects to hydrology, water quality, and wetlands.

Once completed, the restoration and enhancement of the Gulf beach, dune system, and marsh would provide long-term benefits to hydrology, water quality, and wetlands. The creation of marshes and dunes and renourishment of the beach would help coastal wetlands reconnect to tidal flooding, which would restore the natural hydrology of the island. Restoring the hydrology would support the reestablishment of natural estuarine salinity gradients and would help maintain and improve coastal water quality, benefiting coastal habitats and resources on West Grand Terre Island and other nearby areas. These long-term benefits to hydrology, water quality, and wetlands from implementation of the alternative would help restore and support natural hydrologic processes and improve overall coastal resiliency. The restoration of wetlands would provide long-term benefits to other resources, including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration, thereby helping support linkages within the broader coastal and nearshore ecosystem. On November 25, 2019, USACE authorized the Clean Water Act and Rivers and Harbors Act permit for the West Grand Terre alternative.

4.2.1.3 AIR QUALITY

Affected Environment

West Grand Terre Island and nearby islands are uninhabited and only accessible by boat. As a result, air pollution sources on or near West Grand Terre Island and the borrow and overburden disposal areas are limited to infrequent boat traffic and small oil and gas processing facilities, including a small oil and gas facility located on the island. The closest major sources of air pollution occur in the urban-industrial

corridor from New Orleans to Baton Rouge, which is at least 70 miles from the island. Other sources of air pollution come from the degradation of wetlands, which are major sources of carbon sequestration. It is estimated that wetlands store upward of 25% of global terrestrial carbon (Wang and Dodla 2013), and the large expanse of wetlands along Louisiana's coast account for some of the world's more significant pools of soil-sequestered greenhouse gases (Harms 2018).

Air quality monitoring stations are operated throughout the state by the LDEQ Air Planning and Assessment Division to determine compliance with National Ambient Air Quality Standards (NAAQS) for carbon monoxide, lead, nitrogen dioxide, ozone, particulate matter (PM) 2.5 and 10, and sulfur dioxide (LDEQ 2019b). There are two air quality monitoring stations in the northern portion of Jefferson Parish near New Orleans: one in Marrero (EPA Air Quality Station [AQS] 220512001) and one in Kenner (EPA AQS 220511001). From 1995 through July 2019, the Jefferson Parish has been listed as an attainment area for all NAAQS (EPA 2019a). There are no air quality monitoring stations in Plaquemines Parish.

Environmental Consequences

Short-term, minor adverse impacts to air quality would result from construction of the alternative. In-water and onshore construction activities during implementation of the West Grand Terre alternative would require the use of vehicles, machinery, and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term adverse impacts to air quality.

4.2.1.4 NOISE

Affected Environment

Because West Grand Terre Island is uninhabited and accessible only by boat, existing noise in the restoration, borrow area, and overburden disposal area is limited. The small oil and gas facility located on the island and transient vessel traffic are the only noise-generating sources in the area. Noise from distant urban areas and other oil and gas production facilities likely contribute negligible noise impacts to the alternative.

Environmental Consequences

The West Grand Terre alternative would result in short-term, minor adverse noise impacts. Construction of the alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials during construction. This adverse noise impact would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction, noise may attract their attention but would not affect their activities. The alternative would not result in long-term adverse noise impacts.

4.2.2 Biological Resources

4.2.2.1 HABITATS

Affected Environment

The alternative is in the Barataria Basin at the southern extent of the Mississippi alluvial plain and is located within the larger deltaic coastal marshes and barrier islands ecoregion, which is dominated by brackish and saline marshes (Daigle et al. 2006). West Grand Terre Island is part of a barrier island chain

that separates Barataria Bay from the Gulf of Mexico. Barataria Pass, a natural tidal channel, is east of the island. Saltwater marsh, coastal dunes, and beaches are the prevalent ecologic features of the island. The alternative includes a tidal zone, an intertidal zone, natural and restored dunes, and a bayside zone of intertidal wetlands surrounded by mangrove and saltwater marsh habitat. The approximately 633-acre island consists of approximately 330 intertidal acres, 200 supratidal acres, 3 dune acres, and 100 subtidal acres (CEC 2018b). Freshwater inputs to the Barataria Basin are primarily rainfall because the construction of levees along the Mississippi River has prevented freshwater and sediment inputs to the basin.

Habitats on West Grand Terre Island include salt marsh, which is a regularly tidally flooded, flat, polyhaline area dominated by salt-tolerant grasses and few other species. Salt marsh in the area is largely dominated by smooth cordgrass broken up by areas of open water and the intertidal zone. CPRA's Coastwide Reference Monitoring System (CRMS) monitors approximately 390 sites throughout coastal Louisiana that cover a range of habitat types including fresh, intermediate, brackish, and salt marshes and swamps. There are no CRMS sites on West Grand Terre Island; however, sites are located approximately 5 miles east near Point Cheniere Ronquile (CRMS 0071) and 6 miles northwest near Raccoon Bayou (CRMS 0178). Dominant vegetation at these sites is smooth cordgrass (CPRA 2019a). Salt marsh habitats are considered important nursery areas for shrimp, crabs, and a variety of fish species and enhance the production of marine organisms in adjacent waters (Holcomb et al. 2015). Pockets of mangroves are present on the island. Salt marshes and mangrove habitats are integral parts of the Louisiana coastal island system. The intertidal zone consists of mudflat areas above water at low tide and occasionally under water at high tide, which provide important foraging habitat for breeding shorebirds. Invertebrates, such as crabs and clams, also inhabit the intertidal zone. Coastal dune habitat consists of scattered areas of shrubs such as groundsel bush (*Baccharis halimifolia*). Coastal dune communities can easily be destroyed by dune migration or erosion and replaced by grasslands. Bermuda grass (*Cynodon dactylon*), a nonnative species, is common around the facilities on the island (Coastal Environments 2013).

The island has been the recipient of beneficial dredging in the Barataria Bay Waterway (BWW) from 1996 through 2020 (CPRA 2020). This dredging, conducted by the USACE, has added sand to the western end of the beach near Fort Jefferson and a created marsh on the landward side of the island. In 2001, approximately 300 acres of the new land created from dredge spoil on the east half of West Grand Terre was planted with bitter panicgrass, saltmeadow-marshhay cordgrass, smooth cordgrass, and black mangrove (*Avicennia germinans*) (CWPPRA 2018).

Submerged aquatic vegetation (SAV) can be found throughout Louisiana's coastal zone marshes and estuaries, typically on substrates that consist of sand/mud and in water depths of 4 feet or less. Estuarine seagrass beds are dominated by widgeon grass (*Ruppia maritima*) and water celery (*Vallisneria americana*), whereas the marine seagrass beds are dominated by turtle grass (*Thalassia testudinum*). Although small beds occur in ponds scattered throughout marshes of coastal Louisiana, the last remaining extensive seagrass beds are located along the north shore of Lake Pontchartrain and Barataria Basins and in and around the Chandeleur Islands approximately 50 miles northeast of the alternative (LDWF 2019a). The areas adjacent to the island and existing marshes may provide suitable conditions for SAV; however, no site-specific surveys have been conducted.

The borrow, overburden disposal, and conveyance areas generally consist of soft-bottom marine benthic habitats. The sediments in these areas are generally characterized by two layers: 1) an overburden layer of silts, clays, and fine sand and 2) a sand layer comprising fine sand with silt and clay. Water depths in the borrow areas range from approximately 27 to 34 feet (8 to 10 m) and from 5 to 26 feet (2 to 8 m) in the conveyance areas. Hydrographic and sonar studies show the seafloor to be generally featureless and gradually slopes from nearshore to offshore (CEC 2018b). The overburden disposal site is in an area that has been previously dredged. The borrow, overburden disposal, and conveyance areas area do not contain SAV (CEC 2019).

Environmental Consequences

Minor, short-term adverse effects to the marine, nearshore, and terrestrial habitats of West Grand Terre Island from construction could occur during structure removal, beach nourishment, and fill activities related to ground disturbance. These adverse impacts include increased potential for erosion and sedimentation and temporary habitat loss in terrestrial environments. In marine environments, minor, short-term adverse impacts may include a localized decrease in available dissolved oxygen and an increase in turbidity, temperature, and biological oxygen demand during sediment placement.

Restoration and nourishment of the beach and dune areas would widen the existing beach and improve and/or create up to 371 acres of beach and dune habitat. Habitats that would be adversely impacted include beach and nearshore intertidal and subtidal sandy habitats. Ground disturbance may result in the loss of individual plants and habitat within the restoration footprint; however, these minor, short-term adverse impacts would be limited to localized areas, and similar habitats are available outside of the disturbance area. Additionally, because the dune platform would be revegetated immediately with native species, the overall disturbance of existing habitats would be short term. Restoration efforts that increase stability and resilience of dunes and beaches may result in long-term benefits to habitats, including increased areal extent and improvement of beach habitat. Restored beaches and dunes reduce erosion, scouring, and subsequent water quality impacts of storm surge events.

Creation of approximately 160 acres of marsh habitat would have minor, short-term adverse impacts on existing benthic and intertidal habitats near the fill area. The marsh fill area includes unvegetated beach and nearshore intertidal bay bottom habitat. As described in the affected environment, the nearshore intertidal bay bottom habitat may provide suitable conditions for SAV. The placement of dredged sediment within the marsh fill area would convert areas of open shallow water to intertidal marsh and may increase turbidity in aquatic habitats located near the marsh fill area in the short term. Sediment placement may result in the loss of individual plants and habitat within the marsh fill footprint; however, these impacts would be limited to localized areas, and similar habitat is available outside of the disturbance area. The newly created marsh area would be planted with native vegetation; therefore, the disturbance of existing habitat would be short term. In the long term, an increase in marsh habitat area would be beneficial for healthy barrier island vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats.

Construction of approximately 5,600 feet of rock revetment would result in minor, short-term adverse impacts to nearshore and benthic habitats. Similar to the impacts discussed above for the marsh fill activities, a short-term increase in turbidity of adjacent marine environments from ground-disturbing activities may occur. Minor, long-term beneficial effects from placement of rock revetments in marine environments include change of existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur.

As noted above, no SAV is present within the borrow areas, conveyance corridors, or overburden disposal area; therefore, no impacts to SAV are anticipated. Impacts associated with the conveyance corridors would result from laying sediment pipeline from the borrow areas to the beach-dune nourishment and marsh fill areas on West Grand Terre Island. These adverse impacts include short-term disturbance of benthic habitat and increased turbidity of marine environments and would be minor and short term. In the borrow areas, minor to moderate, short-term adverse impacts to benthic resources would occur as the overburden is removed from the borrow area. Long-term, benthic resources in disturbed areas would reestablish from adjacent undisturbed areas. Following fill operations, the conveyance corridor and borrow areas would return to ambient conditions and be recolonized by benthic populations within 1.0 to 2.5 years (Greene 2002; Michel et al. 2013) following construction.

Ground-disturbing activities could result in the spread of invasive species near the beach and dune nourishment and marsh fill areas of the alternative, which would be a minor, adverse, long-term impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.2.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

Wildlife species may inhabit the terrestrial and intertidal habitats on West Grand Terre Island. Mammals such as coyote (*Canis latrans*), raccoon (*Procyon lotor*), muskrat (*Ondatra zibethicus*), rabbit (Leporidae), squirrel (Sciuridae), opossum (*Didelphis virginiana*), and the nonnative nutria (*Myocaster coypus*) are likely present on West Grand Terre Island given the widespread distribution of these species in coastal Louisiana. With the exception of American alligator (*Alligator mississippiensis*) harvest data, little if any information exists regarding population status of amphibians and reptiles in the alternative. Species typically found in the Gulf salt marsh environments are the Gulf salt marsh snake (*Nerodia clarkii clarkia*), the Gulf Coast toad (*Bufo valliceps*), and the diamondback terrapin (*Malaclemys terrapin*) (Abernethy 1987), and these species may be present on West Grand Terre Island.

Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species, providing both year-round habitat for resident wildlife and important wintering or stopover habitat for migratory birds. The North American waterfowl management plan identifies coastal Louisiana as one of the most important regions for the maintenance of continental waterfowl populations in North America (North American Waterfowl Management Plan 2018). Coastal Louisiana is the terminus of the Mississippi Flyway, which is the largest waterfowl migration route in North America spanning from Canada to the Gulf of Mexico (USACE 2004). The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37. High-priority birds of concern common to the BCR are prothonotary warbler (*Protonotaria citrea*), sedge wren (*Cistothorus platensis*), Swainson's warbler (*Limnothlypis swainsonii*), and painted bunting (*Passerina ciris*) (Bird Studies Canada and NABCI 2014).

The intertidal zone provides important foraging habitat for breeding and overwintering shorebirds. Because of its location along the Mississippi flyway, many families of birds may be present and include waterfowl, wading birds, diving birds, colonial nesting birds, songbirds, shorebirds, migratory birds, seabirds, and raptorial birds. Many colonial waterbirds use mangroves as nesting areas; however, unlike the pelican and shorebird rookeries found on other Louisiana barrier islands, no known rookeries are present on West Grand Terre Island.

There is no official species list for the birds of West Grand Terre Island; however, 103 species have been observed on the island since 2010, with the most common being double-crested cormorant (*Phalacrocorax auritus*), lesser scaup (*Aythya affinis*), and laughing gull (*Leucophaeus atricilla*). Brown pelican (*Pelecanus occidentalis*) has also been observed on the island (eBird 2019). A species list from neighboring Grand Isle (approximately 0.5 mile southwest of West Grand Terre Island) reports 305 species (Lepage 2019). On Queen Bess Island (approximately 2 miles north of West Grand Terre Island), 63 bird species have been recorded (eBird 2019), including a variety of gulls, herons, night-herons, egrets, sandpipers, sparrows, terns, shorebirds, and waterfowl.

Environmental Consequences

Minor, short-term adverse impacts from construction may occur to wildlife individuals during structure removal, beach nourishment, and fill activities related to human noise and disturbance and habitat change or loss. Minor, short-term adverse impacts to wildlife individuals could occur during ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Other minor, short-term adverse impacts include the temporary loss of habitat during construction. However, such impacts would be localized and short term, and most wildlife individuals would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the beach nourishment and marsh fill activities. The creation of additional beach and dune and highly productive marsh habitat is anticipated to be ecologically beneficial. The creation of additional habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species could occur within the disturbance area. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential adverse impacts to resident and migratory birds. Therefore, adverse effects to these species would not be anticipated. Beach nourishment activities can result in minor, short-term adverse impacts to shorebirds from disturbance and reduced foraging efficiency if the birds are roosting and feeding in the area during a migration stopover. For example, the deposition of sand would temporarily deplete the intertidal food base during construction; however, intertidal areas are available outside of the beach nourishment areas and would provide foraging habitat. Potential adverse effects from the dredging, conveyance, and overburden disposal activities on birds would be limited to short-term, minor impacts that include disturbance in nearshore waters from increased vessel traffic. However, such impacts would be localized and short term, and impacted individuals would move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.2.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the island and the borrow, overburden disposal, and conveyance areas. On the back side of the island, the submerged bottom appears to be almost uniformly mud, except where storm overwash has created a veneer of sand. The wetlands, flats, and subtidal habitat around West Grand Terre Island provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Invertebrates such as crabs and clams also inhabit the intertidal zone. The marsh community provides highly productive nursery areas for shrimp, crabs, and fish. The cover and food mangroves provide create excellent nursery areas for fish and shellfish.

The most typical bottom substrate in the central Gulf of Mexico is soft muddy bottom where polychaetes are the dominant benthic organism. This soft-bottom marine habitat is present in the borrow, overburden disposal, and conveyance areas and can present a diverse assemblage of benthic species. Benthic habitats near the alternative support bacteria and algae. Dominant groups of benthic fauna are infauna (animals that live in the substrate, such as burrowing worms, crustaceans, and mollusks) and epifauna (animals closely associated with the substrate, such as crustaceans, echinoderms, mollusks, hydroids, sponges, and soft and hard corals). These may include protozoans, nematode worms and polychaete worms, decapod crustaceans, bryozoans, bivalve mollusks/oysters, sand dollars, gastropods/moon snails, oyster drills, and other interstitial fauna (Day et al. 1989). In addition, oysters have created their own hard-bottom substrate, in the form of oyster reefs, where conditions have been appropriate. Oysters are most abundant

in shallow, semi-enclosed waterbodies (less than 12 m in depth) in areas where salinity levels are between 15 and 30 parts per thousand (VanderKooy 2012). Oyster leases are present along the northwestern side of the island (LDWF 2019b).

In Barataria Bay, 23 species of estuarine fish and 26 species of estuarine-marine fish have been documented (Thompson and Forman 1987). These include species such as bay anchovy (*Anchoa mitchilli*), Atlantic croaker (*Micropogonias undulatus*), Atlantic bumper (*Chloroscombrus chrysurus*), Gulf menhaden (*Brevoortia patronus*), spot (*Leiostomus xanthurus*), hardhead catfish (*Arius felis*), sand seatrout (*Cynoscion arenarius*), Atlantic threadfin (*Polvdactylus octonemus*), striped anchovy (*Anchoa heosetus*), and gafftopsail catfish (*Barge marinus*). The borrow, overburden disposal, and conveyance areas are in state waters approximately 5 miles from West Grand Terre Island. Fish species include a seasonal mix of tropical and temperate pelagic species (which is estimated at more than 100 species) as well as adult representatives of the benthic species encountered in Barataria Bay (Conner and Day 1987). Open water habitat for species such as gar (*Lepisosteus* spp.), catfish (Ictaluridae), bass (*Micropterus* spp.), Atlantic croaker, black drum (*Pogonias cromis*), sunfish (*Lepomis* spp.), and striped mullet (*Mugil cephalus*) is present.

Aquatic fauna requires healthy surroundings to survive and reproduce. Essential fish habitat (EFH) includes all types of aquatic habitat—wetlands, coral reefs, seagrasses, and mangroves—where fish spawn, breed, feed, or grow to maturity. The Magnuson-Stevens Fishery Conservation and Management Act of 1996 is the primary law governing marine fisheries management in federal waters of the United States and fosters long-term biological and economic sustainability of the nation's marine fisheries out to 200 NM. The key objectives of the act are to prevent overfishing, rebuild overfished stocks, increase long-term economic and social benefits, and ensure a safe and sustainable supply of seafood. EFH is defined as "those waters and substrates necessary for fish to spawn, breed, feed, or grow to maturity" (Public Law 104-297). The designation and conservation of EFH seek to minimize adverse effects on habitat caused by fishing and non-fishing activities. Any federal agency that takes an action that could adversely affect EFH by reducing the quantity or quality of habitat must work with the National Marine Fisheries Service (NMFS) to identify impacts and steps for conserving the habitat and reducing the impact of the action (NOAA Fisheries 2019). NMFS has identified EFH habitats for the Gulf of Mexico in its fisheries management plan amendments. Three habitat zones are defined: estuarine (inside barrier islands and estuaries), nearshore (18 m [60 feet] or less in depth), and offshore (greater than 18 m [60 feet] in depth). Within the three habitat zones there are 12 defined habitat types: SAV, mangroves, drifting algae, emergent marshes, sand/shell bottoms, soft bottoms, hard bottoms, oyster reefs, banks/shoals, reefs, shelf edge/slope, and water column associated (WCA). The EFH components within the alternative include emergent wetlands, soft bottoms, and WCA.

The Gulf of Mexico Fishery Management Council (GMFMC) has delineated EFH for federally managed species in coastal Louisiana (GMFMC 2005). The alternative is in EFH Ecoregion 4 (East Texas and West Louisiana), which extends from the Mississippi Delta to Freeport, Texas. In the nearshore and estuarine open water and wetland habitats around West Grand Terre Island and in the borrow, overburden disposal, and conveyance areas, EFH has been designated for red drum (*Sciaenops ocellatus*), reef fishes (gray [mangrove] snapper [*Lutjanus griseus*], lane snapper [*Lutjanus synagris*], red snapper [*Lutjanus campechanus*], gray triggerfish [*Balistes capriscus*], greater amberjack [*Seriola dumerili*], and Almaco jack [*Seriola rivoliana*]), sharks (Atlantic sharpnose shark [*Rhizoprionodon terraenovae*], blacktip shark [*Carcharhinus limbatus*], blacknose shark [*Carcharhinus acronotus*], bull shark [*Carcharhinus leucas*], finetooth shark [*Carcharhinus isodon*], scalloped hammerhead shark [*Sphyrna lewini*], silky shark [*Carcharhinus falciformis*], and spinner shark [*Carcharhinus brevipinna*]), coastal migratory pelagic fish species (Spanish mackerel [*S. maculatus*] and cobia [*Rachycentron canadum*]), and shrimp (brown [*Panaeus aztecus*] and white shrimp [*P. setiferus*]) (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.2-1). Table 4.2-1 provides a description of each of these EFHs. The GMFMC and NMFS are also responsible for designating subsets of EFH called Habitat Areas of Particular Concern (HAPC) and EFH Areas Protected from Fishing (EFHA) for managed species. There are no HAPCs or EFHAs in the alternative.

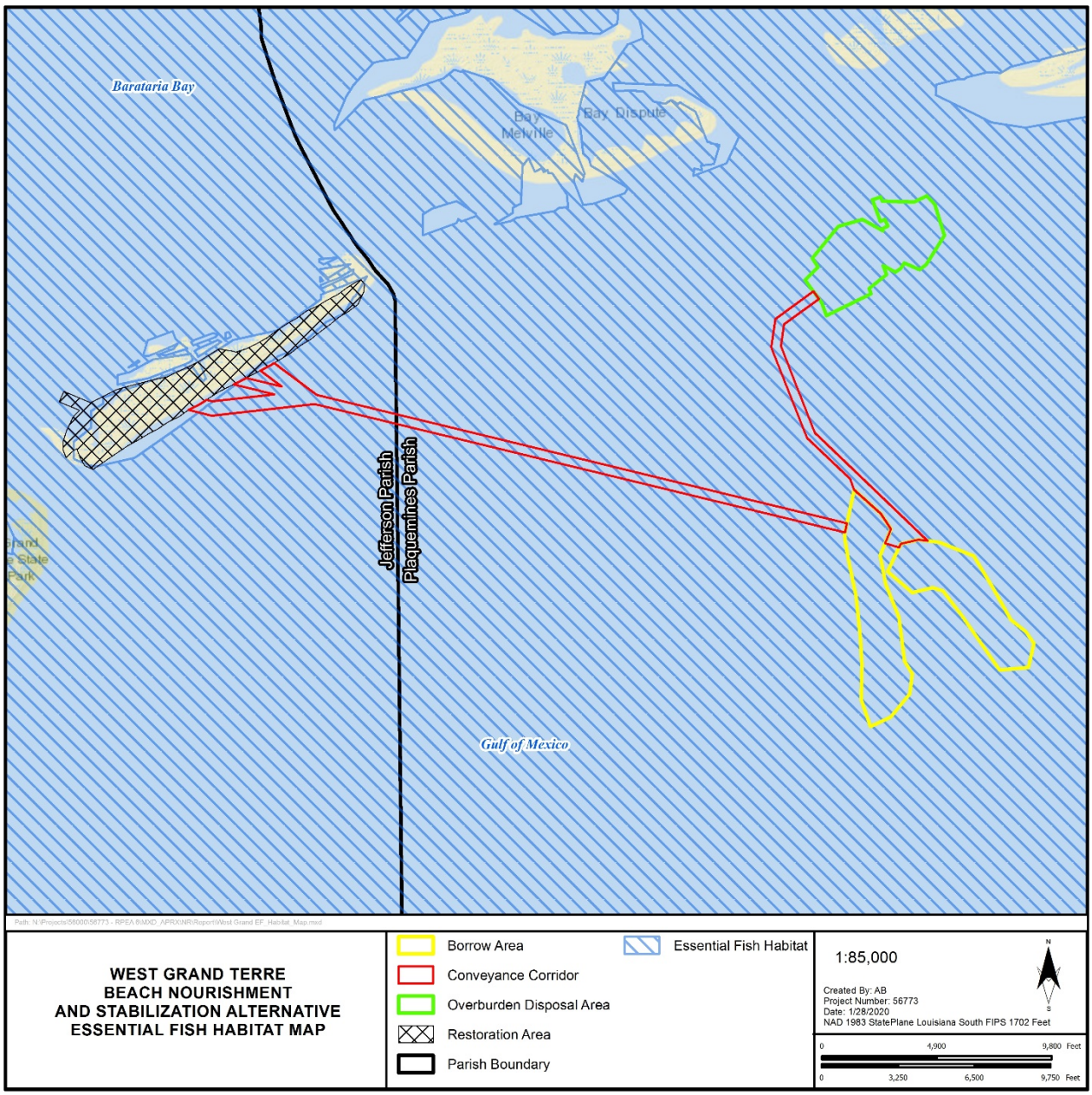

Figure 4.2-1. Essential fish habitat within the West Grand Terre Beach Nourishment and Stabilization alternative.

Table 4.2-1. Essential Fish Habitat for the West Grand Terre Beach Nourishment and Stabilization Alternative

EFH Species	Life Stage	Description
Red drum (*Sciaenops ocellatus*)	All	All Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana, to the eastern edge of Mobile Bay, Alabama, out to depths of 25 fathoms (1 fathom = 6 feet); waters and substrates extending from Crystal River, Florida, to Naples, Florida, between depths of 5 and 10 fathoms; and waters and substrates extending from Cape Sable, Florida, to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council between depths of 5 and 10 fathoms.
Reef fishes	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.
Atlantic sharpnose shark (*Rhizoprionodon terraenovae*)	Juvenile/adult	Shallow coastal areas including bays and estuaries off Louisiana from the Atchafalaya River to Mississippi River Delta out to the 40-m isobath; coastal waters from Texas to the Florida Keys.
Blacktip shark (Gulf of Mexico stock) (*Carcharhinus limbatus*)	Juvenile/adult Neonate	Gulf of Mexico coastal areas, including estuaries, out to the 100-m-depth contour in the Gulf of Mexico from the Florida Keys to southern Texas; coastal areas of Mississippi and Louisiana, including Mississippi Sound, Mobile Bay, Terrebonne Bay, Timbalier Bay, and Chandeleur Sound; water depth ranging from 0.7 to 9.4 m in silt, sand, mud, and seagrass habitats.
Blacknose shark (*Carcharhinus acronotus*)	Adult	Shallow coastal waters in the Mississippi Sound from Mobile Bay, Alabama, to the waters off Terrebonne Parish, Louisiana, in waters with depths of 13 to 55 fathoms; coastal waters of Texas, western Louisiana, Mississippi, and Florida.
Bull shark (*Carcharhinus leucas*)	Juvenile/adult Neonate	Gulf of Mexico coastal habitats between Mobile Bay and Lake Borgne; coastal areas along Texas to the mouth of the Mississippi River, particularly the inland bay and bayou systems of Louisiana (i.e., interior of Lake Pontchartrain, the Pearl River system, Little Lake/Barataria Bay and its inland waters, the Terrebonne/Timbalier Bay system, and the Atchafalaya/Vermilion Bay system), the west side of Mississippi River Delta, and coastal areas along the Texas coast.
Finetooth shark (*Carcharhinus isodon*)	All	Gulf of Mexico shallow coastal waters of the northeastern Gulf of Mexico with muddy bottom (between depths of 1 and 3 fathoms) on the seaward side of coastal islands, especially around the mouth of the Apalachicola River and the Gulf side of St. Vincent Island to just southeast of St. Andrews Bay Inlet, Florida; St. Vincent Sound, Saint Andrew Sound, Saint Joseph Bay, and Apalachicola Bay, Bay St. Louis, Perdido Sound, Bon Secour Bay and lower Mobile Bay, Alabama; Terrebonne and Timbalier bay system, Louisiana (between depths of 0 and 3 fathoms); the Mississippi Sound between the islands and the coast of Louisiana; coastal areas of Texas, including portions of Corpus Cristi Bay, Aransas and Copano Bays, San Antonio Bay, Espiritu Santo Bay, Matagorda Bay, Galveston Bay, and Trinity Bay (between depths of 9 and 20 fathoms); and beaches of the southeastern Texas coast (between depths of 1 and 3 fathoms).
Scalloped hammerhead shark (*Sphyrna lewini*)	All	Gulf of Mexico; all shallow coastal waters from the shoreline out to the 50-m isobath, in the area of Mobile Bay, Alabama, and Gulf Islands National Seashore; coastal and offshore waters from Texas to Louisiana.
Silky shark (*Carcharhinus falciformis*)	Adult	Offshore waters in the Central Gulf adjacent to Texas, Louisiana, and the Florida Keys.
Spinner shark (*Carcharhinus brevipinna*)	Neonate	Gulf of Mexico coastal areas surrounding the Florida Keys and from the Big Bend Region to southern Texas; sandy bottom areas.
Coastal migratory pelagics	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.

EFH Species	Life Stage	Description
Shrimps	All	Gulf of Mexico waters and substrates extending from the United States-Mexico border to Fort Walton Beach, Florida, from estuarine waters out to depths of 100 fathoms; waters and substrates extending from Grand Isle, Louisiana, to Pensacola Bay, Florida, between depths of 100 and 325 fathoms; waters and substrates extending from Pensacola Bay, Florida, to the boundary between the areas covered by the GMFMC and the South Atlantic Fishery Management Council out to depths of 35 fathoms, with the exception of waters extending from Crystal River, Florida, to Naples, Florida, between depths of 10 and 25 fathoms and in Florida Bay between depths of 5 and 10 fathoms.

Source: NOAA Fisheries (2019).

Environmental Consequences

Short-term, minor adverse impacts to benthic habitats during beach nourishment and marsh fill activities may occur from the placement of pipelines in the conveyance channels, dredging of the borrow areas, and placement of sediment in the footprint where existing shallow water and intertidal habitats would be covered. Disturbance of sediments during dredging and sediment placement may increase turbidity around these areas in the short term, which could adversely affect sensitive benthic habitats such as oyster reefs and seagrasses (Michel et al. 2013). Slow-moving or sessile benthic organisms found within the borrow areas and intertidal footprints of the beach nourishment and marsh fill site may be adversely impacted through removal or burial, respectively. More mobile benthic species would likely be displaced in the short term, whereas potential for removal or burial would be localized and confined to construction areas. Sediment placement may also adversely impact benthic fauna in both the beach and intertidal zones by covering them with a layer of sediment. Some benthic species can burrow through a modest layer of added sediment; however, thicker layers of sediment are likely to smother the benthic fauna (DWH Trustees 2016). In areas where the depth of sediment placement would exceed the burrowing limits for benthic species, there would be an increased likelihood of localized loss of existing benthic fauna. However, BMPs such as silt curtains, buffer zones, and water quality monitoring would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often generally within 1 year and achieving community composition similar to undisturbed sites in 2.5 years (Greene 2002; Michel et al. 2013). In the long term, the footprint of hard structures, such as rock revetments, changes existing habitat from a soft to a hard substrate and would have beneficial effects to the benthic community. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur, often such as oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

During construction, short-term, minor adverse impacts to marine species habitats may occur through sediment deposition and increased turbidity. The conversion of shallow open water habitat to intertidal marsh could result in long-term, minor adverse impacts to habitat; however, this impact would be offset by the long-term ecological benefits from restoring intertidal marsh. Productive marsh 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. Many of the species that use coastal marshes as juveniles later move offshore where they may serve as prey for open ocean species. Beach habitats contribute to the quantity and quality of adjacent shallow water habitats that serve as nurseries or forage areas for marine species, and the beach-shallow water interface also provides nutrient exchange to aquatic habitats. Overall, beach nourishment and marsh creation would provide long-term benefits for many marine species, including fish, shrimp, and shellfish in the form of food, shelter, breeding, and nursery habitat.

Short-term, minor adverse impacts may include effects to EFH during dredging and fill-related activities. During these activities, species and their prey species may leave the borrow area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in disturbance of feeding or spawning and other behaviors by some species individuals in the short term. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed restoration of marsh habitat would result in long-term benefits to marine and estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh restoration would also benefit species within the ecosystem by contributing to the marine food web and providing a more productive habitat. On May 29, 2019, NOAA concluded that the West Grand Terre alternative would not have substantial adverse effects to EFH, and consultation was concluded.

4.2.2.4 PROTECTED SPECIES

Affected Environment

Protected species include wildlife and plant species that are protected from harm or harassment by law. The ESA protects all federally listed wildlife and plant species, and designated critical habitat of these species, in the United States. The ESA requires that federal agencies ensure that 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 (e.g., the common bottlenose dolphin [*Tursiops truncatus*]) protected by the Marine Mammal Protection Act of 1972 (MMPA) and migratory birds (see Section 4.2.2.2) protected by the Migratory Bird Treaty Act of 1908 (MBTA). Another statute, the Bald and Golden Eagle Protection Act of 1940 (BGEPA), further protects eagles within the United States. The primary regulatory agencies responsible for ESA compliance are USFWS and NMFS. *Critical habitat* is defined as areas containing the physical or biological features essential to a listed species' conservation, and is designated when it is both "prudent and determinable." These features are referred to as primary constituent elements. Any action authorized, funded, or carried out by an agency is prohibited from destroying or adversely modifying designated critical habitat.

The West Grand Terre Beach alternative analysis area for protected species is a 1-mile buffer around all potential disturbance areas and includes portions of Jefferson and Plaquemines Parishes. Ten species are listed as threatened or endangered within these two parishes (Table 4.2-2). This species list was developed using the USFWS Information for Planning and Consultation (IPaC) resource list for both parishes (USFWS 2019a).

Table 4.2-2. Federally Protected Species under the Endangered Species Act and Marine Mammal Protection Act for Orleans and St. Bernard Parishes

Common Name	Scientific Name	Federal Status*	Parish	Habitat Description†
Piping plover	*Charadrius melodus*	T	St. Bernard	In Louisiana, winters on intertidal beaches with sand and/or mudflats with no or very sparse vegetation.
Red knot	*Calldris canatus rufa*	T	St. Bernard	Winters on barrier island systems in southeastern Louisiana.
Gulf sturgeon	*Acipenser oxyrinchus* (=*oxyrhynchus*) *desotoi*	E	Orleans and St. Bernard	All saltwater habitats. Found in major rivers that empty into the Gulf of Mexico during spawning season (such as the Pearl River Basin and Lake Pontchartrain Basin).
Pallid sturgeon	*Scaphirhynchus albus*	E	Orleans and St. Bernard	Prefers main channels of excessively turbid rivers in areas with strong currents over firm sandy bottoms. Found in the Atchafalaya River Basin, Mississippi River Basin, and Lake Pontchartrain Basin.

Common Name	Scientific Name	Federal Status*	Parish	Habitat Description†
West Indian manatee	*Trichechus manatus*	T	Orleans and St. Bernard	Found in freshwater and saltwater habitat of canals, creeks, lagoons, or rivers, in areas with access to natural springs or warm water (in winter), and to areas with vascular plants and freshwater sources.
Hawksbill sea turtle	*Eretmochelys imbricate*	E	St. Bernard	Found in warm bays and shallow portions of oceans, such as seagrass beds and estuaries. Nesting occurs on mainland beaches and islands.
Green sea turtle	*Chelonia mydas*	T	St. Bernard	Found in warm bays and shallow portions of oceans, such as seagrass beds and estuaries. Nesting occurs on mainland beaches and islands.
Kemp's Ridley sea turtle	*Lepidochelys kempii*	E	St. Bernard	Found in warm bays and coastal waters, such as seagrass beds, tidal rivers, and estuaries. Nesting occurs on mainland sandy coastal beaches.
Leatherback sea turtle	*Dermochelys coriacea*	E	St. Bernard	Found in open ocean and deeper waters of the Gulf and coastal bays. Nesting occurs on coastal beaches and barrier islands.
Loggerhead sea turtle (Northwest Atlantic Ocean DPS)	*Caretta*	T	St. Bernard	At different life stages this species can be found in coastal waters, including estuaries, and deep ocean. Nesting occurs primarily on ocean beaches and occasionally on estuarine beaches with coarse-grained sands.

* USFWS Status Definitions

E = Endangered. Endangered species are those in imminent jeopardy of extinction. The ESA specifically prohibits the take of a species listed as endangered. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

T = Threatened. Threatened species are those in imminent jeopardy of becoming endangered. The ESA prohibits the take of a species listed as threatened under Section 4d of the ESA. *Take* is defined by the ESA as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to engage in any such conduct.

† Range or habitat information is from USFWS Louisiana Ecological Services Field Office (USFWS 2019a) or LDWF (LDWF 2019c).

Of these 10 species listed as threatened or endangered within these two parishes, Gulf sturgeon, West Indian manatee, piping plover (*Charadrius melodus*), red knot (*Calldris canatus rufa*), and all five species of sea turtles (hawksbill sea turtle [*Eretmochelys imbricate*], green sea turtle [*Chelonia mydas*], Kemp's Ridley sea turtle [*Lepidochelys kempii*], leatherback sea turtle [*Dermochelys coriacea*], and loggerhead sea turtle [*Caretta caretta*]) are listed as being potentially present in the area by the USFWS IPaC resource list (USFWS 2019a). Of these species, the alternative and vicinity may provide habitat for West Indian manatee, piping plover, red knot, and three species of sea turtles (hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle).

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending on its life stage and on the season (NOAA Fisheries 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). The alternative is located within historical Gulf sturgeon range but outside of the species' current range and designated critical habitat in Lake Borgne and Lake Pontchartrain. Therefore, it is unlikely this species would be present in or near the alternative.

Habitats suitable to support marine vegetation that could attract the West Indian manatee may be present within the alternative. However, no known occurrences of this species have been documented within the alternative; thus, occurrences of this species is rare and there is a low probability the species would occur in the alternative (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within the alternative.

Three of the five species of sea turtles have potential to occur near the alternative (USFWS 2019a): hawksbill sea turtle, leatherback sea turtle, and loggerhead sea turtle. Because the nearshore habitats of the alternative do not provide suitable foraging habitat for hawksbill or leatherback sea turtles it is unlikely that these species would be present (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). Of these three species, only the loggerhead sea turtle may nest within the alternative; the remaining two species (Kemp's Ridley and green sea turtles) would be present but only within the marine environments of the alternative. The loggerhead sea turtle is the most common sea turtle species in Louisiana. Most sea turtle species are not known to nest in Louisiana because of the lack of suitable nesting habitat; however, loggerhead sea turtle nests have been observed on Grand Isle, which is approximately 0.5 mile west of West Grand Terre Island. Because similar beach habitat is also present on West Grand Terre Island, loggerhead sea turtles may use the terrestrial habitats of the alternative for nesting. Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for Kemp's Ridley and green sea turtles, these species are not expected to use terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The green and Kemp's Ridley sea turtles may be present within the alternative because the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe2016). Loggerhead sea turtles may also be present in the shallow waters of the alternative for feeding.

Piping plover and red knot wintering habitat is present in and around the alternative and includes beaches, tidal sand flats, mudflats, algal mats, washover passes, and small dunes where they feed primarily on small invertebrates (Campbell 2003).

Piping plover designated critical habitat is present on Grand Isle and East Grand Terre islands, adjacent to the alternative (Figure 4.2-2). Piping plover designated critical habitat is located all along the southeastern shoreline of Grand Isle and other neighboring barrier islands, including East Grand Terre Island (Unit LA-5). Grand Isle is approximately 0.5 mile west of West Grand Terre and East Grand Terre is approximately 1.0 mile to the east. This designation applies to suitable overwintering habitats on the beaches, mudflats, and estuarine wetlands abutting and adjacent to the Gulf of Mexico. Primary constituent elements for piping plover overwintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. The elements include intertidal flats, including sand and/or mudflats with no or very sparse emergent vegetation, and adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide, which are important for roosting plovers.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents the estuarine area near West Grand Terre Island. The Atlantic spotted dolphin (*Stenella frontalis*) does not frequent inshore areas but occurs in nearshore shelf waters; therefore, this species may be present near the borrow and overburden disposal portions of the alternative (Hayes et al. 2019).

Bald eagles (*Haliaeetus leucocephalus*) are known to breed and winter near the alternative.

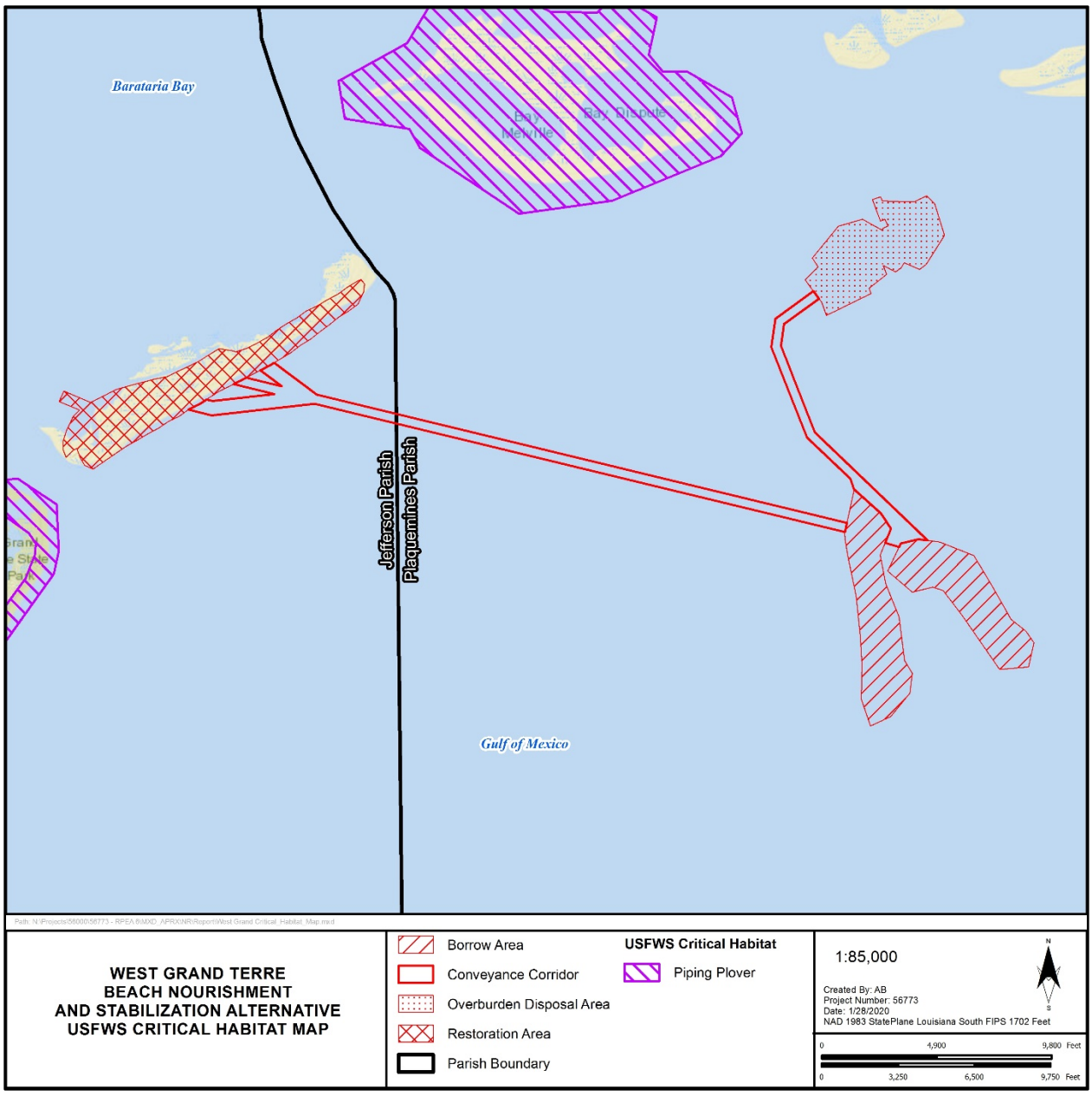

Figure 4.2-2. Critical habitat within West Grand Terre Beach Nourishment and Stabilization alternative.

Environmental Consequences

Activities that may affect manatees present in and around the alternative are construction-related in-water work that would include dredging, beach nourishment, marsh fill, overburden deposition, and placement of conveyance pipelines. These activities could result in adverse impacts from temporary localized turbidity and construction noise that may result in avoidance behaviors. Other adverse impacts include the potential for collision with vessels/barges and entanglement with debris that may catch on anchor management systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential impacts to this species. Adherence to the protection measures would help prevent adverse effects to any manatees that may be present in the area

of disturbance associated with construction of the alternative. The disturbance to manatee, if present in the area, would be short term, limited to construction, and resulting in temporary displacement of individuals that would likely move to another area for foraging or resting purposes. In the long term, an increase in marsh habitat area would be beneficial for healthy barrier island vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats, which could contribute to improved conditions for SAV in the region.

Activities in beach habitat that could adversely impact piping plover and/or red knot include beach nourishment and would result in temporary, localized construction noise and human activity that may result in avoidance behaviors. Other impacts may include temporary effects to prey species within the beach nourishment footprint; however, individual piping plover and red knot would likely move to another area for foraging purposes. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS, including seasonal avoidance of construction in important wintering habitats when piping plovers are present (approximately late July through mid-May) or when red knots are present (approximately August through mid-May), would be implemented to reduce potential disturbance. As these species have been documented on the beaches in the area, restoration of beach habitat may be beneficial in the long term via increasing total available habitat for these species (deMay et al. 2016).

Adverse impacts to the terrestrial life stage for the loggerhead sea turtle would include potential disturbance of nesting habitat as a result of beach nourishment activities; however, these activities could ultimately benefit the loggerhead sea turtle in the long term by increasing suitable nesting habitat in the area. Adverse impacts to the marine life stage of this species would be similar to those described for the other sea turtle species below. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to this species. In the long term, impacts associated with the beach restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit this species.

Construction activities associated with the West Grand Terre alternative may result in adverse impacts to the marine life stages for Kemp's Ridley and green sea turtles. The in-water work of beach nourishment, marsh fill, dredging of the borrow areas, and disposal of overburden may result in temporary increases in turbidity and construction noise that may result in avoidance behaviors. Dredging and conveyance activities are expected to last approximately 16 months and thus these activities are not anticipated to cause long-term behavioral changes. Other adverse effects of construction may include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with debris that may catch on anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. In the long term, impacts associated with the beach restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit these species.

Although the alternative overlaps piping plover critical habitat on Grand Isle, no adverse effects from the alternative are expected to impact critical habitat. Grand Isle is approximately 0.5 mile away from West Grand Terre and therefore activities related to beach nourishment and shoreline stabilization on West Grand Terre Island would not adversely affect the foraging, sheltering, or roosting needs of piping plovers within critical habitat.

Bald eagles in and around the alternative may be sensitive to changes in noise sources or levels due to construction. However, potential adverse impacts to bald eagles would be limited to temporary disturbance of individuals and potential foraging habitat because the alternative does not contain elements (such as trees) that would provide suitable breeding or roosting habitat. The alternative would include BMPs described in Section 6, Appendix A of the Final PDARP/PEIS. Potential short-term adverse impacts to bald eagles would be minimal.

Potential impacts to dolphins would be similar to those discussed for West Indian manatee.

4.2.3 Socioeconomic Resources

4.2.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The West Grand Terre alternative is located within Jefferson Parish and Plaquemines Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the Census tracts in which the alternative would be located (Census tracts 279.02, 504, 9900, and 9901), Jefferson Parish, Plaquemines Parish, state of Louisiana, and the U.S. Census tracts are statistical subdivisions of a county and are roughly equivalent to a neighborhood, therefore providing socioeconomic indicators appropriate for characterizing localized areas. These data are summarized in Table 4.2-3.

Table 4.2-3. Demographic, Economic, and Social Data for the West Grand Terre Beach Nourishment and Stabilization Alternative

Description	Census Tract 279.02	Census Tract 504	Census Tract 9900	Census Tract 9901	Jefferson Parish	Plaquemines Parish	Louisiana	United States
Total population	1,872	3,236	0	0	437,038	23,394	4,663,461	321,004,407
Total minority population*	1	1,274	0	0	152,577	6,519	1,670,819	76,872,258
Population under the age of 5	93	40	0	0	27,903	1,659	310,431	19,853,515
Population 65 and older	374	649	0	0	68,345	2,782	655,848	47,732,389
Median age	50.3	45.4	–	–	39.0	35.9	36.4	37.8
Median household income (dollars)†	$41,977	$32,395	–	–	$50,868	$49,635	$46,710	$57,652
Population below poverty level (%)	23.9%	24.2%	–	–	16.3%	19.3%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	357	367	0	0	46,219	2,705	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The populations in Jefferson Parish and Plaquemines Parish make up 9.4% and 0.5%, respectively, of Louisiana's population. Jefferson Parish has a minority population of approximately 35%, which is about the same as the minority population of Louisiana (36%) and more than the overall United States (approximately 24%). Plaquemines Parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the minority population overall in the United States.

Most of the West Grand Terre alternative is in Census tract 279.02, which also includes a portion of the borrow area that extends into Census tracts 504 and 9900. The conveyance corridors extend from Census tract 279.02 into Census tracts 9901 and 9900, and the overburden disposal areas are in Census tracts 504 and 9900. Census tracts 9900 and 9901 are uninhabited and are therefore not further discussed for the alternative.

The percentage of minority residents in Census tract 279.02 (approximately 0.05%) is less than the parishes, state, and country. The population under the age of 5 (approximately 5%) is comparable to Jefferson Parish (6.5%), Plaquemines Parish (7.1%), Louisiana (6.7%), and the United States (6.2%). The median age of 50.3 is more than 10% greater than the parishes, state, and country. The median household income for Census tract 279.02 ($41,977) is approximately 19% lower than Jefferson Parish, 17% lower than Plaquemines Parish, 11% lower than the state, and 32% lower than the country. The population living below the poverty level (23.9%) is lower for this Census tract, which is higher than Jefferson and Plaquemines Parishes, Louisiana, and the country. In addition, the population with a less-than-high-school degree within Census tract 279.02 (19.1%) is more than Jefferson Parish (10.6%), Plaquemines Parish (11.6%), Louisiana (10.4%), and the United States (8.5%).

Minority residents make up approximately 39% of Census tract 504, which is more than Jefferson and Plaquemines Parishes, Louisiana, and the overall United States. Because the minority population of Census tract 504 is more than 10% of the general population, which is represented by Plaquemines Parish (27.9% minority population), it is a significant area of environmental justice populations. In this Census tract, the population under the age of 5 (1.2%) is lower than the populations in the parishes, state, and country, but the median age of 45.4 is higher. The median household income for Census tract 504 ($32,395) is 44% lower than Jefferson Parish, 42% lower than Plaquemines Parish, 36% lower than Louisiana, and 56% lower than the country. The population living below the poverty level (24.2%) is higher than the parishes, state, and country. The population with a less-than-high-school degree within Census tract 504 (11.3%) is higher than Jefferson Parish, Louisiana, and the United States, but similar to Plaquemines Parish.

Environmental Consequences

The West Grand Terre alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative would not require displacements or demographic shifts from implementation of the alternative and the proposed activities for which would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may resulted in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparently and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Although Census tract 504 is a significant area of environmental justice populations, no adverse effects to environmental justice populations are anticipated because of the semi-remote location and small size of the alternative as it relates to available fishing areas. If members of the environmental justice population engage in subsistence fishing in or near West Grande Terre Island, the fishing opportunities would

continue in adjacent areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally, adversely affected from construction and implementation of the West Grand Terre alternative.

4.2.3.2 CULTURAL RESOURCES

Affected Environment

An archaeological assessment of the West Grand Terre alternative was conducted from June 2 through 13, 2018. The assessment focused on the proposed borrow areas and conveyance corridors located offshore West Grand Terre Island and resulted in approximately 1,384 acres (560 hectares) surveyed. Review of remote sensing data identified 211 magnetic anomalies and five side scan sonar contacts. Bathymetric and sub-bottom profiler data also were incorporated into the assessment. No relict geomorphic features deemed potentially archaeologically significant were identified within the area of potential effect (APE) for the borrow areas and conveyance corridors. As a result of the assessment, four archaeological targets indicative of submerged cultural resources were noted within the APE (R. Christopher Goodwin and Associates, Inc. 2018).

An archaeological field investigation of the West Grand Terre alternative was conducted in May 2019 and focused on the submerged portion of the Lafitte Settlement (site 16JE128), which overlaps with the restoration area portion of the alternative. The portion of 16JE128 within the APE associated with the restoration area has been recommended not eligible for the National Register of Historic Places (NRHP), and no additional investigations of the portion of the site within the APE is recommended based on the result of the 2019 investigation (R. Christopher Goodwin and Associates, Inc. 2019).

The LDWF lab is an abandoned scientific research and investigation facility built in 1957 to support Louisiana's fishing industry. It is located on the west end of West Grand Terre Island and was surveyed in January 2019. The facility no longer retains integrity to convey its significance and the Louisiana State Historic Preservation Office (SHPO) has concurred that facility is not eligible for the NRHP (Louisiana Division of Historic Preservation 2019). Therefore, impacts to the LDWF lab are not discussed under environmental consequences.

Fort Livingston is a nineteenth century defense fort located on the west end of the West Grand Terre Island. The fort was listed in the NRHP in 1974. The West Grand Terre alternative would avoid direct impacts to the Fort Livingston property; therefore, impacts to this resource are not discussed under environmental consequences for cultural resources.

Environmental Consequences

The four archaeological targets indicative of submerged cultural resources are in the borrow area. These anomalies would be avoided by a minimum distance of 50 m (164 feet) from the edges of the anomaly.

The alternative would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Disturbance of the seafloor during construction activities has the potential to encounter and cause long-term adverse impacts to unidentified submerged cultural resources. Although remote sensing surveys conducted in accordance with current professional standards for cultural resource identification are expected to be highly effective at recognizing submerged cultural resources, the possibility of encountering an unidentified and unanticipated submerged cultural resource, however unlikely, is always present during dredging and construction activities. Impacts to portions of historic properties that damage characteristics that make them eligible for the NRHP are long term and irretrievable. Restoration measures and management actions, such as avoidance buffers around the four archaeological targets, would be designed to avoid cultural resources to the extent practicable.

Consultation with affected tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative. Consultation with the Louisiana SHPO regarding the offshore cultural resource survey findings is currently ongoing.

4.2.3.3 INFRASTRUCTURE

Affected Environment

West Grand Terre is completely uninhabited, so there is limited infrastructure on the island and no public infrastructure.

On the western side of West Grand Terre is the LDWF lab, a small abandoned marine research laboratory. The LDWF lab was established by LDWF in the late 1950s. The LDWF lab complex included a laboratory, three dormitories, a radio tower, three water storage tanks, a cistern, a maintenance workshop, a boat maintenance shed, a boat lift, a boat shed, two sets of fisheries research ponds, and an access channel (Providence 2018a). The LDWF lab complex was heavily damaged by Hurricane Katrina in 2005 and Hurricane Gustav in 2008 and was abandoned shortly thereafter. The LDWF built a new Fisheries Research Laboratory on Grand Isle, which opened in July 2009, relocating the research activities previously conducted at the LDWF lab. Currently, the buildings that made up the LDWF lab are in various states of disrepair and require demolition, removal, and disposal.

On the eastern bayside of the island is an existing oil and gas facility operated by Hilcorp Energy with electricity provided by Entergy. There is a submerged electrical line from Grand Isle that crosses Barataria Pass and enters the island through a pull box just south and east of Fort Livingston. The submerged electrical line continues through two more pull boxes, approximately 300 feet east of the initial box to a 45-foot power pole, which is the first of nineteen poles that carry an overhead electrical line across the island from the southwest to the Hilcorp Energy facility to the northeast (Roussell 2018).

Environmental Consequences

Construction of the West Grand Terre alternative would result in short-term, minor adverse impacts to infrastructure. The alternative would result in no long-term adverse impacts to infrastructure. Because of the limited infrastructure and users of that infrastructure, impacts could include localized interruptions to access, public services and utilities. Impacts to utilities (including electrical utilities [Entergy]) and public service would likely be localized and within operational capacities. These impacts may include unintended interruptions to service and outages, as well as reduced access for the utilities to conduct maintenance activities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing electrical and oil and gas infrastructure in the alternative. The location of borrow areas for the alternative was sited to avoid impacts to existing oil and gas infrastructure in the alternative. In order to minimize any potential impacts, prior to any ground disturbance activities the contractor would coordinate with utility operations and pipeline companies and would adhere to the following special provisions as provided in the provisions and specifications for the alternative (CPRA 2019b) and BMPs for infrastructure in Appendix C.

Before construction of the alternative, portions of the abandoned LDWF lab would be removed. This would result in no adverse impact to the LDWF lab because the lab is previously abandoned and is not in use.

4.2.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

West Grand Terre is located within Jefferson and Plaquemines Parishes. West Grand Terre Island forms the western end of the Barataria Basin barrier island system and is the most southeastern point of land in Jefferson Parish, Louisiana. Fort Livingston on the Island is managed by the Louisiana Office of State Parks and is designated a State Cultural Area, part of Grand Isle State Park. The Barataria Pass is managed as part of the BWW for navigation by the USACE. The borrow area for the alternative is located approximately 4.6 NM east-southeast of the center of West Grand Terre Island.

Jefferson Parish lies within the Louisiana Coastal Zone established by the State and Local Coastal Resources Management Act of 1978 (Act 361). Jefferson Parish established the Jefferson Parish Coastal Zone Management (CZM) Program in 1984, which was approved by the state on January 4, 1985. Jefferson Parish's CZM is consistent with the state guidelines and with the policies and objectives of Act 361 (Jefferson Parish 2019). The alternative is within the Grand Isle Management Unit, which includes management goals of marsh restoration, beach stabilization, flood control, and erosion control on the islands (Jefferson Parish 1984).

Plaquemines Parish lies entirely with Louisiana's coastal zone. Plaquemine's current local CZM program is an update to the program that was approved by Plaquemines Parish Council in 2000. The local CZM program is consistent with the State of Louisiana's Coastal Resources Management Act, as amended, and the state guidelines. The alternative intersects the Barataria Bay Environmental Management Unit (EMU). Goals for this EMU within the Plaquemines CZM are similar to those in the Jefferson Parish CZM. These goals include reducing land loss; creating new wetlands; maintaining, protecting, and/or restoring barrier islands, headlands, and adjacent wetlands as hurricane buffer zones; encouraging the USACE and others to use dredged material to restore and maintain barrier islands and shorelines; plugging canals and breaches, and/or creating wetlands; and using existing and newly created wetland as storm buffer zones (Plaquemines Parish Department of Coastal Zone Management 2013).

Environmental Consequences

This alternative would not result in adverse impacts to land and marine management. Implementation of the West Grand Terre alternative would provide long-term benefits to land and marine management. The alternative would result in the creation and restoration of habitat and protection of shoreline along West Grand Terre Island. A CUP is required for implementation of the West Grand Terre alternative. In October 2018, the applicant submitted a CUP/Consistency Determination to the LDNR Office of Coastal Management. A CUP/Consistency Determination was issued on May 18, 2019, which demonstrates compliance with the Coastal Zone Management Act (CZMA). The alternative is consistent with the goals of 2017 coastal master plan (CPRA 2017a) and with state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Therefore, the alternative would not result in any changes to land and marine management because it would be consistent with the current parish and coastal management, practices, and plans. The alternative would assist both parishes in achieving CZM goals of protecting and improving shorelines.

4.2.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

There are limited opportunities for tourism and recreational use at West Grand Terre Island because of its uninhabited nature. The waters around the island and over the borrow area and overburden disposal area provide opportunities for recreational angling but do not provide attractions for recreational snorkeling or SCUBA diving. Recreationally important fish species such as spotted seatrout (*Cynoscion nebulosus*), red

drum, black drum, and southern flounder (*Paralichthys lethostigma*) use the barrier island habitats and are the target species for anglers. Fort Livingston is listed on the NRHP and is a recreational attraction; however, it is only accessible by boat, which limits access and use. There are no readily available recreation numbers for Fort Livingston.

Environmental Consequences

The alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary, localized impacts to recreational experiences, such as fishing, from interruptions to recreational activities or visual interference or obstruction from construction. These short-term impacts to recreation and tourism would be limited to the construction period and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including Fort Livingston and areas for recreational fishing.

4.2.3.6 FISHERIES AND AQUACULTURE

Affected Environment

The Terrebonne-Barataria estuary is a nationally important fishery resource that overlaps West Grand Terre. The estuary system ecosystem, encompassing 4.1 million acres of upland forests, swamps, marshes, bayous, bays, and barrier islands, is bound on the west by the Atchafalaya River and bound on the east by the Mississippi River in south Louisiana. Sixteen parishes fall within its boundaries: Ascension, Assumption, Iberville, Jefferson, Lafourche, Plaquemines, Pointe Coupee, St. Charles, St. James, St. John the Baptist, St. Mary, Terrebonne, West Baton Rouge and only small portions of Iberia, St. Martin, and Orleans. A variety of commercially and recreationally important finfish species use the Terrebonne-Barataria estuarine environment, including West Grand Terre, at some or all stages of their life cycles. Estuaries in Louisiana are recognized as among the most productive in the United States (USACE 2004). The Terrebonne-Barataria estuarine system is also known for producing significant amounts of white shrimp (*Litopenaeus setiferus*) and brown shrimp (*Farfantepenaeus aztecus*).

The most common target species for Louisiana commercial fishers are Gulf menhaden (locally known as pogie; processed for fish meal), white and brown shrimp, blue crab (*Callinectes sapidus*), black drum, eastern oyster (farmed and dredged), red snapper, *Procambarus* (a genus of crayfish), yellow fin (*Thunnus albacares*), king mackerel, and blue catfish (*Ictalurus furcatus*) (NMFS 2017). Blue crab landings from the Barataria Basin averaged 8.22 million pounds annually from 2000 to 2013 and ranged from a high of 10.89 million pounds in 2006 to a low of 4.94 million pounds in 2010, the year of the DWH Oil Spill (Bourgeois et al. 2014). The borrow area and overburden disposal area are in state waters approximately 4.6 miles from the island. For this reason, the ichthyofauna can include a seasonal mix of tropical and temperate pelagic species as well as adult representatives of the benthic species encountered in the adjacent estuary.

Environmental Consequences

The West Grand Terre alternative would have short-term, minor adverse impacts to fisheries, but overall it would result in long-term benefits to fisheries and aquaculture. The noise and increased turbidity of surface waters arising from earth-moving activities during project construction could cause short-term, minor adverse impacts to fish species. Construction may temporarily impact West Grand Terre's function as a fish nursey for estuary-dependent fish species, as a fish nursey for forage species, and as a forage area for transient species. To minimize impacts to fisheries, contractors are required to avoid impacting

oyster leases and commercial fisheries during construction activities as stated in the provisions and specifications for the alternative (CPRA 2019b). During construction, some commercial fishers or businesses may be affected because of reduced access; however, these impacts would be temporary and localized and not expected to substantially alter social or economic conditions for commercial fisherman or the industry. Overall, the alternative would provide long-term benefits to fisheries and aquaculture by protecting existing estuarine marshes that provide nursery areas for juvenile finfish, shrimp, and other invertebrates.

4.2.3.7 MARINE TRANSPORTATION

Affected Environment

West Grand Terre Island is easily accessible by boat from Grand Isle, which is located across Barataria Pass to the west. The island is only accessible by boat. Barataria Pass is a deep tidal inlet, managed as part of the BWW for navigation by the USACE. The BWW serves as navigation route connecting the Gulf of Mexico with the interior of the central coast of Louisiana cutting through and providing pathways to natural waters before discharging into Barataria Bay north of Grand Isle. These natural waterways and are not currently used for navigation purposes, but smaller vessels may access portions for recreational opportunities.

Environmental Consequences

Construction and implementation of the West Grand Terre alternative would result in short-term, minor adverse impacts to marine transportation. There would be no long-term adverse impacts to marine transportation. Because of the current marine transportation levels in the area, the alternative is unlikely to impact marine transportation. Dredging and disposal pipelines may cause temporary interference to navigation by blocking sections of the BWW during construction, which would be a short-term minor impact. Furthermore, existing NAVAIDS located within or near work areas may be removed if necessary by the USCG (and/or as directed by the USCG) in advance of dredging operations. This need would be assessed by, and any movement shall be coordinated with, USCG. Construction activities shall not remove, change the place of, obstruct, willfully damage, make fast to, or interfere with any NAVAID (CPRA 2019c). There could be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. The creation of the marsh and borrow area would not result in long-term adverse impacts to marine transportation because it would not impede marine transportation routes.

4.2.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. A view refers to a direct and unobstructed line-of-sight to an on- or off-site aesthetic resource, which may take the form of panoramic viewpoints from particular vantages. Existing views may be obstructed or blocked by modifications to the environment (e.g., grading, landscaping, and building construction).

West Grand Terre Island is uninhabited, and its viewshed is predominantly open water and marsh land, with dense weed and brush vegetation on most land surfaces. There are the remnants of Fort Livingston and former LDWF lab operations which make up approximately 45 acres of land (Hydro-Environmental

Technology, Inc. [HET] 2017). As stated above, the buildings that made up the LDWF lab are in various states of disrepair and require demolition, removal, and disposal. Along the eastern portion of the island is an oil and gas facility and electric utility lines that can also be seen. Overall these views can be characterized as a mix of uninhabited natural areas with some development in the form of the LDWF lab, Fort Livingston, and energy infrastructure.

Environmental Consequences

The West Grand Terre alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction and would have long-term benefits to aesthetics and visual resources. Modifications to the existing viewshed may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective.

The West Grand Terre alternative would include construction of back-barrier marsh, beach nourishment, and rock revetment, which are intended to restore the barrier shoreline and provide wetland habitat for plant and animal species.

Fort Livingston affords the only opportunity for the public to access the West Grand Terre beach nourishment area, back-barrier marsh, rock revetment, borrow area, and conveyance corridors (see Figure 3.2-1). Visitors at Fort Livingston would be able to see much of the beach nourishment area, back-barrier marsh, and rock revetment. The public would also be able to see portions of the restoration area, borrow area, and conveyance corridors from the open water surrounding the island and from nearby Grand Isle State Park, which is approximately 1 mile from the south end of West Grand Terre. Vegetation and topography in the West Grand Terre analysis area would allow for long-distance views in most parts of the island and surrounding open water. During construction, short-term, minor adverse impacts to visual resources would result from the presence of construction personnel, equipment, vehicles, and partially completed restoration elements.

After construction, the alternative would result in an improvement to visual resources and aesthetics because the back-barrier marsh and protected beach would create a diversity of natural landscape elements within the viewshed. New habitat is anticipated to attract additional birds and wildlife, thereby benefiting the enjoyment of the area by recreational users and the general public. The creation of the restoration area and marsh would be perceived as a beneficial effect for aesthetics and visual resources and could result in improved viewsheds.

4.2.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

In 2017, HET conducted a Phase I Environmental Site Investigation of the West Grand Terre for LDWF that included approximately 80 acres of land consisting of remnants of Fort Livingston and the former LDWF Lab, open marsh areas, access canals, and open waterways (HET 2017). The buildings that made up the LDWF Lab are in various states of disrepair and require demolition, removal, and disposal.

The HET report found that the property contains several structures that are uninhabitable and abandoned, and waters from the Gulf of Mexico were observed under or adjacent to several of the structures. Suspected asbestos containing materials (ACM) were observed within construction materials located on-site. However, an official asbestos inspection of building materials for suspect ACMs was not conducted during this investigation. The investigation also found that there were no vent pipes, fill valves, or other evidence indicative of an underground storage tank (UST) located on the property. Potential concerns

included the abandoned aboveground storage tanks (ASTs) on-site and the suspect ACMs observed in the building materials; however, no recognized environmental conditions (RECs) were identified in connection with the property. The report recommended that ASTs should be evaluated prior to future use or removal (HET 2017).

In addition, three hazardous, toxic, and radioactive waste (HTRW) studies were previously conducted on West Grand Terre. The 2001 report prepared by G.E.C., Inc. was a broad-scale project, broken down into six project areas that covered the entire Barataria Basin. Project area II, Grand Terre, included West Grand Terre Island. Based on the site reconnaissance, aerial reconnaissance, records review, land use data, and best engineering judgment, it was G.E.C's professional opinion that the relative risk of 1) an encounter with HTRW in amounts warranting the intervention of health and safety upgrades to levels of personal protective equipment great than Level D (as specified in CFR 1910.120) or 2) actions associated with environmental regulations pertaining to the handling, storage, disposal, or ownership of contaminated sediments is low (G.E.C. 2001).

A separate Phase I Environmental Site Assessment was done at West Grand Terre in 2018 (Providence 2018a). The 2018 Phase I Environmental Site Assessment revealed no evidence of REC in connection with the property (Providence 2018b). Specialized knowledge of beach and overspray areas of West Grand Terre Island being impacted with oil from the DWH Oil Spill is considered a historical REC based on sediment testing completed in March 2018 (Providence 2018b), because concentrations were within regulatory limits. The 2018 Phase I Environmental Site Assessment found that lead-based paints and ACM may be present within interiors and exteriors of the abandoned LDWF Lab structures on the western portion of the property based on the age of the structures. Asbestos sheeting is also suspected to be present in the levees of the LDWF research ponds. The 2018 Phase I Environmental Site Assessment stated that lead-based paints and ACM should be properly managed during demolition, as applicable. Also, the ASTs, septic systems, mechanical debris, used tires, creosote-treated poles, and other household trash and debris at the property should be managed in accordance with applicable LDEQ regulations as part of demolition (Providence 2018a).

In August 2018, soil samples were collected from the wrack line of West Grand Terre Island and offshore sediment samples were collected from the planned borrow site in Grand Terre to determine contaminant levels within the sediments. Sediment samples were compared to LDEQ Risk Evaluation/Corrective Action Program (RECAP) Limiting Screening Standards based on non-industrial land use and EPA's Sediment Benchmarks for Aquatic Life in Response to the DWH Oil Spill. Both soil samples were below their respective thresholds of RECAP Limiting Screening Standards and combined toxicity totals. Based on these results, borrow material is considered suitable for placement on the island, and onshore locations tested are protective based on intended future use (Providence 2018b).

FLOOD AND SHORELINE PROTECTION

West Grand Terre Island has experienced persistent degradation and erosion for more than a century. Shoreline rate changes were developed using historic and recent shoreline positions to identify the following five shoreline change rates for West Grand Terre: historical (1884–1996), short term including Katrina (1996–2006), short term post-Katrina (2006–2017), near term (1996–2017), and overall (1884–2017) (CEC 2018a). Coastal restoration projects have previously been undertaken on West Grand Terre Island by the USACE through the beneficial use of sediment dredged from the BWW between 1996 and 2020 (USACE n.d. [2014]; CPRA 2020). According to Jefferson Parish, sea levels are projected to rise from 1.52 to 2.73 feet above current levels, and in the next 50 years, the parish could lose 1,125 square miles (42%) of its current footprint (Jefferson Parish 2018).

West Grand Terre Island and its neighboring islands are aligned in an east–west arc and are susceptible to both extratropical frontal storms and tropical storms. The former are primarily winter events, with winds from the south, whereas the latter occurs in the warmer months and wind directions are quite variable, depending on the storm track. The Louisiana coast feels the impact of a tropical storm or hurricane on average every 1.2 years, with actual landfall on average every 2.8 years (Roth n.d.). Regardless, the shallow nature of the sea floor approaching the islands facilitates storm surge flooding of coastal areas, which increases beach erosion and island washover. As such storms approach or pass by the coastline, the counterclockwise (cyclonic) wind circulation can drive waves and surges that can impact both the Gulf-facing and back-barrier shorelines. In addition to storm surge flooding, the post-storm retreat can erode tidal inlet shores and exacerbate breach formation. While the borrow area and overburden disposal area are completely submerged, they are also susceptible to storm-related sediment transport.

Environmental Consequences

There may be short-term minor adverse impacts to public health and safety from the West Grand Terre alternative; however, no long-term adverse impacts to public health and safety would result from the alternative. Impacts to public health and safety may occur during construction from the potential increase in small boat traffic (construction related) in the area, and appropriate safety measures would be employed to ensure water-related accidents and conflicts are minimized. Potential exists for accidental spills and releases of hazardous or toxic wastes. As discussed above, soil and sediment samples were tested and found suitable for use as borrow material and presented no risks to public health and safety (Providence 2018b). Construction projects involving the use of boats and barges and associated equipment could cause oil, fuel, or other hazardous material spills in surface waters, resulting in short-term, minor adverse impacts. Construction contractors are required to implement BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, to prevent oil, fuel, or other hazardous substances from entering the air or water, and they are required to have a spill contingency plan for hazardous, toxic, or petroleum products in place, to be implemented in the unlikely event of an occurrence.

Before construction of the alternative, portions of the abandoned LDWF lab would be removed. The Phase I Environmental Site Assessments identified potential concerns including abandoned ASTs on-site and the suspect ACMs observed in the building materials; but did not find RECs in connection with the property. In accordance with the Phase I Environmental Site Assessment finding, suspected ACMs should be confirmed prior to conducting any demolition or renovation activities on site. The ASTs should be evaluated prior to future use or removal. If encountered during demolition, lead-based paints and ACMs should be properly managed by the construction contractor according to applicable health and safety guidelines.

BMPs 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. No adverse effects to public health and safety are expected as a result of the alternative. Outreach with recreational users of the site would also be used to inform the public of the bathymetry and topography of the constructed marsh and the protective hard structure breakwater that would result from the alternative. Impacts to public safety would be minor and short-term, occurring only during the construction period.

FLOOD AND SHORELINE PROTECTION

No short-term adverse impacts to flood and shoreline protection during construction of the alternative would occur. The alternative would result in long-term benefits to flood and shoreline protection. The alternative would result in the protection of 8,500 linear feet of shoreline along Barataria Pass and

Barataria Bay on the western side of West Grand Terre Island. This would be accomplished through the construction of up to 371 acres and approximately 14,000 feet of beach and dune habitat on West Grand Terre Island. This shoreline protection would both help prevent shoreline degradation and erosion and serve as a buffer to reduce the force and effects of wave action, saltwater intrusion, storm surge, and tidal currents. This could result in a decreased risk of potential hazards (e.g., decreased likelihood of storm surge) to visitors, residents, and workers from increased shoreline integrity, which would be temporary and localized. The wetland restoration would also provide benefits to coastal populations and infrastructure through improved flood and shoreline protection, thereby improving coastal resiliency and providing a long-term beneficial impact to flood and shoreline protection.

4.3 Golden Triangle Marsh Creation Alternative

4.3.1 Physical Resources

4.3.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The Golden Triangle alternative is in Orleans Parish and St. Bernard Parish, Louisiana, in the eastern portion of the Golden Triangle Marsh, a narrow band of brackish marsh directly east of New Orleans. The marsh, which is located between Lake Borgne and the confluence of the MRGO and the GIWW, is part of the Deltaic Coastal Marshes and Barrier Islands ecoregion of Louisiana (Daigle et al. 2006) within the Pontchartrain Basin. The northern portion of the marsh falls within the Bayou Sauvage NWR, which is one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018). The Golden Triangle alternative is accessible only by boat and includes undeveloped coastal land, marshland, and intertidal and subtidal wetlands. The other features of the alternative, including conveyance and access corridors and a borrow area, extend southeast off the MCAs into Lake Borgne, also crossing into St. Bernard Parish.

The Golden Triangle MCAs are relatively flat areas, with elevations ranging from 1.01 feet above sea level to 0.25 feet below sea level (referenced to NAVD88), underlain by marsh deposits from the Holocene age, consisting of very soft to soft clay with varying silt and sand contents. Underlying the layer of Holocene clay is a layer of Pleistocene clay and sandy clay deposits (GeoEngineers 2018). Surface soils in the MCAs are part of the Clovelly series and Lafitte series (NRCS 2019), which support marsh vegetation and wildlife habitat (Matthews 1982). Clovelly muck, which is part of the Clovelly series, is found throughout the alternative and consists of very deep, very poorly drained, very slowly permeable soils typical of broad coastal marshes that are continuously flooded with brackish water. Lafitte muck, which is part of the Lafitte series, is also found throughout the MCAs and consists of very deep, very poorly drained, rapidly permeable organic soils found in intermediate and brackish marshes of Louisiana's coastal areas. Substrates in the MCAs consist of very soft peat and organic clay to a depth of approximately 15 feet below the mudline. From depths of 15 to 60 feet are very soft to soft Holocene clay with varying silt and sand contents that are underlined by soft to very soft clay, medium to stiff Pleistocene clay, and sandy clay deposits. Borrow area sediments are made of very soft clays and silts with little sands.

The coastal regions of Louisiana, including the MCAs, have experienced significant elevation and land loss due to subsidence and sea level rise. Rates of subsidence for the Orleans Landbridge, which is a stretch of land and marsh north of the Golden Triangle alternative between Lake Borgne and Lake Pontchartrain, were estimated to range between 0.002 and 0.009 m per year (CPRA 2012).

Environmental Consequences

The Golden Triangle alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

The use of onshore staging areas and construction activities on the shoreline of Lake Borgne would disturb substrate materials. Offshore activities, including anchoring of vessels and the use of equipment on the shoreline and on marsh buggies and other vessels to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The dredging depth in the borrow area would be -24.0 feet NAV88, and the maximum excavation depth to accommodate the booster pump within the borrow area would be -10.0 feet NAV88.

The creation of the MCAs, containment dike areas, and overburden disposal area would result in localized compaction and sediment disturbance that would permanently alter geologic characteristics and substrates, including sediment dynamics, at a localized level. The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to geologic changes.

Centrally locating the staging area between the three MCAs, rather than creating multiple staging areas, and locating the sidecast disposal area in a previously disturbed location would reduce disturbance that would lead to disruption or changes in geology and substrates from erosion and compaction. Containment dikes would be built using in-situ material within boundaries of the marsh fill areas, which would be refilled during construction of the MCAs, thereby reducing the extent of areas excavated or dredged. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing erosion during and after construction.

Once completed, the MCAs would provide long-term benefits to geology and substrates. The depositions of sediments in the MCAs would raise substrate elevations affected by subsidence and sea level rise, thereby helping to increase the resiliency of the coastal wetlands. Restoration of the marshes would increase protection of the coastline from sea level rise and help reduce shoreline erosion. The long-term benefits to geology and substrates from implementation of the alternative help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.3.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

Basins and Impaired Waterbodies

The Golden Triangle alternative is in the Pontchartrain Basin, which covers portions of southeast Louisiana and southwest Mississippi. The topography of the Pontchartrain Basin is marked by rolling hills and coastal wetlands with elevations ranging from 300 feet above sea level to 10 feet below sea level (LDWF 2005b). The northern portion of the basin includes freshwater lakes, whereas lakes in the southern portion of the basin, Lakes Maurepas, Pontchartrain, and Borgne, form a shallow brackish basin. This brackish basin receives freshwater inputs from several rivers and regional drainage and diversion canals, with saltwater inputs from the Gulf of Mexico that travel through the Mississippi Sound, MRGO, Chef Pass, and Rigolets Pass (LDWF 2005b). The flows in the basin have been influenced by a number of sources, including channelization, construction and operation of drainage and diversion systems, mining practices, and operation of dams or reservoirs (LDWF 2005b).

There are no fresh surface waterbodies in the Golden Triangle alternative. The waters around the MCAs and the western terminus of the conveyance corridor would include the estuarine portion of the Bayou Bienvenue River from MRGO to Bayou Villere (subsegment 042004) (LDEQ 2014). Water levels in the MCAs vary, with water bottoms typically being less than 1 foot below the ground surface (NAVD88). The conveyance corridor, borrow area, and the southern portion of the access corridor are in Lake Borgne (subsegment 042001), which is an estuarine coastal lagoon, with depths near the alternative ranging from 6 to 10 feet. The northern portion of the access corridor is in the Bayou Sauvage, which is an estuary that includes a hurricane protection levee to Chef Menteur Pass (subsegment 041702). There are no aquifers underlying the MCAs, and the closest aquifer is the Mississippi River alluvial aquifer, approximately 1 mile north of the MCAs and approximately 0.2 mile north of the most northern extent of the proposed access corridor.

The water quality of the Pontchartrain Basin is heavily influenced by saline water inputs through tidal exchanges (USGS 2002). The MCAs have experienced changes in salinities and hydrology from loss of wetlands, freshwater inputs (primarily rainfall), and saline inputs from Lake Borgne, which is heavily influenced by saltwater inputs from the Mississippi Sound and by freshwater inputs from the Pearl River (USGS 2002). Bayou Bienvenue (subsegment 042004), which surrounds the MCAs, fully supports PCR, SCR, and FWP. However, this subsegment does not fully support OYS because of the presence of fecal coliform from wildlife and other waterfowl sources, and it was placed on 2018 303(d) List of Impaired Waterbodies (LDEQ 2019a). Lake Borgne fully supports PCR, SCR, FWP, and OP, and the Bayou Sauvage segment crossed by the alternative fully supports PCR, SCR, and FWP.

Water quality measurements were collected in 2018 from 38 locations in and around the borrow area in Lake Borgne at depths of 1 to 10 feet (APTIM 2018a). These measurements revealed salinity concentrations in Lake Borgne ranging from 2.79 to 2.85 practical salinity unit, or parts per thousand (ppt), which fall within the average salinity for brackish surface water, which is defined by state water quality standards as 2 parts per thousand (ppt) or greater and less than 10 ppt (LDEQ 2017). Dissolved oxygen concentrations in Lake Borgne ranged by depth from 7.34 to 6.84 milligrams per liter, which exceed estuarine water quality standards of 4 milligrams per liter. Turbidity levels in the lake, which range in depth from 5.72 to 8.91 FNU, are well below the maximum guideline level for estuarine lakes, as defined by state water quality standards, of 50 NTU.

Wetlands and Floodplains

There is more than 480,000 acres of wetlands in Pontchartrain Basin, including brackish marshes throughout the Golden Triangle MCAs and the banks of Lake Borgne surrounding the alternative (CWPPRA 2019; LDWF et al. 2013). These wetlands serve as major sources of carbon sequestration. CWPPRA (2019) estimates more than 66,000 acres of marsh in the basin has been converted to open water since 1932. As described for the West Grand Terre alternative, wetlands in the region have been deteriorating because of subsidence and sea level rise. Levees along the Mississippi River limit freshwater, sediment, and nutrient inputs to the basin, and the construction of the MRGO and other canals has led to increased subsidence rates from heightened salinity, thereby increasing stress to wetlands in the region. Wetlands have also deteriorated because of erosion from vessel traffic in the MRGO channel, which results in waves along the channel (CWPPRA 2019). It is estimated that erosion has caused the direct loss of more than 1,700 acres of marsh since 1968 (CWPPRA 2019).

The Golden Triangle alternative is located within SFHAs subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone). The MCAs, areas north of the conveyance corridor and borrow area, and the access corridor are within a SFHA Zone VE, with BFEs ranging from 17 to 24 feet (FEMA 2016).

Coastal brackish marshes in the MCAs are irregularly tidally flooded. The construction of channels, including the MRGO, have impacted the area's hydrology and likely contributed to the severity of flooding in the area, including flooding in New Orleans during Hurricane Katrina in 2005 (van Heerden et al. 2009).

As part of the Hurricane and Storm Damage Risk Reduction System, three permanent canal closures and pumps, 107 miles of levees/floodwalls, 1,400 acres of levee turn maintenance areas, 200 flood gates, and six navigable floodgates have been constructed by Orleans Levee District (Southeast Louisiana Flood Protection Authority – East 2017a). In St. Bernard Parish, 57 miles of levees/floodwalls, 1,400 acres of levee turn maintenance areas, 32 land-based flood gates, two navigable floodgates, 56 miles of drainage canals, and eight drainage pump stations have also been constructed as part of the system. The levees/floodwalls in these areas include a 1.8-mile-long Lake Borgne Surge Barrier designed to prevent the inundation of New Orleans metropolitan areas in the event of a 100-year flood (or storm surge) in Lake Borgne, the MRGO, and the GIWW (Southeast Louisiana Flood Protection Authority – East 2017b).

Environmental Consequences

Construction and implementation of the Golden Triangle alternative would result in short-term, minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

The use of a staging area on the shoreline of Lake Borgne would disturb soils and lead to erosion. Anchoring and other offshore activities, including the use of equipment near the shoreline and on pontoons to excavate, dredge, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration.

The disturbance of soils and sediments and increases in erosion during construction could lead to increased turbidity and sedimentation in nearby wetlands and waterbodies, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into wetlands or waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards. Sand fencing and vegetation would be installed in the dune and MCAs to reduce erosion.

Centrally locating the staging area between the three MCAs, rather than creating multiple staging areas, and constructing dikes along the perimeters of the MCAs to contain marsh creation materials would reduce disturbance that would contribute to erosion and sedimentation. The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize adverse impacts on hydrology, water quality, and wetlands by minimizing sediment and pollutant loads into waterbodies and controlling stormwater runoff. Therefore, construction and implementation of the Golden Triangle alternative would result in short-term and minor adverse impacts to hydrology, water quality, and wetlands.

Once completed, the MCAs would provide long-term benefits to hydrology, water quality, and wetlands. The creation of marshes would help coastal wetlands reconnect to tidal flooding, which would restore the natural hydrology in and around the localized the marsh areas. Restoring the hydrology would support the reestablishment of natural estuarine salinity gradients and would help maintain and improve coastal water quality, thereby benefiting coastal habitats and resources in the Golden Triangle Marsh area. These long-term benefits to hydrology and water quality from implementation of the alternative would help restore and support natural hydrologic processes and improving overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.3.1.3 AIR QUALITY

Affected Environment

The Golden Triangle alternative is uninhabited and only accessible by boat. As a result, air pollution sources would be limited to infrequent boat traffic and small oil and gas processing facilities. The closest major sources of air pollution come from vessel and boat traffic along the GIWW and the MRGO, which serve as major shipping channels, ports along shipping routes, and urban-industrial areas in and around New Orleans. As described for the West Grand Terre alternative (see Section 4.2.1.3), other sources of air pollution come from the release of soil-sequestered greenhouse gases through wetland degradation.

There are two LDEQ air quality monitoring stations in the Orleans Parish that are both located in New Orleans: the City Park station (EPA AQS 220710012) and the I-610 New Orleans Near Road station (EPA AQS 220710021) (LDEQ 2019b). There are also two stations in St. Bernard Parish in the cities of Chalmette (EPA AQS 220870007) and Meraux (EPA AQS 220870004). From 1995 through July 2019, the Orleans Parish has been listed as an attainment area for all NAAQS (EPA 2019a). St. Bernard Parish has been listed as nonattainment area for sulfur dioxide from 2013 through July 2019.

Environmental Consequences

Short-term, minor adverse impacts to air quality would result from construction of the alternative. In-water and onshore construction activities during implementation of the Golden Triangle alternative would require the use of vehicles, machinery, and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.3.1.4 NOISE

Affected Environment

Because the Golden Triangle alternative marsh area is uninhabited and accessible only by boat, noise is limited to activities associated with oil and gas wells, the pipeline crossing Lake Borgne, and transient vessel traffic. Noise from distant urban areas and other oil and gas production facilities likely contribute negligible noise impacts to the MCAs and conveyance corridor. The borrow area and access corridor are closer to major noise-producing sources including vessel and boat traffic and port activities in GIWW and MRGO. In addition to these noise sources, the northern portion of the access corridor is within 1 mile of noise-producing developed areas, including a rail line, Chef Menteur Highway, and industrial and residential areas. However, this area is sparsely populated, and noise generated by these urban areas is negligible.

Environmental Consequences

The Golden Triangle alternative would result in short-term minor adverse noise impacts. Construction of the Golden Triangle alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials. These noise impacts would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. The alternative would not result in long-term noise impacts.

4.3.2 Biological Resources

4.3.2.1 HABITATS

Affected Environment

The Golden Triangle alternative is in the St. Bernard Delta of the Mississippi River, which is geographically located at the southern end of the Lower Mississippi River Ecosystem (LMRE). The LMRE includes the deltaic plain and associated marshes and swamps created by the meanderings of the Mississippi River and its distributaries. The alternative is located within the Gulf Coast Prairies and Marshes ecoregion of the LMRE, occupying the coastal zone of the Gulf of Mexico and defined by coastal prairie and marsh communities (Daigle et al. 2006). Louisiana's coastal marsh areas comprise salt, brackish, intermediate, and fresh marsh habitat types.

The alternative falls within and directly adjacent to the Bayou Sauvage NWR on the shoreline of Lake Borgne, within the city limits of New Orleans. The NWR was established in 1990 to provide wintering habitat for migratory birds and waterfowl (USFWS 2009). The NWR includes fresh and brackish marshes and coastal hardwood forest and serves as valuable habitat for wildlife, fish, and shellfish, and contains one of the last remaining marsh areas adjacent to Lake Pontchartrain and Lake Borgne. Lake Pontchartrain and adjacent lakes in Louisiana form one of the larger estuaries in the Gulf Coast region. The marshes along Lakes Pontchartrain and Borgne serve as estuarine nurseries for various fish species, crabs, and shrimp.

Specifically, the proposed marsh restoration portion of the alternative consists of brackish marsh, which is irregularly tidally flooded and is usually found between salt marsh and intermediate marsh. Brackish marshes support salt-tolerant vegetation and typically have higher plant diversity and soil organic matter than salt marshes (LDWF 2019d). Brackish marshes are dominated by saltmeadow-marshhay cordgrass, followed by smooth cordgrass. Smooth cordgrass generally dominates the edges of marsh ponds (USFWS 2019b). Other species may include saltmarsh lythrum (*Lythrum lineare*), sturdy bulrush (*Bolboschoenus robustus*), and coastal saltgrass (*Distichlis spicata*). Common reed (*Phragmites australis*), a nonnative species, has also been recorded near the alternative at monitoring station CRMA3650 (CRPA 2019a). Black mangrove exists in a few areas, and some live oak (*Quercus virginiana*) can be found along natural levees. Observations from site visits suggest the alternative would support a brackish marsh community dominated by smooth cordgrass and saltmeadow-marshhay cordgrass. SAV was observed in shallow water areas throughout the marsh restoration portion of the alternative (APTIM 2018a).

The alternative's borrow area, most of the pipeline corridor, and the access corridor generally consist of soft-bottom marine benthic habitats. The borrow area has a substrate consisting of a mud/sand/silt matrix and water depths range from 2 to 3 m (6–10 feet). Surveys conducted in the borrow, overburden disposal, and conveyance areas confirmed that there are no SAV present (APTIM 2018b). The borrow area and a portion of the pipeline corridor are within critical habitat for Gulf sturgeon designated under the ESA (see Section 4.3.2.4).

Environmental Consequences

Minor, short-term adverse effects to the marsh and estuarine habitats of the Golden Triangle alternative from construction could occur during fill activities. These adverse impacts include increased potential for erosion and sedimentation and temporary habitat loss related to ground disturbance and placement of sediment in marsh habitats. In estuarine environments, adverse impacts include a localized and short-term decrease in available dissolved oxygen and an increase in turbidity, temperature, and biological oxygen demand during sediment removal and placement.

Creation and/or nourishment of approximately 774 acres of brackish marsh habitat would have short-term, minor adverse impacts on existing habitat near the fill area. The marsh fill area includes approximately 694 acres of degraded marsh and approximately 80 acres of intact marsh habitat. The placement of dredged sediment within the marsh fill area would convert areas of open shallow water and degraded marsh to approximately 494 acres of intertidal and 263 acres of subtidal brackish marsh. This may increase turbidity in aquatic habitats located near the marsh fill area in the short term. Sediment placement may result in the loss of individual plants (including SAV) and habitat within the marsh fill footprint; however, these impacts would be limited to localized areas, and similar habitat is available directly adjacent to the disturbance area. Post-construction, the newly created marsh area would be revegetated with native vegetation; therefore, the disturbance of existing habitat would be short term. In the long term, an increase in quality and quantity of brackish marsh habitat would be beneficial for estuarine and marine ecosystems because healthy marshes provide dissolved organic compounds and detritus that would provide food and energy resources for both the planktonic and benthic communities of estuarine and nearshore habitats.

Construction of approximately 44,000 linear feet of containment dike would result in minor, short-term impacts to estuarine habitats. Similar to the impacts discussed above for the marsh fill activities, an increase in turbidity of adjacent aquatic environments from ground-disturbing activities (such as digging and placement of sediment and pile driving) may occur in the short term. Post-construction, the containment dikes would be revegetated with native vegetation; therefore, the disturbance of existing habitat would be short term. Minor, long-term beneficial effects from placement of sheet piling and containment dikes could result in a change in elevation that may affect the vegetation community that reestablishes on the containment dike.

As noted above, no SAV are present within the borrow area, pipeline corridor, or navigation channel; therefore, no adverse impacts to SAV are anticipated. Minor, short-term impacts associated with the pipeline corridor would result from laying sediment pipeline from the borrow area to the marsh fill areas. These adverse impacts include disturbance of benthic habitat and increased turbidity of estuarine environments and would be minor and short-term. In the borrow site, minor to moderate short-term adverse impacts to benthic resources would occur as the overburden is removed from the borrow area. Long-term, benthic resources in disturbed areas would reestablish from adjacent undisturbed areas. Following fill operations, the pipeline corridor and borrow areas would return to ambient conditions and be re-colonized by benthic populations within 1 to 3 years (Greene 2002) following construction.

Impacts associated with the potential dredging of the navigation channel would be similar to those described for the borrow areas.

Ground-disturbing activities could result in the spread of invasive species near the MCAs of the alternative, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring, and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.3.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. Continued land loss in and around the alternative has changed the landscape and use of habitat over time (USFWS 2009). In particular, Hurricane Katrina affected available habitat for terrestrial species. Bayou Sauvage NWR is directly adjacent to the proposed marsh creation portion of the alternative. Because of the proximity of the NWR to the alternative, it is assumed that wildlife species

described as potentially occurring in the NWR may also be present within similar habitats in the alternative.

Mammals common to the Bayou Sauvage NWR and likely to use the Golden Triangle alternative are white-tailed deer (*Odocoileus virginianus*), squirrels, otter (*Lutra canadensis*), raccoon, feral hog (*Sus scrofa*), nutria, and mink (*Mustela vison*). Large numbers of American alligators and turtles, such as the diamondback terrapin, existed on the refuge; however, these species have experienced population declines as a result of habitat loss related to Hurricane Katrina (USFWS 2009).

The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37. The Bayou Sauvage NWR provides habitat for more than 340 species of birds and is recognized as an important area for migratory waterfowl and other waterbirds that depend on shallow water with submerged and emergent herbaceous aquatic plants. The position of the NWR as an oasis in the midst of development and open water also makes it an important resting and feeding area for migratory songbirds. Wading birds use the abundant forage resources in the shallow water habitats; however, because trees and other vertical features are rare, the alternative provides limited nesting habitat. The emergent marsh habitat supports marsh birds; these species need a mosaic of open, shallow water with emergent vegetation. Secretive marsh bird surveys in the Bayou Sauvage NWR prior to 2005 revealed large numbers of nesting king and clapper rails (*Rallus elegans* and *R. crepitans*), purple and common gallinules (*Porphyrio martinica* and *Gallinula galeata*), and least bittern (*Ixobrychus exilis*); these numbers have declined since Hurricane Katrina. A number of gull and tern species use the Bayou Sauvage NWR for loafing and feeding. Other waterbirds of management concern that feed in the area are the brown pelican, which is observed year-round but does not breed on the refuge, and the American coot (*Fulica americana*) and American white pelican (*Pelecanus erythrorhynchos*), which winter in the area (USFWS 2009).

Environmental Consequences

Minor, short-term adverse impacts from construction may occur to wildlife individuals during marsh fill activities and pile driving related to human noise and disturbance and habitat change or loss. Short-term, minor adverse impacts to wildlife individuals could occur during ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Other short-term, minor adverse impacts include the loss of habitat during construction in the short term. However, any such impacts would be localized and temporary, and impacted individuals of most wildlife would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the marsh fill activities. The restoration of additional highly productive marsh habitat is anticipated to be largely ecologically beneficial. The improvement in quality of habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species have the potential to occur within the alternative. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential impacts to resident and migratory birds. Therefore, long-term adverse effects to these species would not be anticipated. Minor, short-term adverse impacts to foraging birds may occur if displaced during construction; however, marsh areas are available outside of the alternative and would provide foraging habitat. Long-term benefits include improved habitat diversity and longevity of the marsh as a foraging resource and an increase in the quantity and quality of the foraging habitat, in addition to improvement of nesting habitat for colonial waterbirds once vegetation becomes established. Potential minor, short-term adverse effects from the dredging activities would be limited to disturbance to birds in nearshore waters from increased vessel traffic. However, such impacts would be localized and temporary, and impacted individuals would move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.3.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the marsh, and the borrow, overburden disposal, and conveyance areas. The wetlands, flats, and subtidal habitat around the Golden Triangle Marsh provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Brackish marsh habitat supports benthic and epiphytic algae and is important for estuarine larval forms of marine organisms including shrimp, crabs, and fish species such as Gulf menhaden (LDWF 2005a).

The borrow area contains a mud/sand/silt matrix, and water depths range from 2 to 3 m (6 to 10 feet). Benthic organisms would be similar to those described for the borrow and conveyance areas of the West Grand Terre alternative (see Section 4.2.2.3). Adjacent to the alternative, Lake Borgne provides habitat for bivalve species including the Gulf wedge clam (*Rangia cuneata*) and eastern oyster. Oyster leases are present along the edge of Lake Borgne directly adjacent to portions of the MCAs and bisected by a conveyance area (LDWF 2019b).

Macroinvertebrate samples were collected from Lake Borgne in 2018, and seven taxa were identified. The dominant species sampled was the Gulf wedge clam, followed by two gastropod mollusks *Texadina sphinctostoma* and *Probythinella protera* (Wood Environment and Infrastructure Solutions 2018). An occasional polychaete worm (*Mediomastu*s sp. or *Hermundura tricuspis*) or aquatic insect (*Collembola* sp.) was found in a few of the samples. No crustaceans, echinoderms, or other phyla were collected in any of the samples. The sampling demonstrated a fairly low species richness. A benthic survey was performed by USACE Engineer Research Development Center to assess potential benthic species assemblages within Lake Borgne and Biloxi Marsh (USACE 2012). The benthic species assemblage was dominated by polychaetes (62%), bivalves (14%), and amphipods (11%). The most abundant species, the polychaete *Mediomastus ambiseta*, accounted for more than 28% of all animals collected. The most abundant bivalve mollusks were *Macoma mitchelli*, *Mulinia lateralis*, and *Mulinia pontchartrainensis*. Amphipods were dominated by *Ampelisca abdita*, *Ameroculodes* sp., and *Cerapus benthophilus*. Other abundant species included the gastropod *Acetocina canaliculata*, two unidentified species of nemerteans, and the oligochaete *Tubificoides* sp. This assemblage is typical of soft bottom, mesohaline communities throughout the northern Gulf of Mexico.

The alternative is considered saltwater as are the areas to the north (Lakes Maurepas and Lake Pontchartrain) and the areas to the south and east (Lake Borgne and the Mississippi Sound). However, the Golden Triangle alternative and surrounding habitat is better described as estuarine; therefore, both freshwater and saltwater fish species may use the area. In Lake Borgne, 29 species of freshwater and estuarine-marine fish have been documented (Davis et al. 1970). These include bay anchovy, striped anchovy, channel catfish (*Ictalurus punctatus*), Atlantic croaker, spot, sand seatrout, southern puffer (*Sphoeroides nephelus*), Gulf menhaden, and gafftopsail catfish. Saltwater species noted as common near Lake Borgne and Lake Pontchartrain are southern flounder, red drum, spotted seatrout, crabs, and shrimp (USFWS 2009).

The alternative is in EFH Ecoregion 3 (East Louisiana, Mississippi, and Alabama), which extends from Pensacola Bay to the Mississippi Delta and contains a variety of estuarine habitat types designated as EFH (e.g., open water, emergent saline and brackish marsh, submerged aquatic grass beds, oyster reef, sand/shell bottom, and mud/soft bottom). In the alternative, EFH has been designated for red drum, reef fishes (gray [mangrove] snapper and lane snapper), shrimps (brown and white shrimp), sharks (Atlantic sharpnose shark, black-tipped shark, bull shark, finetooth shark, and scalloped hammerhead shark), and one coastal migratory pelagic (Spanish mackerel) (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.3-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

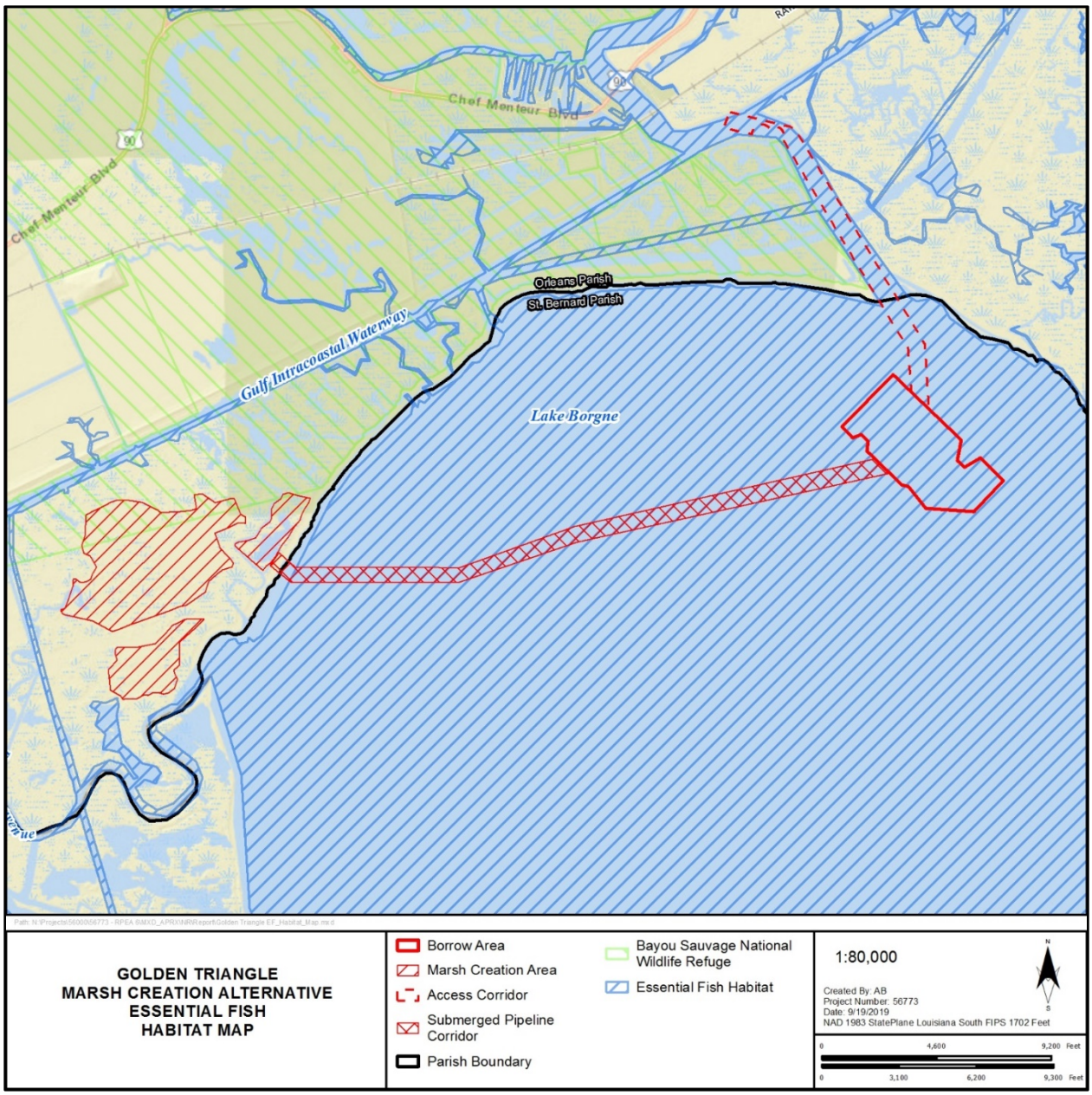

Figure 4.3-1. Essential fish habitat within the Golden Triangle alternative.

Environmental Consequences

The Golden Triangle alternative was designed to avoid oyster lease locations during construction activities (i.e., dredging and marsh creation) and during placement of construction features (i.e., submerged pipeline and booster pump locations). Therefore, no direct adverse impacts to existing oyster leases in the alternative are anticipated. Potential indirect adverse impacts would be similar to those described below for benthic fauna and fish habitats.

Short-term, minor adverse impacts to benthic habitats during marsh fill activities may occur from the placement of pipelines in the pipeline corridor, dredging of the borrow area, and placement of sediment in the footprint where existing shallow water and intertidal marsh habitats would be covered. Disturbance of sediments during dredging and sediment placement may increase turbidity around these areas, which could affect sensitive benthic habitats such as SAV (Michel et al. 2013) in the short-term; however, SAV was only observed in the marsh fill areas and would not be adversely impacted by installation of the pipeline or dredging of the borrow area. Minor, short-term adverse impacts to any slow-moving or sessile benthic organisms found within the borrow area and intertidal footprints of the marsh restoration sites through removal or burial (as discussed in Section 4.2.2.3), respectively. More mobile benthic species would likely be displaced, whereas other impacts to the benthic fauna would be localized and confined to construction areas. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly. The recovery of abundance, diversity, and evenness relative to reference sites often generally occurs within 1.0 year and achieving community composition similar to undisturbed sites occurs within 2.5 years (Greene 2002; Michel et al. 2013).

During construction, short-term, minor adverse impacts to marine and estuarine species habitats may occur through pile driving, sediment deposition, and increased turbidity. The conversion of shallow open water habitat within degraded marsh habitats to restored intertidal and subtidal marsh could result in long-term, minor adverse impacts to habitat; however, this impact would be offset by the long-term ecological benefits from restoring marsh habitats. Productive marsh habitats support ecological connectivity within the estuarine ecosystem through the movement of animals that use wetlands during their lifecycle to grow and reproduce. Many of the species that use brackish marshes as juveniles later move into deeper waters, where they serve as prey for other species. Overall, marsh restoration would provide long-term benefits for many estuarine and marine species, including fish, shrimp, and shellfish in the form of food, shelter, breeding, and nursery habitat. Marsh restoration would benefit benthic resources by providing increased dissolved organic compounds and detritus that would provide food and energy resources for benthic organisms.

Short-term minor adverse effects to EFH may occur during dredging and fill-related activities (such as pile driving). During these activities, species and their prey species may leave the borrow area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in disturbance of feeding or spawning and other behaviors by some species individuals in the short term. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed restoration of marsh habitat would result in long-term benefits to estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh restoration would also benefit species within the ecosystem by contributing to the aquatic food web and providing a more productive habitat. On February 14, 2019, NOAA concluded that the Golden Triangle alternative would not have substantial adverse effects to EFH, and consultation was concluded.

4.3.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of Orleans and St. Bernard Parishes. The list of species listed as threatened or endangered within these two parishes is the same as those described for the West Grand Terre alternative and are described in Table 4.2-2. Because the alternative consists of estuarine and brackish marsh habitats and is located far from the nearest barrier island and/or beach habitat, six species included in Table 4.2-2 (Gulf sturgeon; pallid sturgeon; West Indian manatee; and green, loggerhead, and Kemp's Ridley sea turtles) have the potential to be present in or near the alternative (USFWS 2019a). However, because the pallid sturgeon inhabits large freshwater rivers with flowing waters specifically

within the main-channel habitats (USFWS 2014) and because the Golden Triangle alternative is in Lake Borgne, the estuarine environments of which lack the characteristics of large riverine main channel habitats, sand bars, and islands preferred by the pallid sturgeon (USFWS 2007), this species is not expected to be present in or near the alternative.

West Indian manatee occurs along the southern Louisiana coast (USFWS 2019a). Manatees feed on submerged vegetation, but mainly forage on marine seagrasses such as turtle grass, manatee grass (*Syringodium filiforme*), and shoal grass (*Halodule wrightii*). Habitats suitable to support marine vegetation, which could attract the West Indian manatee, may be present in the alternative. However, West Indian manatee has not been documented in or near the alternative; thus, occurrences of this species is uncommon, and there is a low probability the species would occur in the alternative (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within the alternative.

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending on the life stage of the species and season (NMFS 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). Gulf sturgeon are categorized into spawning populations based on the river system they inhabit. Currently Gulf sturgeon inhabit and spawn in seven river systems, the Pearl River system is the closest to the alternative. The Pearl River empties into the eastern portion of Lake Borgne near the Rigolets. The alternative is located within designated critical habitat for this species in Lake Borgne and Lake Pontchartrain (discussed in more detail below).

Designated critical habitat for Gulf sturgeon is present within the alternative (Figure 4.3-2). Critical habitat for the Gulf sturgeon was designated in 2003 (USFWS 2007) and is restricted to the eastern half of Lake Pontchartrain and the entirety of Lake Borgne, in the eastern portion of the alternative (see Figure 4.3-2). This critical habitat (Unit 8) (USFWS and NMFS 2003) contains habitat identified as estuarine and marine habitat of the species, and provides juvenile, subadult, and adult feeding, resting, and passage habitat from the Pascagoula and the Pearl River subpopulations. Lake Pontchartrain is thought to provide important wintering habitat for juveniles and subadults (USFWS 2007). Few Gulf sturgeon have been found inhabiting Lake Borgne (USACE 2012).

Elements of the Golden Triangle alternative that would be located within the critical habitat unit include the 78-acre borrow area and the portion of the pipeline corridor within Lake Borgne. Suitable habitat is considered where water is 2 to 4 m deep with at least 80% sand, and the benthic community is dominated by crustaceans and annelids (Fox et al. 2002). As sandier substrates provide higher concentrations of benthic organisms, habitats with substrates consisting of greater than 75% sand are likely more valuable foraging habitat. During the borrow area design stage for the Golden Triangle alternative, surveys were conducted in 2017 and 2018 to characterize the substrate in potential borrow areas to determine potential for Gulf sturgeon habitat. Areas with 75% or greater sand content were determined to be potential foraging habitat (Fox et al. 2002) and were eliminated from consideration for borrow area placement. All the sediment samples collected in the proposed borrow area contained sand composition below the 75% concentration (APTIM 2018a). Generally, sandy habitat is absent from Lake Borgne, although Gulf sturgeon prey also includes amphipods that are closely associated with brackish, muddy habitats that are common across Lake Borgne (USACE 2012). Therefore, it is possible that the Gulf sturgeon is present within the alternative. Although sturgeon may still attempt to forage in areas with lower sand content, the best available science indicates that foraging sturgeon are associated with sandier substrates (> 75%) (Fox et al. 2002; Harris et al. 2005; Ross et al. 2009). Based on monitoring data (telemetry) of sturgeon presented by USFWS, there does not appear to be a population of sturgeon that inhabits the borrow areas in Lake Borgne.

Three species of sea turtles (loggerhead, Kemp's Ridley, and green sea turtles) may be present within the alternative's marine environments. Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for loggerhead, Kemp's Ridley, and green sea turtles, these species are not expected to use terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The loggerhead, green, and Kemp's Ridley sea turtles may be present within the shallow waters of the alternative for feeding because the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe 2016). The loggerhead sea turtle is the most common sea turtle species in Louisiana.

No piping plover critical habitat is in the alternative (USFWS 2001). The closest piping plover critical habitat is CH Unit LA-7, which is approximately 55 miles west of the alternative and includes the Chandeleur Islands and other islands to the south in the Gulf of Mexico.

No bald eagles are known to breed and winter near the alternative.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) uses the southeastern Louisiana salt and brackish marsh habitat within Lake Borgne and Bay Boudreau, Louisiana (Hayes et al. 2019); therefore, this species may be present in and around the alternative.

Environmental Consequences

Activities that may adversely affect manatees present in and around the alternative are construction-related in-water work that would include dredging, pile driving, marsh fill, and placement of pipeline. These activities would result in adverse impacts related to temporary, localized turbidity and construction noise that may result in avoidance behaviors by manatees if present near the alternative's construction area. Other adverse impacts include collision with vessels/barges and entanglement with debris that may catch on anchor management and/or dredge systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential adverse impacts to this species. Adherence to the protection measures would help ensure that any manatee present in the alternative would not be adversely affected. Any potential disturbance to the manatee would be intermittent, would be limited to project construction, and would result in temporary displacement as individuals would likely move to another area for foraging or resting purposes. In the long term, an increase in marsh habitat area would be beneficial for healthy vegetative communities because marsh habitats are a major energy source for both the planktonic and benthic communities of estuarine and nearshore habitats, which could contribute to improved conditions for SAV in in and around the alternative.

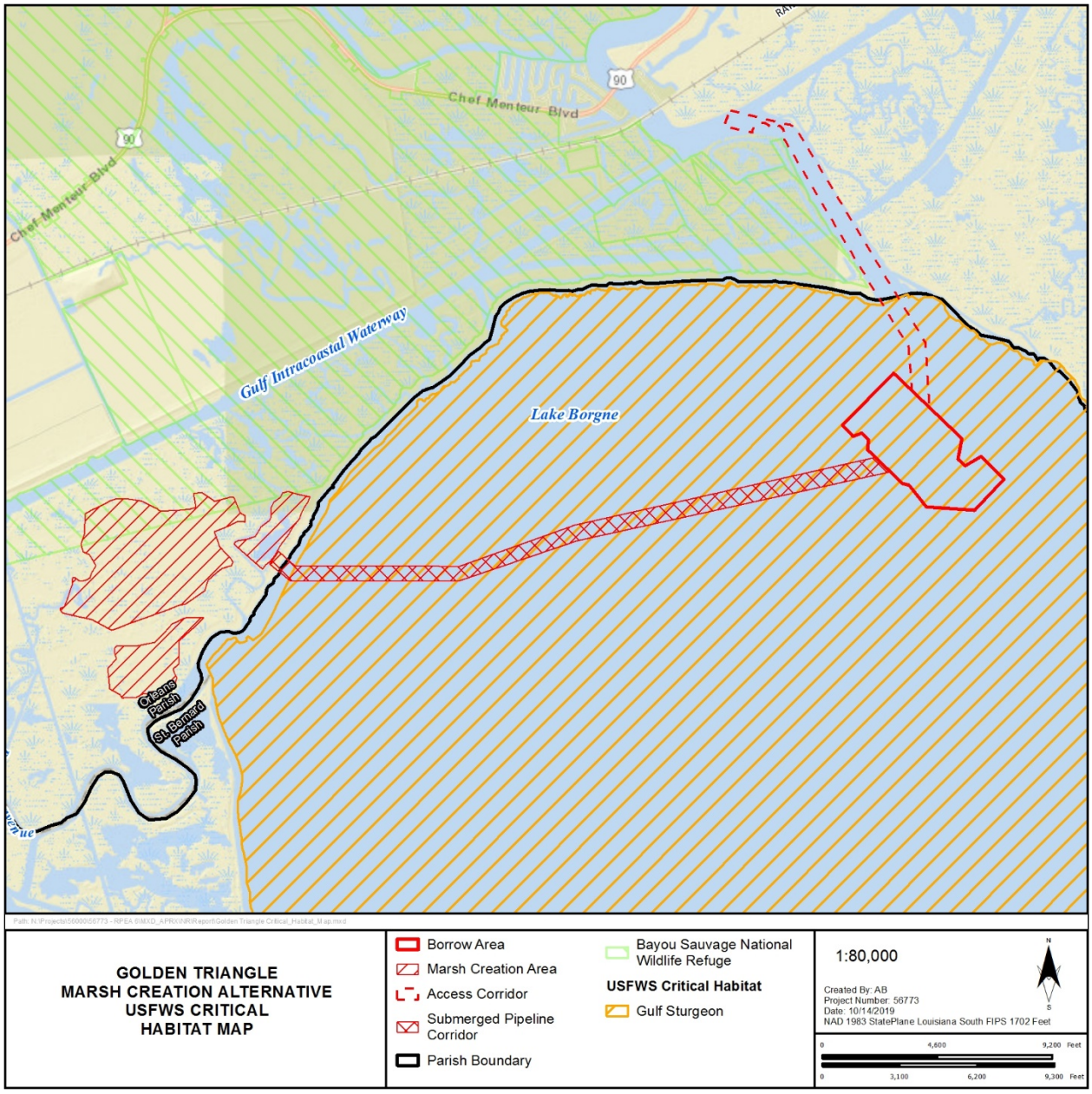

Figure 4.3-2. Critical habitat within Golden Triangle Marsh Creation alternative.

Because the alternative contains estuarine habitat, the Golden Triangle alternative would have the potential to result in adverse impacts to adult and sub-adult Gulf sturgeon while overwintering and foraging. Gulf sturgeon could be adversely impacted by in-water work that would include dredge activities that result in temporary, localized turbidity, decreases in dissolved oxygen, and habitat alteration. Noise related to construction and human activity, such as pile driving, may also disturb Gulf sturgeon. These fish are highly mobile; therefore, individuals disturbed by effects from construction activities would likely move to another area. Other adverse impacts may include potential entrapment or entrainment during dredging and/or entanglement with anchor management systems. Long-term adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated because of the localized and temporary nature of the construction activities and the implementation of the Gulf sturgeon BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS to reduce and avoid potential

adverse impacts to this species. The long-term beneficial effects of the Golden Triangle alternative would contribute to improvement of shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem. As a result, the Golden Triangle alternative would contribute to long-term net benefits to biological resources and ecological conditions, which could benefit this species.

Adverse impacts to Gulf sturgeon critical habitat may include disturbance to benthic habitats within Lake Borgne and the loss of potential foraging habitat adjacent to the area of disturbance. The dredging operations could result in temporary degradation of water quality through the release of buried organic matter causing the reductions in dissolved oxygen and sediment suspension resulting in increased turbidity. Additionally, noise associated with construction activities (such as pile driving) could result in the temporary loss of foraging habitats because individuals may avoid suitable habitats in and near the alternative. These effects are not anticipated to result in long-term, adverse impacts to designated critical habitat for Gulf sturgeon because dredging areas are located outside of potential high-value foraging habitat and suitable foraging habitat is available outside of the alternative. As described in the affected environment, Gulf sturgeon use of Lake Borgne is believed to be low, and potential high-value foraging Gulf sturgeon habitat was eliminated from consideration for borrow area placement; therefore, potential adverse impacts to critical habitat would be limited to short-term disturbance in the vicinity of the borrow areas during dredging. Construction activities would be temporary and localized in nature during construction activities. Long-term adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated.

Construction activities associated with the Golden Triangle alternative may result in temporary impacts to the marine life stages for loggerhead, Kemp's Ridley, and green sea turtles. Sea turtles could be adversely impacted by in-water work that would include dredge activities that result in temporary, localized turbidity; decreases in dissolved oxygen; and habitat alteration. Noise related to construction and human activity, such as pile driving, may also temporarily disturb sea turtles and may result in avoidance behaviors if sea turtles are present in the alternative's construction area. Other adverse effects of construction may include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with debris that may catch on anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. In the long term, impacts associated with the marsh restoration are anticipated to be beneficial to ecological conditions in and around the alternative, and the overall impacts would benefit these species.

Potential impacts to bald eagle would be similar to those discussed for the West Grand Terre alternative (Section 4.2.2.4). Potential impacts to bottlenose dolphin would be similar to those discussed for West Indian manatee.

4.3.3 Socioeconomic Resources

4.3.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Golden Triangle alternative is located within Orleans Parish and St. Bernard Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the census tracts in which the alternative is located (Census tracts 17.34, 9801, and 9900), Orleans Parish, St. Bernard Parish, state of Louisiana, and the United States. These data are summarized in Table 4.3-1.

Table 4.3-1. Demographic, Economic, and Social Data for the Golden Triangle Marsh Creation Alternative

Description	Census Tract 17.34	Census Tract 9801	Census Tract 9900	Orleans Parish	St. Bernard Parish	Louisiana	United States
Total population	977	0	0	388,182	45,067	4,663,461	321,004,407
Total minority population*	51	0	0	249,524	12,484	1,670,819	76,872,258
Population under the age of 5	101	0	0	23,322	3,453	310,431	19,853,515
Population 65 and older	287	0	0	50,009	4,629	655,848	47,732,389
Median age	57.1	–	–	35.9	33.6	36.4	37.8
Median household income (dollars)†	$69,115	–	–	$38,721	$45,265	$46,710	$57,652
Population below poverty level (%)	5.7%	–	–	25.4%	19.7%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	66	0	0	38,385	5,302	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation-adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The populations in Orleans Parish and St. Bernard Parish make up 8.3% and 1.0%, respectively, of Louisiana's population. Orleans Parish has a minority population of approximately 64%, which is more than the minority populations of Louisiana (36%) and the United States (approximately 24%). St. Bernard parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the overall United States.

The Golden Triangle MCAs are in Census tract 9801, which also includes a portion of the conveyance corridor that extends into Census tract 9900. The borrow area is in Census tract 9900, which also includes a portion of the access corridor that extends into Census tract 17.34. Census tracts 9801 and 9900 are uninhabited and are therefore not further discussed for the alternative.

The percentage of minority residents in Census tract 17.34 (approximately 5.2%) is less than the parishes, state, and country. The median household income for Census tract 17.34 ($69,115) is 56% more than Orleans Parish, 42% more than St. Bernard Parish, 39% more than Louisiana, and 18% more than the United States. The population living below the poverty level is lower for this Census tract than the parishes, Louisiana, and the United States. The population with a less-than-high-school degree within Census tract 17.34 (6.7%) is less than Orleans Parish (9.9%), St. Bernard Parish (11.8%), Louisiana (10.4%), and the United States (8.5%). Because minority and low-income populations in Census tract 17.34 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Golden Triangle alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative would not require displacements or demographic shifts from implementation of the alternative and the proposed activities would occur in uninhabited areas. Temporary closures made in the

alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

None of the Census tracts overlapping with the alternative are identified as an environmental justice population. Furthermore, because the alternative is located primarily on private land, it is unlikely that environmental justice communities outside of the three Census tracts referenced above would use the area for subsistence fishing. Therefore, environmental justice populations would not be disproportionally, adversely affected from construction and implementation of the Golden Triangle alternative.

4.3.3.2 CULTURAL RESOURCES

Affected Environment

A terrestrial cultural resource survey was conducted between December 4 and December 9, 2017, for the three MCAs and one equipment staging area. This survey included an airboat and pedestrian survey, nine bucket auger tests, forty-two piston cores, and one aluminum core to identify subsurface landforms and any evidence of culturally significant materials. The excavation materials were mostly peat deposits, which were not indicative of culturally significant resources. Review and testing of the fill areas did not indicate any evidence of archaeological sites or culturally significant materials (SEARCH 2018a).

A marine remote sensing survey was conducted from December 12 to 21, 2017, and from January 3 to 7, 2018. The remote sensing survey was conducted for the two sediment borrow areas, two pipeline corridors, and one dredge corridor. Analysis of the remote sensing data identified 356 magnetic anomalies, 77 side-scan sonar acoustic contacts, and 115 sub-bottom profiler acoustic reflectors. Of the 548 anomalies, contacts, and reflectors that were analyzed, nine magnetic anomalies in the proposed sediment borrow areas and dredge corridor exhibited characteristics similar to submerged cultural resources (e.g., shipwrecks) (SEARCH 2018a).

Environmental Consequences

The alternative would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. No new cultural resources were identified during the terrestrial survey, and no further testing is recommended within the terrestrial portions of the alternative.

The nine anomalies that exhibited characteristics similar to submerged shipwrecks are located as follows:

- One in the southwest borrow area
- Six in the northeast borrow area
- Two in the dredge access corridor

These anomalies are recommended for avoidance by a minimum distance of 50 m (164 feet) from the edges of the anomaly. If avoidance is not an option, additional archaeological investigation/diver identification is recommended to determine their nature and eligibility for nomination to the NRHP would be implemented (Louisiana Division of Historic Preservation 2018).

Disturbance of the seafloor during construction activities has the potential to encounter and cause long-term adverse impacts to unidentified submerged cultural resources. The possibility of encountering an unidentified and unanticipated submerged cultural resource is always present during dredging and construction activities. Impacts to portions of historic properties that damage characteristics that make them eligible for the NRHP are long term and irretrievable. Restoration measures and management actions, such as avoidance buffers, would be designed to avoid cultural resources to the extent practicable.

Consultation with the Louisiana SHPO and tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative.

4.3.3.3 INFRASTRUCTURE

Affected Environment

The Golden Triangle alternative is uninhabited and is located directly east of New Orleans. The alternative is bounded to the southeast by Lake Borgne and to the southwest by Bayou Bienvenue. The MCAs are located along the Intracoastal Waterway. The closest road is Industrial Parkway, which runs parallel to the Intracoastal Waterway. The MCAs are approximately 2 miles from U.S. Route 90, which runs east–west along the coast. CSX railroads also run along U.S. Route 90 along the coast. Two small private airports are within 10 miles of the alternative: New Orleans Lake Front Airport located east of IHNC and Fishers Field in Meraux. The Bayou Sauvage NWR intersects the alternative.

Several pipeline canals and interconnected bayous run throughout the Golden Triangle alternative. Oil and gas exploration in the area has also resulted in pipelines and wells as shown in Figure 3.2-2. The Entergy natural gas transmission line traverses MCA 3 from west to east. A petroleum flowline also traverses MCA 3 from south to north. Database research indicates that this petroleum pipeline may have been owned by Exxon Pipeline Company/Meraux Terminal but was sold to PBF Energy. All other pipelines listed in the databases are located outside of the fill and borrow area design footprints. The Entergy natural gas line traverses MCA 3 from east to west. Goodrich Petroleum Company LLC is located near the western corner of MCA 3. Southern Natural Gas Company has many pipelines adjacent to MCA 3 and west of fill areas. PXP Louisiana is east of MCA 1 and adjacent to the proposed borrow areas (LCSINC 2019).

Environmental Consequences

The Golden Triangle alternative would result in short-term, minor adverse impacts to infrastructure from localized interruptions to access, public services, and utilities, but it would not cause any long-term impacts to infrastructure. Potential impacts may include unintended interruptions to service and outages, as well as reduced access for the utilities to conduct maintenance activities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure that traverse the alternative. During the alternative's design, the area was surveyed to avoid oil and gas resources. Although most of the existing infrastructure is located outside the direct alternative footprint, there are a few natural gas pipelines that cross MCA 3, including an existing pipeline that crosses the proposed pipeline corridor. To minimize potential impacts during dredge operations, BMPs, including those discussed in Appendix C under Infrastructure, would be implemented to avoid significant impacts to infrastructure. Additionally, the alternative would not affect any highways, other major transportation networks, or other infrastructure.

4.3.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

The Golden Triangle is a narrow band of brackish marsh in Orleans Parish and is between Lake Borgne and the confluence of the MRGO and the GIWW. The IHNC Lake Borgne Surge Barrier stretches across the Golden Triangle Marsh. This area is primarily wetland and open water and is void of business or residential structures; however, some of the property within the alternative is privately owned. Most of the alternative is owned by Chalmette Meadows, LLC and the Bayou Sauvage NWR (managed by the USFWS).

The Golden Triangle area in Orleans Parish is zoned as a "Natural Areas District." It is the largest urban NWR and is located entirely within the city limits of New Orleans (USFWS 2009). In addition, the Golden Triangle Marsh falls within the Bayou Sauvage NWR acquisition boundary, one of the last remaining marsh areas adjacent to Lakes Pontchartrain and Borgne (USFWS 2018). The alternative was also introduced in the 2012 coastal master plan (CPRA 2012) to mitigate the effects of saltwater intrusion and land degradation.

Similar to Jefferson Parish, both Orleans and St. Bernard Parishes also have established local CZM programs to maintain consistency with Louisiana State and Local Coastal Resources Management Act of 1987. Both parishes are located entirely within the Louisiana Coastal Zone Boundary (Orleans Parish 1985 and St. Bernard Parish 2013). Orleans Parish revised its local CZM in 1985. St. Bernard Parish's local CZM program was finalized in 1982, received federal approval in 1987, and was subsequently updated in 2013. The Golden Triangle falls within EMU 14 Lake Borgne, which is a newly designated unit consisting primary of large expansions of open water in St. Bernard Parish's coastal zone. EMU 14 Lake Borgne is an embayment opening into the Mississippi Sound and the Gulf of Mexico and includes all of the designated Lake Borgne area and a small portion of the Mississippi Sound, and Grand Island (recently relabeled Halfmoon Island on USGS quadrangles) (St. Bernard Parish 2013).

Environmental Consequences

The Golden Triangle alternative would result in no short-term adverse impacts to land and marine management. Implementation of the Golden Triangle alternative would also result in long-term benefits to land and marine management. The alternative would restore marsh in the form of three MCAs, a borrow area, and pipeline corridor connecting the borrow area to the restoration site. A CUP is required for implementation of the Golden Triangle alternative. On August 21, 2019, CPRA received the CUP/Consistency Determination from the LDNR Office of Coastal Management, which demonstrates compliance with CZMA. This action is consistent with the goals of the 2017 coastal master plan (CPRA 2017a); 2009 *Bayou Sauvage National Wildlife Comprehensive Conservation Plan* (USFWS 2009); and state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Coordination with private landowners is underway.

The alternative would not affect existing land uses within the Bayou Sauvage NWR managed by the USFWS or conflict with the Bayou Sauvage NWR management objectives. Therefore, the alternative would not result in any changes to land and marine management because it would be consistent with the current parish and coastal management, practices, and plans. The alternative would assist both parishes in achieving CZM goals of protecting and improving shorelines and result in a long-term beneficial impact to land and marine management.

4.3.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

Bayous, open marsh areas, and small lakes in St. Bernard Parish and the alternative offer many opportunities for recreation and sightseeing. Louisiana Highway 47 is a designated scenic highway that serves as a corridor to promote sightseeing and enjoyment of the parish's natural and cultural opportunities (St. Bernard Parish 2013). Bayou Bienvenue is an 8-mile designated scenic stream in St. Bernard Parish located from Bayou Villere east of Louisiana Highway 47 to Lake Borgne. Common recreational activities on scenic streams include boating, fishing, birdwatching, canoeing, and kayaking (St. Bernard Parish 2013). The waters surrounding the alternative support swimming, boating, fishing, and oyster propagation. In addition, duck hunting is a common recreational activity on the private lands in the alternative (CRPA 2019d).

The Golden Triangle Marsh falls within the Bayou Sauvage NWR acquisition boundary and offers recreational opportunities such as birdwatching, hiking, boating, wildlife observation and photography, hunting, fishing, and crabbing (USFWS 2019b). According to the 2009 *Bayou Sauvage National Wildlife Comprehensive Conservation Plan* (USFWS 2009), many areas in the NWR have been temporarily closed since the 2005 hurricane season. The refuge would gradually reopen these areas as ongoing recovery efforts are completed. Currently, the Bayou Sauvage NWR serves as one of the last remaining non-hunted sanctuaries in the area for wildlife and presently is not opened to hunting. However, the refuge is considering opening the marshes outside of the Hurricane Protection Levee System to limited youth waterfowl hunting (USFWS 2009).

The primary objectives of the Bayou Sauvage NWR are to provide habitat for the protection of fish and other wildlife. Fishing is one of the main public uses of the refuge. Access to and recreational use of refuge resources are permitted in designated areas and in accordance with state and federal regulations. The refuge sport fisheries and crawfish populations provide sustainable recreational fishing opportunities. The introduction of limited waterfowl hunting is also being evaluated. There are several public access points for fishing activities. There is a handicap accessible observation pier on U.S. Route 90, at the Wayside Park location. The U.S. Route 11 boat launch provides access to anglers whose boat engines are 25 horsepower or less. The Madere Marsh Unit off U.S. Route 90 is a popular site for fishermen to catch bait. Opportunities for crawfishing are also abound at the Madere Marsh Unit (USFWS 2009).

Environmental Consequences

The Golden Triangle alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreational users at the Bayou Sauvage NWR from temporary or partial closures, interruptions to recreational activities, or visual interference or obstruction from construction. These short-term impacts to recreation and tourism would be limited to the construction period for the alternative and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including Bayou Sauvage NWR and other scenic areas.

In the long term, the alternative could have a minor beneficial impact on recreation and recreational fishing because it would benefit and create a habitat for a variety of fish and wildlife species that could use the Bayou Sauvage NWR. The temporary impacts associated with the construction of the alternative would be offset by the potential long-term benefits to tourism and recreation.

4.3.3.6 FISHERIES AND AQUACULTURE

Affected Environment

The Lake Borgne area encompasses 162,505 acres of waters of Lake Borgne. Lake Borgne is an important estuarine system that supports commercial fishing for shrimp, crabs, and oysters. Lake Borgne contains some of Louisiana's prime oyster grounds (USGS 2018). It is also a recreational fishing destination for fishing spotted seatrout, red and black drub, and seasonal fish such as Atlantic tripletail (*Lobotes surinamensis*) (St. Bernard Parish 2013).

Oysters grow in the coastal waters of Louisiana and are an important economic resource. Oystermen harvest oysters from public oyster grounds and from bottom waters leased by private entities for oyster production. There is approximately 1.68 million acres available for public harvest and approximately 385,000 acres currently under lease in the state of Louisiana (Banks et al. 2016). The oyster growing areas in St. Bernard Parish are divided into public oyster growing areas and private oyster growing areas, which are leased by individuals from the state. Recent data indicate that there is approximately 89,124 acres of privately leased oyster grounds and 700,872 acres of public oyster growing areas in St. Bernard Parish (St. Bernard Parish 2013). There are two active oyster leases along the coast in Lake Borgne comprising approximately 0.30 acre.

Commercial fishing is important to the residents and local economy of St. Bernard Parish. Commercial fishing is a year-round activity for many residents of St. Bernard Parish, and sport fishing is important for both residents and visitors. The Pontchartrain estuarine unit, of which St. Bernard Parish is a major component, ranks second in total harvest only to the Barataria Basin area. Louisiana as a whole produces 27% of the fisheries tonnage of the entire United States (St. Bernard Parish 2013). For example, in 2014, oyster landings by volume in Lake Pontchartrain were 3,701,817 pounds and Barataria Basin landings were 4,351,435 pounds. Together these two major estuarine basins made up approximately 65% of state oyster landings by volume for 2014 (Banks et al. 2016). However, despite the problems of saltwater intrusion, subsidence, and land loss, estuarine areas of St. Bernard Parish still serve as important nursery grounds and grow-out areas for many species of fish and shellfish. In the estuaries and offshore waters of St. Bernard, there are many species of commercial and sport fish and shellfish including the alligator gar (*Atractosteus spatula*), Atlantic croaker, black drum, Gulf menhaden, red drum, sand seatrout, sheepshead (*Archosargus probatocephalus*), southern flounder, spotted seatrout, striped mullet, eastern oyster, blue crab, brown shrimp, and white shrimp. Among these, the most commercially important include the Gulf menhaden, white and brown shrimp, blue crab, spotted seatrout, red drum, black drum, spot, sand seatrout, southern flounder, Atlantic croaker, and eastern oyster (St. Bernard Parish 2013).

Within the refuge is a diversity of freshwater and saltwater species. Common freshwater species are bass, catfish, mullet (Mugilidae), crappie (*Poxomis*), minnow (*Phoxinus phoxinus*), and bream (*Abramis brama*). Common saltwater species are flounder, red drum, spotted seatrout, crabs, and shrimp. Fish assemblages in Lake Pontchartrain change seasonally depending on the balance between the amount of freshwater entering the lake from drainages and the amount of saltier Gulf waters that dominate during times of little rainfall. Presently, most fishing in the refuge is by bank fishers. Anglers are seeking brackish-water species deposited in the impoundments during the storm surge. Spotted seatrout fishing and crabbing have increased, whereas largemouth bass (*Micropterus salmoides*) and bluegill (*Epomis macrochirus*) have declined (USFWS 2009).

Environmental Consequences

The Golden Triangle alternative would have short-term, minor adverse impacts to fisheries within the borrow area and MCAs during restoration construction, but it would result in long-term benefits to fisheries and aquaculture. Dredging would relocate benthic and infaunal organism and potentially entrap slow-moving organisms from the borrow areas. In the MCAs, benthic organisms, sessile fish, and invertebrate species may be smothered during fill placement. Impacts to marine vegetation and coastal habitats are described in Section 4.3.2.1. Mobile aquatic animals would likely relocate from the alternative during construction and return after construction activities end. There may be short-term, minor adverse effects on fish eggs and larvae in the immediate area. Early-stage recruitment of defaunated sediments occurs rapidly by opportunistic infauna in coastal systems (Grassle and Grassle 1974; McCall 1977; Simon and Dauer 1977, as cited in EPA 2003). Continued and complex colonization would be more gradual and would depend on environmental conditions after construction activities are complete. Fish and invertebrates are expected to recover as turbidity returns to pre-construction levels. However, beneficial impacts are anticipated over the long term in the marsh habitat because it provides valuable nursery resources for estuarine-dependent fisheries. Access to the marsh habitat would be maintained after construction through dike gapping.

Impacts to the oyster leases in the Golden Triangle area would be similar to the impacts stated above. One of the pipeline corridors passes through a 500-foot-wide area adjacent to the northwest shoreline of Lake Borgne that had been previously cleared of oyster leases. Access routes would avoid oyster leases, and CPRA would conduct oyster assessments on these sites to document pre-construction conditions. The alternative could result in short-term, minor adverse impacts to fisheries and aquaculture during construction; however, such impacts would be minimized through BMPs. Fisheries and aquaculture would experience long-term benefits as a result of marsh habitat creation.

4.3.3.7 MARINE TRANSPORTATION

Affected Environment

The alternative is bounded to the southeast by Lake Borgne, to the southwest by Bayou Bienvenue, to the north by the GIWW, and to the west by the IHNC. The Golden Triangle alternative is located near the confluence of two major navigation and shipping channels, the MRGO and the GIWW. In 1956, Congress authorized the MRGO federal navigation channel to provide a shorter route between the Port of New Orleans and the Gulf of Mexico, which was authorized as a 36-foot deep, 500-foot-wide waterway extending from the IHNC lock to the 38-foot-deep contour in the Gulf of Mexico. Construction started in 1958, and the project was completed in 1968 (USACE 2012). Severe shoaling in the MRGO channel caused by Hurricane Katrina in 2005 led to its deauthorization by Congress in 2006. Through Public Law 109-234, Congress planned for a deauthorization rather than funding channel operation and maintenance, and on June 5, 2008, the MRGO was officially deauthorized from the confluence with the GIWW to the Gulf of Mexico as a federal navigation channel. A rock closure structure was constructed across the MRGO near the Bayou La Loutre Ridge in St. Bernard Parish, Louisiana, in 2009 (USACE 2012). Now, the MRGO channel is no longer a USCG-designated navigable waterway.

The channel was dredged between 1958 and 1968 across existing waterways and through wetlands to provide a shorter route to New Orleans and to enhance shipping interests in the area. After 2005, the USACE ceased dredging the MRGO to maintain deep draft navigation. In 2009, the MRGO was damned south of the Bayou La Loutre south bank natural levee thus preventing the channel's use by ocean-going ships. A second closure on the MRGO was in place by 2011 with construction of the flood wall across the MRGO south of its crossing of Bayou Bienvenue as part of the IHNC Lake Borgne Surge Barrier Project. This action further segmented the former navigation channel to reduce the risk of storm damage associated with a tidal surge (St. Bernard Parish 2013; USACE 2012).

Environmental Consequences

The Golden Triangle alternative would likely result in short-term, minor adverse impacts to marine transportation, and no long-term adverse impacts to marine transportation would occur. The alternative is located to the south of the GIWW and can only be accessed by boat; therefore, construction would likely result in a temporary increase in marine traffic volumes due to the locations of staging equipment areas in marinas and marshes in and near the alternative. This could result in negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators, but would not result in actual disruptions to larger transportation systems because this impact would be localized and confined to the alternative. A 210-acre access corridor from Chef Menteur Pass into Lake Borgne would be designated as the dredge access corridor to the Golden Triangle borrow area. Equipment would enter the area via the GIWW and into Lake Borgne via the Menteur Pass. Bathymetric surveys show that this access corridor may allow for navigation of equipment to access the borrow area without the need for access dredging. There is also a delineated staged area near the shoreline of Lake Borgne. In addition, all dredge pipe/subline installed within the corridor would be submerged, and navigation lights shall be affixed to buoys every 500 feet or per USCG regulations to notify marine traffic of the submerged pipeline. This would help minimize impacts to marine transportation and navigation.

4.3.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. Existing views may be obstructed or blocked by modifications to the environment (e.g., levee structures and graded areas).

Opportunities for public viewing of the Golden Triangle MCAs, borrow area, pipeline corridor, and access corridor occur along the Bayou Sauvage NWR located on the northern edge of the Golden Triangle restoration area, the GIWW located approximately 0.4 mile from the closest edge of the restoration area, and from the open water of Lake Borgne. Viewers of the Golden Triangle area see a variety of different vegetation and landscape features, including freshwater marshes, brackish marshes, bottomland hardwood forests, lagoons, canals, borrow pits, chenieres (former beach fronts), and natural bayous (USFWS 2009). Vegetation communities that make up the terrestrial and marsh areas are likely to obstruct most long-distance views because of the growth of taller vegetation such as live oak, sugar berry (*Celtis laevigata*), switchgrass (P*anicum virgatum*), and hogcane (*Arundinaria gigantea*). Long-distance views are likely to occur only along the open water of Lake Borgne and offer views of the open water and brackish marsh that are unobstructed by development. The existing viewshed of this area could be characterized as uninhabited natural areas along Lake Borgne.

Environmental Consequences

The Golden Triangle alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction. There would be long-term benefits to aesthetics and visual resources. The Golden Triangle alternative would include construction of three MCAs, a borrow area, and pipeline corridor to connect the borrow area to the restoration site and provide access to the three MCAs. The alternative would result in the creation and restoration of 884 acres of broken marsh and open water to provide intertidal and subtidal habitat. Public viewing of the Golden Triangle alternative area from land is somewhat limited because there are limited areas for viewing of the marsh, as discussed above. From the Bayou Sauvage NWR, the public would be able to view portions of construction for the creation of the

marsh area through the brackish marsh and open water landscape. Opportunities for the public to view the Golden Triangle area from the water may result in more short-term, minor adverse impacts as viewers would be witness construction equipment and activities interrupting the natural landscape. During construction, impacts to visual resources from the alternative would be short term, minor, and adverse because of the presence of construction personnel, equipment, vehicles, and partially completed restoration elements.

After construction, the alternative would result in an improvement to visual resources and aesthetics through the restored coastal habitats to restore degraded brackish marsh. The marshes would serve as a buffer to reduce storm surge and protect and restore wetland, fish, and wildlife habitats within the viewshed. New and restored habitat is anticipated to attract additional birds and wildlife, thereby adding to the enjoyment of the area by recreational users and the general public. Furthermore, the creation of the restoration area and marsh would be perceived as a long-term, beneficial visual effect impact and could result in an improved viewshed and offer visual improvements to recreationalists in the immediate area.

4.3.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

An HTRW study was not conducted because no indication of HTRW had been observed at the alternative (APTIM 2018a).

Subsidence, also known as vertical land movement, was estimated based on subsidence values for regions of coastal Louisiana in the 2017 coastal master plan (CPRA 2017a). CPRA estimated subsidence range of between 0.002 and 0.009 m/year for the New Orleans Landbridge of Orleans Parish (Region 3) (CPRA 2012). In addition, along the coast, the land elevation is decreasing while the mean sea level elevation is increasing, resulting in significant land loss. Subsidence, wind and wave erosion, and altered hydrology are historic causes of land loss that continue to convert land to open water in the area (LCWCRTF and WCRA 1999).

There are many estimates for eustatic sea level rise and subsidence. Tide data have been collected at the Grand Isle, Louisiana, tide gauge since 1947. The published data are a combination of data collected from two tide gauges, Bayou Rigaud and East Point, which are located approximately 0.9 mile apart along the northwest shore of Grand Isle. NOAA calculated the rate of relative sea level rise at Grand Isle using monthly means of tide data collected between 1947 and 2006. According to NOAA, the sea level at Grand Isle is increasing at a rate of 0.0303 feet/year (9.24 mm/year) (NOAA 2018).

The MRGO channel dramatically impacted hydrology and salinity (Shaffer et al. 2009), likely contributed to the severity of the flooding in New Orleans during Hurricane Katrina (van Heerden et al. 2009), and exacerbated wetland loss and damages to estuarine habitats in Louisiana from the other tidal marshes in Breton Sound to the cypress forests and freshwater marshes in the western reaches of the Lake Borgne basin (USACE 2012). It is estimated that the dredging of the MRGO channel and placement of dredged material resulted in the conversion of 19,400 acres of wetlands and 4,750 acres of shallow open water to deep open water or dredge material banks (USACE 1999, 2012).

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may occur during construction of the Golden Triangle alternative. There would be no long-term adverse impacts to public health and safety from the alternative. Construction projects involving the use of boats and barges, and associated equipment, for the placement of materials to create habitat could cause oil, fuel, or other hazardous

material spills in surface waters, resulting in short-term, minor adverse impacts. BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, would be incorporated into construction activities on-site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Because of the potential increase in small boat traffic (construction related) in the area, appropriate safety measures would be employed to avoid potential water related accidents and conflicts. As discussed above, there is no indication of HTRW near the alternative, which thereby presents no risks to public health and safety. There would be no long-term impacts to public health and safety from the alternative.

No short-term adverse impacts to flood and shoreline protection during construction of the Golden Triangle alternative would occur. This alternative would provide long-term benefits to flood and shoreline protection. The Golden Triangle alternative would create or restore approximately 774 acres of broken marsh and open water, which comprises the restoration of 694 acres of degraded marsh and nourishment of 80 acres of marsh, through the construction of approximately 44,000 linear feet of containment dikes. These marshes would act as a buffer to reduce the full force and effects of wave action, saltwater intrusion, storm surge, and tidal currents on associated estuaries and wetlands. The alternative would help buffer the surge barrier, which would provide natural storm protection and increase flood protections to highly populated areas of New Orleans and provide important estuarine habitat for Lake Borgne. As a result, the alternative would help maintain landscape integrity and enhance community resilience and promote natural resource stewardship and environmental education and outreach. Overall this would result in long-term beneficial effects on public health and safety.

4.4 Biloxi Marsh Living Shoreline Alternative

4.4.1 Physical Resources

4.4.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

The Biloxi Marsh alternative is in St. Bernard Parish, Louisiana, in the southern portion of the Pontchartrain Basin. The marsh is in the Mississippi River Delta plain and includes the St. Bernard Delta complex, which was created through alluvial valleys onto the continental shelf. The St. Bernard Delta complex buried the Pine Island barrier island and overtime experienced land loss, which led to the formation of the Chandeleur Islands (USGS 2002).

The nearshore elevations in the Biloxi Marsh alternative range from approximately -2.0 to -6.0 feet (NAVD88). The area is underlain by marsh deposits from the Holocene age, consisting of undifferentiated clays and layers of interdelta deposits of sandy soils. Within Bayou La Loutre are natural levee and point bar deposits consisting of silts and sands. Surface soils in the marsh area are part of the Scatlake series, which is described in detail in the affected environment of the West Grand Terre alternative (see Section 4.2.1.1.1). Most of the marine soil borings collected along the proposed breakwaters at the existing mudline near the edge of the marsh revealed top layers of very soft, dark-brown peat, and organic clays underlain by very soft clays with high moisture contents and very soft dark grey peat (Ardaman & Associates, Inc. 2018). Several soil borings collected near the middle of the proposed breakwaters and one soil boring near the eastern terminus of the breakwaters revealed layers of silty sand starting near or below depths of 10 feet below the surface.

Changes to the Biloxi Marsh and surrounding areas from subsidence and sea level rise are the same as those described for the Golden Triangle alternative (Section 4.3.1.1.1).

Environmental Consequences

Adverse impacts to substrates from construction and implementation of the Biloxi Marsh alternative would be short term and minor. The long-term benefits to geology and substrates from implementation of the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

Offshore activities, including the use of barges to excavate, fill and backfill, and construct the alternative, as well as installation of pilings, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of disturbance in the excavated areas would be limited to depths needed to contour the area for intimate contact with the ground surface. Removal of individual stumps within the alternative may require excavation and backfilling; however, this would be limited in scope.

The disturbance of sediments during construction would be small, localized, and temporary and would not result in detectable geologic or substrate changes in the localized area. The placement of materials in the temporary spoils area would result in localized sediment disturbance and compaction. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid disturbance to onshore geology and substrates. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing sediment disturbance and compaction during and after construction.

Once completed, the oyster reef breakwaters would provide long-term benefits to geology and substrates. Placement of reefs would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive shoreline erosion and loss experienced on nearby shorelines and increase the resiliency of coastal wetlands. The long-term benefits to geology and substrates from implementation of the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.4.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

Basins and Impaired Waterbodies

The Biloxi Marsh alternative is in the Pontchartrain Basin, and the hydrology and water quality conditions of the alternative are described for the affected environment of the Golden Triangle alternative (see Section 4.3.1.2.1). The Biloxi Marsh extends from the southeastern shoreline of Lake Borgne into Chandeleur Sound. The marsh crosses segments of the Bayou La Loutre, which was once a distributary of the Mississippi. The marsh is also part of the Biloxi WMA, which provides New Orleans a protective barrier against storm surges and waves.

The western portion of the proposed breakwaters is at the boundary of the Bayou La Loutre MRGO to Eloi Bay (subsegment 042003), an estuarine segment of the Mississippi River, and Eloi Bay (subsegment 042206), an estuary (LDEQ 2014). The eastern portion of the breakwaters would be located in Eloi Bay and in the Morgan Harbor (subsegment 042205), which is also an estuary. Water elevations measured during soil sampling in the alternative ranged from 0.5 feet above sea level to -0.1 feet below sea level (NAVD88). There are no aquifers underlying the Biloxi Marsh alternative, and the closest aquifer is the Mississippi River alluvial aquifer, approximately 30 miles northwest of the western terminus of the oyster leases.

The Biloxi Marsh area has experienced loss and degradation of shoreline and marsh areas from a number of factors, including erosion, which is exacerbated during hurricanes and other storm events that increase wave heights and force, sea level risk, sediment compaction and deprivation, and saltwater intrusion. In addition, the area's hydrology and water quality have been influenced by oil and gas infrastructure and activities and levee construction and maintenance. Despite these ongoing conditions, the water quality in the Biloxi Marsh alternative meets LDEQ's (2017) water quality standards. In 2018, Bayou La Loutre (subsegment 042003), Eloi Bay (subsegment 042206), and Morgan Harbor (subsegment 042205) were listed as fully supporting PCR, SCR, FWP, and OYS and had no water quality impairments (LDEQ 2019a).

Wetlands and Floodplains

The Biloxi Marsh alternative includes saline marshes in the Pontchartrain Basin. The characteristics of the Pontchartrain Basin system of wetlands and the sources of their deterioration are described for the affected environment of the Golden Triangle alternative (see Section 4.3.1.2.1). General flooding conditions for the Biloxi Marsh alternative, including sources of impacts to hydrology and increased flooding severity in the area, are also the same as described for the Golden Triangle.

Tidal levels in the Biloxi Marsh alternative range from 1.1 to -3.0 feet in elevation (NAVD88). During a storm event that would be comparable to a Category 1 hurricane, water levels in the alternative can reach +9.8 feet (NAVD88) (CPRA 2019e). The alternative is located within SFHAs subject to inundation by the 1% annual flood chance (i.e., 100-year flood zone). The marsh areas are in SFHA Zone VE, with BFEs ranging from 18 to 19 feet (FEMA 2017a, 2017b). Eloi Bay is in SFHA Zone V, which, similar to Zone VE, is a coastal flood zone with velocity hazards from waves but does not have a determined BFE.

Environmental Consequences

Construction and implementation of the Biloxi Marsh alternative would result in short-term minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improve overall coastal resiliency.

Anchoring and other offshore activities, including the use of equipment on barges to mobilize and demobilize all equipment, and barges and equipment to excavate and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration.

The disturbance of sediments during construction could lead to the movement of sediments and increased turbidity, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change in wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid surface disturbance that would cause sedimentation and lead to changes in hydrology and water quality. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. The alternative's design would implement BMPs, including those described in Appendix C under Hydrology and Water Quality, to minimize impacts on hydrology and water quality by minimizing sediment and pollutant loads into waterbodies and wetlands.

Once completed, the oyster reef breakwaters would provide long-term benefits to hydrology, water quality, and wetlands. Placement of reefs would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive alterations to hydrology and degradations of water quality experienced in the localized area. These long-term benefits to hydrology, water quality, and wetlands from implementation of the alternative would help restore and support natural hydrologic processes and improve overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration, thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.4.1.3 AIR QUALITY

Affected Environment

Air pollution sources in or near the Biloxi Marsh are limited because the area is uninhabited and only accessible by boat. Boat traffic around the alternative is infrequent, resulting in limited contributions to air pollution. There are multiple active and abandoned oil and gas wells and pipelines throughout the area. Activities associated with active oil and gas wells and maintenance of pipelines contribute limited and infrequent air pollution. Similar to the Golden Triangle alternative, the closest major sources of air pollution come from vessel and boat traffic along the GIWW and the MRGO, ports along shipping routes, and urban-industrial areas in and around New Orleans. As described for the West Grand Terre alternative, other sources of air pollution come from the release of soil-sequestered greenhouse gases through wetland degradation.

There are two LDEQ air quality monitoring stations in St. Bernard Parish in the cities of Chalmette and Meraux (LDEQ 2019b), which are described above for the Golden Triangle alternative in Section 4.3.1.3.1, Affected Environment. St. Bernard Parish was designated as a maintenance area for ozone in 1995 and has been classified as a nonattainment area for sulfur dioxide from 2013 through July 2019. The parish has been in attainment for all other NAAQS from 1995 through July 2019.

Environmental Consequences

Construction of the Biloxi Marsh alternative would result in short-term, minor adverse impacts to air quality. In-water construction activities during implementation of the Biloxi Marsh alternative would require the use of machinery and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.4.1.4 NOISE

Affected Environment

The major sources of noise in the marsh area would come from vessel and boat traffic and port activities in the GIWW and the MRGO. Because the Biloxi Marsh is uninhabited and accessible only by boat, other noise sources would be limited to oil and gas development activities and commercial fishing that are prevalent in and around the alternative area. Noise from distant urban areas contribute negligible noise impacts to the alternative.

Environmental Consequences

The Biloxi Marsh alternative would result in short-term, minor adverse noise impacts. Construction of the alternative would generate temporary, intermittent noise associated with vessels and equipment (such as a pile driver) and transport and placement of materials. Noise during construction would be localized. Because of the lack of residences and sensitive noise receptors near the alternative, noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. Following construction of the oyster reef breakwater, anticipated increases in recreational and commercial use of the adjacent oyster beds could lead to noise from users and motorized boats or equipment over the life of the alternative. However, these activities are already present in the nearby oyster leases; therefore, no new adverse noise impacts would occur.

4.4.2 Biological Resources

4.4.2.1 HABITATS

Affected Environment

The Biloxi Marsh lies within the Mississippi Alluvial Plain section of the Coastal Plains physiographic province of North America (Fenneman and Johnson 1946). Deltaic environs associated with the Mississippi River and the Gulf of Mexico are complex and include multiple ecosystems ranging from freshwater to saline. The deltaic plain landscape consists of several large interdistributary basins dominated by freshwater and saltwater marshes and numerous shallow lakes and ponds. The Biloxi Marsh lies entirely within the Deltaic Coastal Marshes and Barrier Islands ecoregion, which includes freshwater and saline marshes (Daigle et al. 2006). The Biloxi Marsh consists of more than 100,000 acres of brackish and salt marshes, which have been greatly impacted by shoreline erosion from wind-driven waves. The region has been modified considerably during the last 75 years as a result of artificial changes related to the oil and gas industry. The alternative is crisscrossed by numerous pipelines and human-made canals and has been subject to levee construction and maintenance (SEARCH 2018b).

The alternative is located along the shoreline of Bayou La Loutre, a previous distributary bayou of the Mississippi River into the Breton and Chandeleur Sound. The alternative is characterized by low marsh with an erosional shoreline. Vegetation includes saltmeadow-marshhay cordgrass, black needlerush (*Juncus roemerianus*), and coastal saltgrass. Black mangrove occurs in a few areas, and some live oaks are found along old natural levees. Seagrass meadows (SAV) decrease in the western bays of Chandeleur and Curlew Islands and in the shoals near Freemason, North, and New Harbor Islands, located approximately 17 miles northeast of the alternative. Brackish marsh SAV communities are composed primarily of water celery, widgeon grass, southern naiad (*Najas guadalupensis*), and horned pondweed (*Zannichellia palustris*). These brackish SAV communities grow in sand/mud bottom substrates in shallow, protected waters with low turbidity. Widgeon grass is the main submerged aquatic plant in the alternative (LDFW 2019c). There are no CRMS sites within the alternative; however, one site is approximately 5 miles north near Skiff Lake (CRMS 0124). Dominant vegetation at this monitoring site was smooth cordgrass (CPRA 2019a).

Environmental Consequences

Construction of 9 to 11 miles (and no more than 12.5 miles) of oyster reef would result in minor, short-term adverse impacts to nearshore and benthic habitats. Access to the oyster reef restoration area would require dredging to create a temporary access channel adjacent to the oyster reef placement area, and temporary and permanent placement of spoil on the seaward side of the marsh shoreline. An increase in

turbidity of adjacent marine environments from dredging activities associated with trenching, spoil placement, pile driving, and reef material placement may occur in the short term. Dredging may also be required for the placement of the oyster reef materials and/or marine mattresses, and spoil from these activities would be placed on the seaward side of the marsh shoreline between the oyster reef and existing marsh shoreline. The temporary access channel would be restored at the culmination of construction activities; therefore, long-term adverse impacts are not anticipated.

Oyster reefs help protect marsh habitats by reducing shoreline recession. Oyster reefs frequently occur just offshore the marsh edge, and their vertical structure serves to attenuate wave energies and reduce water velocities resulting in reduced erosion as well as increased sediment deposition behind the reef, both of which act to stabilize the shoreline (Campbell 2004; Piazza et al. 2005). As a result, long-term beneficial effects of the oyster reef installation would include shoreline and marsh protection. In addition, minor, long-term beneficial effects from placement of oyster reef materials in marine environments include change of existing habitat from a soft to a hard substrate. By adding vertical habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur. Bioengineered oyster reef can naturally rebuild vertically and respond to sea level rise. Long-term ecological benefits would result as the oyster reef would become a self-sustaining and valuable habitat for many estuarine species and benefit the water quality in the area.

Approximately 24 acres of saline marsh habitat would be lost as a result of the installation of marine mattress materials resulting in long-term, minor adverse impacts. However, benefits related to protection of marsh shoreline are anticipated to be greater than the total area of marsh lost and would be overall beneficial to marsh habitats, in addition to indirect benthic and estuarine ecosystem benefits.

Ground-disturbing activities could result in the spread of invasive species near the areas of the alternative where marine mattresses may be installed, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species. Post-construction, monitoring, and management for invasive species, as described in Appendix D, would reduce the potential for long-term adverse impacts to habitats from invasive species.

4.4.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. The Biloxi marshes provide important habitat for a wide range of fish and wildlife species. Coastal wetlands are rich in wildlife resources and provide nesting grounds and important stopovers for waterfowl and migratory birds. Specific to the alternative, continued land loss in and around the alternative and increased salinity have changed the landscape and use of habitat over time.

The Biloxi WMA is located approximately 10 miles northwest of the alternative. Because of Biloxi WMA's tremendous number of bayous, sloughs, and potholes, the area is home to an abundance of fish, shrimp, crabs, waterfowl, and furbearers. There are a few canal spoil banks and ridges scattered throughout the marsh, which provide birds and mammals refuge from rising water levels during storms or high tides (LDFW 2019e). Mammals that may be present are raccoon, squirrels, whitetail deer, mink, river otter, nutria, bats, rodents, and shrews. Alligators are known to be present within the alternative. Brackish wetlands are typically used by many different bird species, including seabirds, wading birds, shorebirds, dabbling and diving ducks, raptors, rails, coots, gallinules, and other emergent brackish marsh residents and migrants. Colonies of nesting birds of various species can be found within the alternative. The alternative is in the Gulf Coastal Prairie area in Bird Conservation Region 37 (see Section 4.3.2.2).

Environmental Consequences

Short-term, minor adverse impacts to wildlife individuals in the Biloxi Marsh may occur as a result of construction-related human noise and disturbance (such as from pile driving) and available habitat change or loss and ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species and temporary loss of habitat. However, any such impacts would be localized and short term, and most wildlife individuals would move to an area with more favorable conditions and return after construction is completed. No permanent displacement of wildlife species would be expected from the oyster reef placement activities; therefore, long-term adverse impacts from disturbance are not anticipated. The permanent loss of approximately 24 acres of saline marsh habitat would reduce the overall availability of this habitat across the landscape and result in minor, long-term adverse impacts to this habitat; however, because large expanses of saline marsh habitat are available directly adjacent to the alternative, it is not anticipated that the loss of 24 acres would have large-scale impacts. Overall, the placement of oyster reefs and resultant protection of existing saline marsh habitat are anticipated to be largely ecologically beneficial in the long term. The protection of marsh habitat and creation of additional oyster habitat would provide long-term benefits including that for reptiles, birds, and terrestrial mammals in the form of food, shelter, and breeding habitat.

Several migratory bird species have the potential to occur within the disturbance area. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential impacts to resident and migratory birds. Therefore, long-term adverse effects to these species would not be anticipated. Construction activities can result in minor, short-term adverse impacts to shorebirds from disturbance and reduced foraging efficiency if the birds are roosting and feeding in the area during a migration stopover. Foraging birds may be temporarily displaced during construction; however, marsh areas are available outside of the disturbance areas and would provide foraging habitat. Long-term benefits of shoreline protection would preserve areas of marsh as a foraging resource. Potential adverse effects from the dredging and oyster reef placement activities would be limited to short-term, minor impacts that include disturbance to birds in nearshore waters from increased human noise and activity. However, such impacts would be localized and temporary, and impacted individuals would likely move to an area with more favorable conditions and return after the disturbance has ceased. Impacts to terrestrial wildlife would be similar to those described for migratory birds.

4.4.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Tidal marshes provide forage habitat, spawning sites, and a predation refuge, and serve as a nursery for resident and nonresident fishes and macrocrustaceans. These organisms use tidal marshes or adjacent subtidal shallows, either year-round or during a portion of their life history, as nurseries. The existing emergent wetlands and shallow open water within and adjacent to the alternative provide important transitional habitat between estuarine and marine environments used by migratory and resident fish, as well as other aquatic organisms for nursery, foraging, spawning, and other life requirements. Shoreline erosion by wind-wave action is the dominant cause of wetland loss in the alternative.

A number of ecologically and economically important nekton and benthic species are dependent on the availability of suitable tidal marsh habitat. See the Golden Triangle alternative (Section 4.3.2.3) for a discussion of the results of a previous benthic organism surveys in the Biloxi Marsh area. Additionally, the water bottoms around the Biloxi Marsh contain extensive areas of low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). A portion of the alternative is located within oyster seed grounds managed by the LDWF.

The nearest major waterbody to the alternative is Chandeleur Sound, where water depths average 10 to 15 feet (USACE 2012). This waterbody and adjacent wetlands provide nursery and foraging habitats which support varieties of economically important marine fishery species, including striped mullet, Atlantic croaker, Gulf menhaden, spotted and sand seatrout, southern flounder, black drum, and blue crab.

The alternative is in EFH Ecoregion 3 (East Louisiana, Mississippi and Alabama), which extends from Pensacola Bay to the Mississippi Delta. The EFH components within the alternative include emergent wetlands, soft bottoms, and WCA. In the alternative, EFH has been designated for the same species as listed for the Golden Triangle alternative (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.4-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

Environmental Consequences

Minor, short-term adverse impacts to marine and estuarine species would be primarily associated with the dredging of the access channel, pile driving, and placement of oyster reef materials. Construction-related short-term, minor adverse impacts may include increased turbidity, siltation, entrainment of benthic species, disturbance, temperature changes, increased biological oxygen demand due to the introduction of organic matter into water column, and decreased dissolved oxygen. Benthic species within the access channel would suffer localized disturbance and/or mortality from dredging and construction. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often occurring generally within 1 year and achieving community composition similar to undisturbed sites within 2.5 years (Greene 2002; Michel et al. 2013).

Long-term installation of the oyster reef materials would have a beneficial impact. Shell reefs created by oysters provide unique, structurally complex habitat that supports distinct and diverse aquatic communities, functions as nursery habitat for many fish and shellfish species and enhances local productivity (Plunket and La Peyre 2005; Scyphers et al. 2011; Soniat et al. 2004, as cited in CPRA 2014a). Because the reef provides abundant and concentrated prey resources, it is a valuable forage site for transient, predatory fishes such as flounder, drum, and spotted seatrout (Plunket and La Peyre 2005; Scyphers et al. 2011). Oyster reefs would not only prevent the erosion of interior emergent wetlands, but would also protect interior shallow ponds, which are essential nursery habitats for many fishery species. Long-term benefits would include the potential for enhancement of the productivity of local oyster stocks as well as supply recruits to nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole.

Short-term, minor adverse impacts to EFH may occur during dredging and oyster reef placement activities. During these activities, species and their prey species may leave the disturbance area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in a temporary disturbance of feeding or spawning and other behaviors by some species individuals. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. The proposed oyster reef would result in long-term benefits to estuarine-related EFH by improving habitat for spawning, nursing, foraging, and shelter. Marsh protection would also benefit species within the ecosystem by continuing to contribute to the aquatic food web and maintaining a productive habitat.

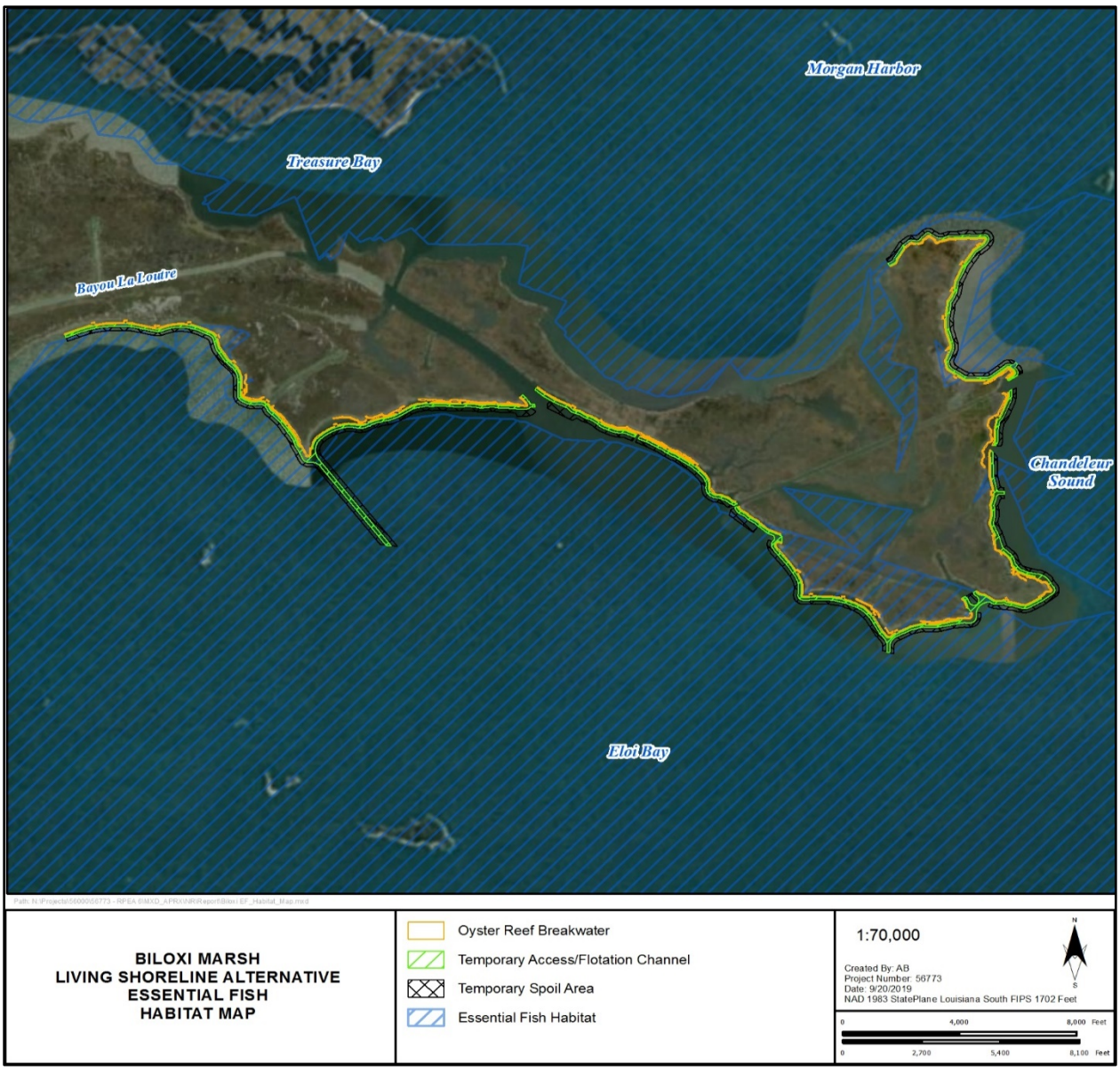

Figure 4.4-1. Essential fish habitat within the Biloxi Marsh alternative.

4.4.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of St. Bernard Parish. The list of species listed as threatened or endangered within this parish is the same as that described for West Grand Terre and described in Table 4.2-2. Because the alternative consists of estuarine and brackish marsh habitats and is located far from the nearest barrier island and/or beach habitat, only five species included in Table 4.2-2 (Gulf sturgeon, West Indian manatee, and three species of sea turtle [loggerhead sea turtle, Kemp's Ridley, and green sea turtles]) have the potential to be present in or near the alternative. There is no critical habitat in the alternative (Figure 4.4-2).

The Gulf sturgeon can occur in river systems and nearshore bays and estuaries depending upon the life stage of the species and season (NOAA Fisheries 2016). In Louisiana, the Gulf sturgeon is found in the Pearl, Bogue Chitto, and Tchefuncte Rivers in St. Tammany and Washington Parishes and is suspected to also occur in any large river in the Lake Pontchartrain drainage (LDWF 2019c). Gulf sturgeon are categorized into spawning populations based on the river system they inhabit. Currently, Gulf sturgeon inhabit and spawn in seven river systems, and the Pearl River system is the closest to the alternative. The Pearl River empties into the eastern portion of Lake Borgne near the Rigolets.

The West Indian manatee is known to occur along the southern Louisiana coast (USFWS 2019a). West Indian manatees are common in shallow coastal waters because they feed on submerged vegetation. Although there are no extensive areas of submerged vegetation in the alternative, widgeon grass is present and could provide limited foraging habitat for West Indian manatee. However, no known occurrences of this species has been documented within the alternative; thus, occurrences of this species is rare, and there is a low probability the species would be present (LDWF 2019c; NatureServe 2016). Manatees moving between areas of suitable habitat may occur within or near the alternative.

Three of the five species of sea turtles listed as threatened or endangered within the Orleans and St. Bernard Parishes may occur near the alternative (USFWS 2019a). The nearshore habitats near the alternative do not provide suitable foraging habitat for hawksbill or leatherback sea turtles; therefore, it is unlikely these species would be present (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). Of these three species, only the loggerhead sea turtle may nest within the alternative; the remaining two species (Kemp's Ridley and green sea turtles) would be present but only within the marine environments of the alternative.

Because of the absence of suitable nesting beach habitats and the absence of any records of nesting for these species, these species are not expected to occur in terrestrial habitats within the alternative (LDWF 2019c; Love et al. 2013; NatureServe 2016; NOAA 2019). The loggerhead, green, and Kemp's Ridley sea turtles may be present within or near the alternative and the alternative is located within the known ranges of these species (LDWF 2019c; NatureServe 2016).

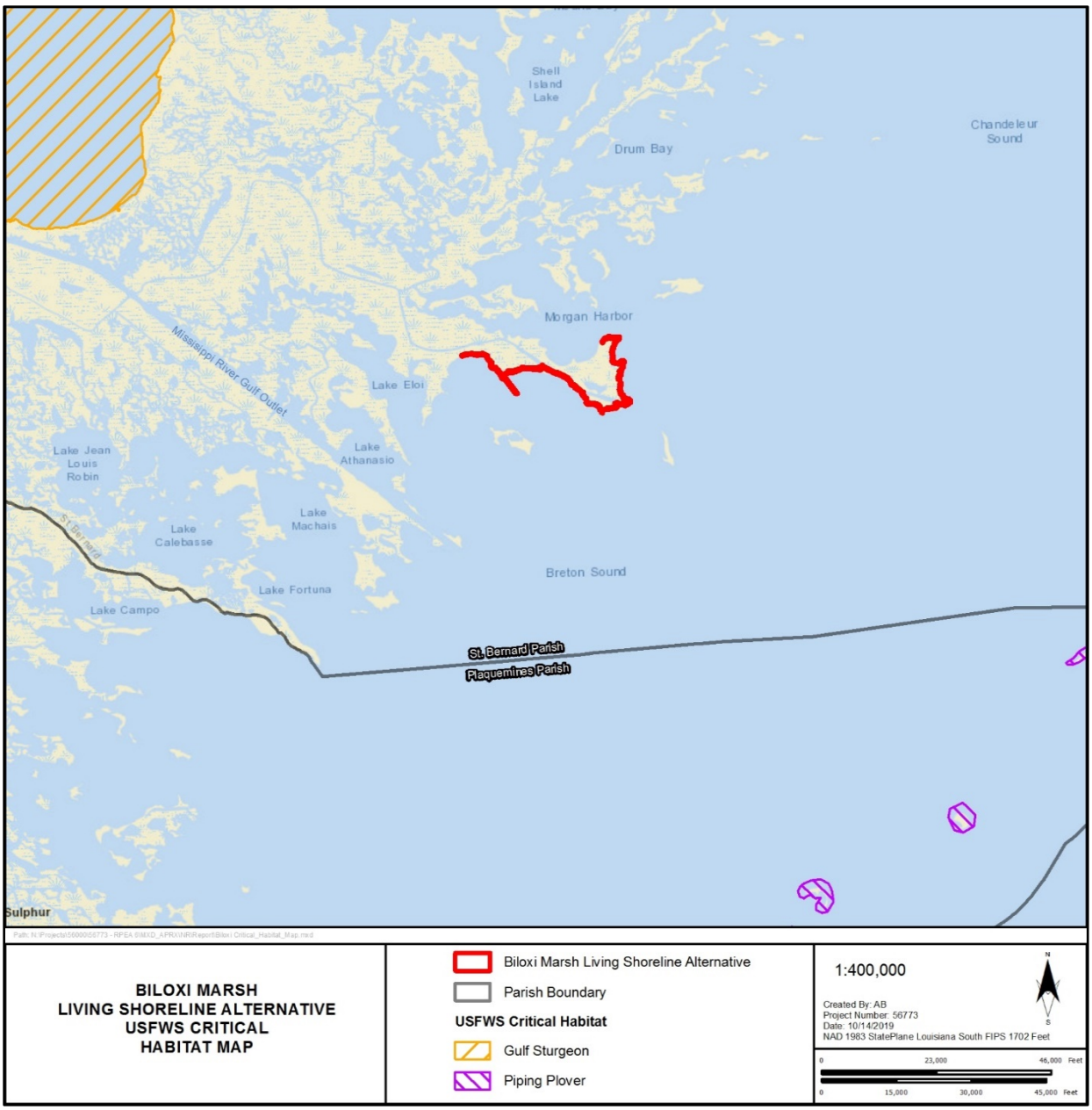

Figure 4.4-2. Critical habitat within Biloxi Marsh Living Shoreline alternative.

Bald eagles are known to breed and winter near the alternative.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents estuarine areas within the region for feeding (Hayes et al. 2019); therefore, this species may be present in the alternative.

Environmental Consequences

Because the alternative contains estuarine habitats, the Biloxi Marsh alternative could result in temporary adverse impacts to adult and sub-adult Gulf sturgeon while overwintering and foraging. Gulf sturgeon could be adversely impacted by dredging, pile-driving, and artificial reef placement activities that result in

localized turbidity and habitat alteration caused by dredging activity. Temporary increases in noise related to construction activities (such as pile driving) and human activity may also disturb Gulf sturgeon. These fish are highly mobile; therefore, individuals disturbed by effects from construction activities would likely move to another area. Long-term, adverse impacts such as downstream turbidity, pollution, or habitat loss are not anticipated because of the localized and temporary nature of the construction activities and the implementation of the Gulf Sturgeon BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS to reduce and avoid potential adverse impacts to this species. Because the long-term effects associated with the Biloxi Marsh alternative are anticipated to be beneficial to ecological conditions of benthic environments in the alternative, the alternative could benefit foraging habitat for this species.

Activities that may result in adverse impacts to manatees present in the alternative are construction-related in-water work that would include dredging and spoil placement for the temporary access channel, pile driving, and placement of artificial reef structures. These activities would result in localized turbidity and construction noise that may result in temporary avoidance behaviors if manatee are present in the construction area. Other adverse impacts include collision with vessels/barges and entanglement with debris that may catch on anchor management systems. Standard manatee conditions BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid potential adverse impacts to this species. The disturbance to manatees would be short term, would be limited to alternative construction, and would result in temporary displacement as individuals would likely move to another area for foraging or resting purposes. Long-term benefits would result because the oyster reef would become a self-sustaining and valuable habitat for many estuarine species and benefit the water quality in the area. The ecosystem benefits could result in improved conditions for SAV, which may provide additional forage for the species.

Construction-related in-water work that may result in temporary adverse impacts to loggerhead, Kemp's Ridley, and green sea turtles would include dredging and spoil placement for the temporary access channel, pile driving, and placement of artificial reef structures. These activities may result in localized increases in turbidity and construction noise that may result in temporary avoidance behaviors if sea turtles are present in the construction area. Other adverse effects of the construction activities include an increased potential for collision with vessels/barges, entrapment during fill activities, and/or entanglement with debris that may catch on anchor management systems. Sea turtle BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to reduce and avoid adverse impacts to these species. Sea turtles would likely avoid or move away from construction activities. The construction of the artificial oyster reef would improve benthic habitat and water quality and could benefit foraging habitat for sea turtles in the area.

Potential impacts to bald eagle would be similar to those discussed for West Grand Terre (see Section 4.2.2.4). Potential impacts to bottlenose dolphin would be similar to those discussed for West Indian manatee.

4.4.3 Socioeconomic Resources

4.4.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Biloxi Marsh alternative is located within St. Bernard Parish, Louisiana. To characterize the socioeconomic conditions and environmental justice communities, which are identified as minority or low-income populations, population, race, ethnicity, income, and poverty data were obtained from the U.S. Census Bureau for the census tract in which the alternative would be located (Census tract 301.05), St. Bernard Parish, state of Louisiana, and the United States. These data are summarized in Table 4.4-1.

Table 4.4-1. Demographic, Economic, and Social Data for the Biloxi Marsh Living Shoreline Alternative

Description	Census Tract 301.05	St. Bernard Parish	Louisiana	United States
Total population	305	45,067	4,663,461	321,004,407
Total minority population*	37	12,484	1,670,819	76,872,258
Population under the age of 5	0	3,453	310,431	19,853,515
Population 65 and older	68	4,629	655,848	47,732,389
Median age	50.6	33.6	36.4	37.8
Median household income (dollars)†	–	$45,265	$46,710	$57,652
Population below poverty level (%)	16.1%	19.7%	19.6%	14.6%
Less than high school graduate (population 25 years and older)	54	5,302	486,085	27,437,114

* Minority populations comprise non-white populations, including Black or African American, American Indiana and Alaska Native, Asian, Native Hawaiian and Other Pacific Islander, some other race, and populations of multiple non-white races, as described by U.S. Census Bureau (2017a).

† 2017 inflation-adjusted dollars.

Sources: U.S. Census Bureau (2017a, 2017b, 2017c).

The population in St. Bernard Parish comprises 1.0% of Louisiana's population. St. Bernard Parish has a minority population of approximately 28%, which is less than the minority population of Louisiana and more than the overall United States.

The Biloxi Marsh alternative is in Census tract 301.05. The percentage of minority residents in Census tract 301.05 (approximately 12.1%) is less than St. Bernard Parish, Louisiana, and the United States. No median household income is reported for Census tract 301.05 because of the small sample size, but the income for most (35%) of the sampled households (152 households) ranges from $35,000 to $74,999, suggesting similar median populations as St. Bernard Parish, Louisiana, and the United States. The population living below the poverty level is lower for this Census tract than St. Bernard Parish and Louisiana and higher than the United States. The population with a less than high school degree within Census tract 301.05 (17.7%) is more than St. Bernard Parish (11.8%), Louisiana (10.4%), and the United States (8.5%). Because minority and low-income populations in Census tract 301.05 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Biloxi Marsh alternative would not result in short- or long-term adverse socioeconomic impacts because the alternative does not require displacements or demographic shifts from implementation of the alternative and the activities for which would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparent and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions. The restored and enhanced oyster habitat from implementation of the alternative would provide long-term benefits to the local economy through increased jobs in oyster production and processing. These long-term socioeconomic benefits would benefit a few individuals, groups, or businesses and would not substantively alter social or economic conditions.

The Census tract overlapping with the alternative is not identified as an environmental justice population. Furthermore, if members of an environmental justice population outside of the Census tract referenced above engage in subsistence fishing in or near the Biloxi Marsh, the fishing opportunities would continue in adjacent areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally or adversely affected from construction and implementation of the Biloxi Marsh alternative.

4.4.3.2 CULTURAL RESOURCES

Affected Environment

A marine archaeological investigation for the Biloxi Marsh alternative, including background research, core sampling, and a remote-sensing survey, was conducted from August to October 2017. The Phase I remote-sensing survey included side-scan sonar, sub-bottom profiler, and magnetometer data collection. The side-scan sonar data suggested that intact deposits might be present at three locations. Phase II field testing to determine the presence or absence of submerged cultural deposits included the collection of six core samples and probing the seafloor to identify possible areas of intact shell midden (Fought et al. 2018).

Following analysis of the marine remote-sensing data, it was determined that no historic cultural materials were present within the alternative. Although the side-scan sonar record and magnetometer data yielded multiple potential targets within the survey area, the targets were determined to be modern in origin. The conclusion is fully supported through comparisons to historic maps and aerial imagery, which effectively show that the entire alternative was a terrestrial landscape less than 50 years ago. Instead, the targets identified in the remote-sensing record are associated with oil and gas development activities and commercial fishing prevalent within and around the alternative. No submerged historic cultural sites or materials would be disturbed during alternative construction, and no further work is recommended (Fought et al. 2018). This determination was reached following analysis of the remote-sensing record, field investigation, and analysis of sediment cores. No previously unknown archaeological sites were discovered within the alternative. Additionally, evidence fully substantiates the conclusion that the four previously identified archaeological sites have been destroyed through environmental processes active in the area, including erosion, subsidence, and relative sea level rise. Therefore, the alternative no longer contains any sites eligible for the NRHP, and no further historic evaluation work is recommended for the alternative (Fought et al. 2018).

Environmental Consequences

Because no historic cultural sites or materials were found within the alternative, the Biloxi Marsh alternative would result in no impacts to cultural resources.

4.4.3.3 INFRASTRUCTURE

Affected Environment

The Biloxi Marsh alternative is located along the Biloxi Marsh shoreline from Eloi Point near the mouth of Bayou La Loutre. The alternative is uninhabited, and there is limited infrastructure in this area. The alternative is crisscrossed with pipelines, human-made canals, and levee construction and maintenance. There is a large energy facility close to the alternative (SEARCH 2018b). A Louisiana Intrastate Gas Co. natural gas pipeline crosses the alternative.

Environmental Consequences

No long-term adverse effects from construction of the Biloxi Marsh alternative would result; however, short-term, minor adverse impacts to infrastructure would result. Because of the limited infrastructure and users of that infrastructure, impacts could include localized interruptions to access, public service, and utilities. Utility providers may have reduced access to facilities to conduct maintenance activities, and there could be unintended interruptions to service and outages. Impacts to utilities and public service would likely be localized and within operational capacities. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure in the alternative. To minimize potential impacts to existing infrastructure, a 50-foot buffer on both sides of the pipeline would be used, where no dredging would be allowed without prior approval.

4.4.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

The Biloxi Marsh alternative is in St. Bernard Parish along the shoreline of Bayou La Loutre, a previous distributary bayou of the Mississippi River into the Breton and Chandeleur Sound. The Biloxi WMA is owned by the Biloxi Marsh Land Corporation and leased to and managed by the LDWF (St. Bernard Parish 2013). The closest community is Shell Beach, which is approximately 20 miles from the alternative. There are no habitable structures within the alternative, and there are no plans for residential or commercial development at this time. A portion of the alternative is located within oyster seed grounds managed by the LDWF. There are five oyster leases within the alternative.

As discussed above, St. Bernard Parish is located entirely within the Louisiana Coastal Zone Boundary and its CZM program was last updated in 2013. The Biloxi Marsh alternative is located within EMU 9, Bay Boudreau – Bay Eloi (St. Bernard Parish 2013).

Environmental Consequences

Construction of the Biloxi Marsh alternative would result in no short- or long-term adverse impacts to land and marine management, but long-term benefits to land and marine management would occur. The alternative would create bioengineered, marsh-fringing oyster reefs to promote the formation of a living shoreline and provide shoreline protection. This action is consistent with the goals of state, parish, and local coastal management plans. It is consistent with existing land use in the area and would not adversely affect current land use. Therefore, the alternative would not result in any changes to land and marine management because the alternative would be consistent with the current parish and coastal management, practices, and plans. A CUP is required for the alternative, and CPRA submitted a permit application in December 2018. On August 14, 2019, CPRA received the CUP/Consistency Determination from the LDNR Office of Coastal Management, which demonstrates compliance with CZMA. The creation of these marshes would also be consistent with the land use with the Biloxi WMA. It is consistent with existing land use in the area and would not adversely affect current land use. The alternative would assist St. Bernard Parish in achieving CZM goals of protecting and improving shorelines.

4.4.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

The alternative is within 10 miles from the Biloxi WMA. The WMA is approximately 25,600 acres and is managed by LWDF. The WMA is the largest publicly accessible wetland in the parish and offers popular locations for hunting, fishing, and bird and wildlife watching; activities that are critically important to the

region's economy (St. Bernard Parish 2013). The WMA provides public access for recreational fishing, hunting, and other outdoor related activities, but can only be reached by boat. Within the WMA, hunting and trapping occur for popular game species such as rabbits, rails, gallinules, Wilson's snipe (*Gallinago delicata*), ducks (mallard [*Anas platyrhynchos*], lesser scaup, blue-winged teal [*Anas discors*], American wigeon [*Mareca americana*], gadwall [*Mareca Strepera*], northern shoveler [*Spatula clypeata*], mottled duck [*Anas fulvigula*], and northern pintail [*Anas acuta*]), and snow goose (*Chen caerulescens*). Common fish species include spotted seatrout, red drum, black drum, sheepshead, southern flounder, and Atlantic croaker and recreational and commercial fishman harvest large amounts of crab and shrimp in the area (St. Bernard Parish 2013). Shell reefs created by oysters and oyster reefs are useful to anglers for recreational fishing (CPRA 2014b). The WMA is accessible by boat via commercial launches at Hopedale and Shell Beach (LDWF 2019e). The closest marina is Breton Sound Marina in Hopesdale, which is approximately 15 miles away.

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction area. There would also be long-term benefits to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreational users from temporary or partial closures, interruptions to recreational activities, or visual interference or obstruction from construction. These short-term, minor adverse impacts to recreation and tourism would be limited to the construction period.

When construction is completed, the alternative would result in long-term benefits to recreational use by offering protection to existing recreational areas, including the Biloxi WMA. Long-term benefits to tourism and recreational use would be expected from implementation of the alternative by increasing recreational shellfish harvest opportunities as well as enhanced recreational fishing near the constructed reef structures. Restoration could increase the natural productivity of the shallow water area, thereby improving the quality of habitat and increasing oyster recruitment, potentially leading to recreational use. The oyster reefs provide abundant and concentrated prey resources and are valuable foraging sites for transient, predatory fishes such as southern flounder, red and black drum, and spotted seatrout (Plunket and La Peyre 2005; Schyphers et al. 2011, as cited in CPRA 2014a), so these oyster reefs are frequently targeted by anglers. The temporary impacts associated with the construction of the alternative would be offset by the potential long-term benefits to tourism and recreation.

4.4.3.6 FISHERIES AND AQUACULTURE

Affected Environment

As stated above, the Biloxi Marsh alternative is located within St. Bernard Parish, so commercial fisheries in this area are similar to those discussed in Section 4.3.3.6. Species abundant in EMU 9 include Atlantic croaker, red drum, black drum, spot, striped mullet, bay anchovy, Gulf menhaden, sand seatrout, scaled sardine (*Harengula jaguana*), marsh clam (*Polymesoda caroliniana*), eastern oyster, and large quantities of brown shrimp. In addition, EMU 9 contains the largest concentration of privately owned oyster grounds in the parish (St. Bernard Parish 2013). As stated above, oysters are an important commercial fishery species, and the high productivity of Louisiana's oyster grounds has made the state a national leader in oyster landings with annual values typically in excess of $35 million in dockside sales (LDWF 2013). Water bottoms around the Biloxi Marsh contain extensive areas of low-relief oyster shell cultch, which supports one of the most productive oyster stocks in Louisiana (LDWF 2013). Oyster reefs also provide unique, structurally complex habitat that supports distinct and diverse aquatic communities and functions as nursery habitat for many fish and shellfish species, which enhances local productivity for both commercial and recreational fisheries (Plunket and La Peyre 2005; Schyphers et al. 2011; Soniat et al. 2004, as cited in CPRA 2014a).

The alternative intersects with five existing oyster leases that make up approximately 330 acres. A biological oyster assessment (T. Baker Smith 2019) was prepared for CPRA for the all oyster leases within 1,500 feet of the alternative in August 2019. Table 4.4-2 includes a breakdown of the acreages for the oyster leases that intersect the alternative.

Table 4.4-2. Oyster Lease Acreage in the Biloxi Marsh Living Shoreline Alternative

Oyster Lease	Alternative Acreage	Lease Acreage	Lease Intersection Percentage
3242207	45.55	92.53	49%
3348008	1.21	61.35	2%
3516112	37.14	46.85	79%
3601815	17.31	91.18	19%
3617515	19.25	39.91	48%
Total	**120.46**	**331.82**	**36%**

Source: T. Baker Smith (2019).

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts to commercial fishing and aquaculture during construction of the bioengineered reefs; however, there would also be long-term benefits to fisheries and aquaculture. Impacts may include displacement and entrapment of nonmobile species from construction equipment, noise, activities or increased turbidity of surface waters from earth-moving equipment and pile driving. These short-term, minor adverse impacts to fisheries and aquaculture from construction could be minimized through the implementation of BMPs.

As stated above, a portion of the alternative is located within oyster seed grounds managed by LDWF. CPRA follows the Oyster Lease Acquisition and Compensation Program per Louisiana Revised Statute (RS) 56:432.1. The statute outlines the process by which CPRA acquires and extinguishes leases within a 150-foot buffer of the alternative. The process requires that a biological survey and appraisal be completed to determine market value. CPRA would then compensate the leaseholder the value of the lease, therefore extinguishing the lease itself and avoiding adverse impacts to the leaseholder. The process has multiple steps and may take up to 1 year. As part of the process, the applicant must notify oyster lease holders about the proposed project and include each affected oyster lease holder a copy of the permit application with forms and plats.

In accordance with the process during construction, oyster lease areas would be buffered by 150 feet to avoid impacts during construction. If unfeasible, oyster leases within the 150-foot buffer would be acquired and extinguished prior to construction. In August 2019, a biological assessment was performed, and the value of the leases is to be determined. A portion of the oyster leases may have to be purchased before construction of the alternative can begin.

Long-term beneficial impacts to fisheries and aquaculture would be expected from implementation of the restoration by ultimately increasing recreational and commercial shellfish harvest opportunities. Restoration could increase the natural productivity of the shallow water area, thereby improving the quality of habitat and increasing oyster recruitment, potentially leading to increased revenue from commercial and recreational activities. Continued monitoring of the alternative would be critical to determine the conditions (e.g., sediments, salinities) under which bioengineered oyster are sustainable and effective in reducing erosion and providing other ecosystem services. Oyster reefs are designated as EFH for red drum and white and brown shrimp. Once established, the alternative could enhance the

productivity of local oyster stocks. An increase is the areal coverage of oyster reefs could lead to an increase in nursery and foraging habitat for those species resulting in a long-term beneficial impact to fisheries and aquaculture.

4.4.3.7 MARINE TRANSPORTATION

Affected Environment

There is no official marine transportation infrastructure in the alternative. Transportation in this area consists of commercial and recreational vessels that use the deeper tidal channels, bays, and lakes. There is a segment of the MRGO that remains open along the southern boundary of EMU 9. Bayou La Loutre is the only large waterway providing access between the Chandeleur Sound and Gulf of Mexico and interior camps, fishing villages and docking facilities (St. Bernard Parish 2013).

Environmental Consequences

Construction and implementation of the Biloxi Marsh alternative would result in short-term, minor adverse impacts to marine transportation, but no long-term adverse impacts to marine transportation would occur. The alternative is unlikely to impact marine transportation because there is no official marine transportation in the alternative. During construction, there could be short-term, minor adverse impacts from small increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. There is no upland access to the restoration area, so access would be obtained from a navigable waterway such as Brenton Sound via the Mississippi River. Shipping routes would be identified prior to the selection of reef restoration sites to prevent any impacts to marine transportation.

Construction activities would take place from the water. Activities related to construction would require coordination with the users of the waterway. Barges would be staged adjacent to the restoration sites and not within approved waterways. It is expected that activities would not interrupt marine traffic or disrupt marine transportation.

Most commercial traffic would take place on a routine schedule, and construction activities would be timed to reduce any interference with commercial operators. In addition, USCG-approved permanent NAVAIDS would be installed approximately every 1,000 feet, or per USCG specifications. These NAVAIDS would warn vessel operators of the breakwater and would be permanently installed in key locations using pile driving to avoid potential impacts to vessels. Temporary warning signs would also be located seaward of the temporary spoil placement areas to warn mariners of limited depth or blocked passage. These signs are anticipated to be pile-mounted or buoy-mounted dayboards placed at approximately 1,000-foot increments along the temporary spoil placement areas. Overall, there would be no long-term impacts to navigation as a result of the alternative, and the bioengineered oyster reef would not impair navigation in or around the alternative.

4.4.3.8 AESTHETICS AND VISUAL RESOURCES

Affected Environment

Opportunities for public viewing of the Biloxi Marsh alternative are based from the open water of Eloi Bay, Bayou La Loutre, canals, and natural bayous. Views from the open waters would include vegetation within the Biloxi Marsh landscape including predominately emergent wetland vegetation, such as marsh grasses. The vegetation and topography in the area allow for long-distance views in and near the restoration area.

Environmental Consequences

The Biloxi Marsh alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction. There would be long-term benefits to aesthetics and visual resources. Modifications to the existing viewshed may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective. Public viewings of the Biloxi Marsh alternative would likely be from the open waters because there are no land developments within the immediate viewshed. If viewing from boats and open water, viewers would be able to see construction of the bioengineered reefs among the existing viewshed of open water, marsh grasses, and vegetation. The construction would temporarily alter the natural viewshed. Construction activities would be expected to have a minor, short-term adverse impact on aesthetics and visual resources in Eloi Bay, Bayou La Loutre, canals, and natural bayous by the presence of barges, excavators, marsh buggies, tugboats, and workers on the water at construction sites. After construction, the alternative would result in an improvement to visual resources and aesthetics through the oyster reefs and reduced shoreline erosion that fragments the marshes in the alternative. Restoration of the oyster reefs would be expected to have a long-term benefit to the aesthetics and visual resources by improving wildlife variety and abundance. Furthermore, the creation of the restoration area and marsh would be perceived as a beneficial visual impact and could result in an improved viewshed and improved viewsheds for recreationalists in the surrounding area. Long-term benefits related to the aesthetics would be expected as the bioengineered oyster reefs continue to develop over time.

4.4.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

The Biloxi Marsh consists of approximately 189 square miles (49,000 hectares) of brackish and salt marshes that have been greatly impacted by shoreline erosion from wind-driven waves, with shoreline retreat rates ranging from 1 to 4 m per year (CPRA unpublished data as cited in CPRA 2014a). Marshes serve as an important storm buffer for the city of New Orleans (CPRA 2014a). Submergence of the wetlands (through land subsidence and sea level rise) and marsh edge erosion by waves are the predominant natural processes affecting the alternative. Between 1932 and 2008, EMU 9 lost approximately 21,582 acres of land.

Recent trends show that interior embayments are increasing in size and depth. St. Bernard Parish predicts that in the absence of effective shoreline protection measures, these embayments would merge into the Chandeleur Sound in the future. Larger volumes of higher salinity waters are moving further inland as the land erodes (St. Bernard Parish 2013). The offshore location of the Breton and Chandeleur barrier islands provides little wave energy protection to the estuary behind them, resulting in shoreline erosion by wind-wave action, which is the dominant cause of wetland loss in the alternative (CPRA 2015).

A shoreline change analysis was conducted by evaluating shoreline positions derived from aerial photography from 1952 to 2010 (Coast & Harbor Engineering 2014). The results of the analysis show that the alternative shoreline is erosional, with long-term retreat rates ranging from a low of -5 feet per year to as much as -20 feet per year. After Hurricane Katrina in 2005 there was a dramatic spike in shoreline retreat, with rates varying from -16 feet per year to -47 feet per year from 2004 to 2005 post-Katrina. Relative sea level rise contributes approximately -1 foot per year to the retreat rates along the shoreline. This indicates that most of the shoreline retreat is a result of wave energy (Coast & Harbor Engineering 2014).

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may result from construction of the Biloxi Marsh alternative. There would be no long-term impacts to public health and safety from the alternative. Short-term, minor adverse impacts to public health and safety may occur during construction. Construction projects involving the use of boats, barges, and associated equipment for the placement of materials to create marshes could cause oil, fuel, or other hazardous material spills in surface waters, resulting in short-term, minor adverse impacts. BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, would be incorporated into construction activities on-site to ensure the proper handling, storage, transport, and disposal of all hazardous substances. Because of 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.

There would be no short-term or long-term adverse impacts to flood and shoreline protection during construction of the this alternative. This alternative would also result in long-term benefits to flood and shoreline protection. The Biloxi Marsh alternative would create 9 to 11 miles of oyster barrier reef along the eastern shore of Biloxi Marsh to reduce shoreline erosion. The living shoreline products would function to dissipate wave energy before it reaches the shoreline, thereby protecting vulnerable shoreline and valuable marsh behind. Oyster reefs help protect marsh habitats by reducing shoreline recession. Oyster reefs frequently occur just offshore of the marsh edge, and their vertical structure serves to attenuate wave energies and reduce water velocities resulting in reduced erosion as well as increased sediment deposition behind the reef, both of which act to stabilize the shoreline (Campbell 2004; Piazza et al. 2005, as cited in CPRA 2014a). Of those that have been adequately monitored, these types of projects have shown that they can significantly reduce shoreline recession and support good oyster recruitment and survival, such that the reefs created may be self-sustaining (Melancon et al. 2013; Piazza et al. 2005, as cited in CPRA 2014a). The alternative would yield similar positive long-term benefits to flood and shoreline protection.

The Biloxi Marsh reefs, therefore, could supply recruits to expedite recovery of flood-damaged oyster grounds, as well as other nearby reefs affected by natural and anthropogenic disturbances, thus improving the resiliency of the system as a whole. These shoreline protection features would serve as an important first line of defense for coastal marshes in the alternative, functioning to help sustain the lower Biloxi Marsh, an important landbridge separating the Gulf of Mexico from Lake Borgne, by helping to prevent and/or reduce the rate of erosion of the marshes and shorelines along the shores of Eloi Bay.

In addition to improved coastal resiliency, there would be benefits to public health and safety from the increased filtration of pollutants by oysters in the form of cleaner water. Overall, the alternative would result in long-term major beneficial impacts as a result of construction of the bioengineered oyster reef.

4.5 Fifi Island Forested Ridge with Breakwater Alternative

4.5.1 Physical Resources

4.5.1.1 GEOLOGY AND SUBSTRATES

Affected Environment

Fifi Island is in Jefferson Parish, Louisiana, and is less than 0.25 mile north of Grand Isle on the Mississippi River Delta plain in the Barataria Basin. The island is accessible only by boat and includes undeveloped coastal land dominated by marshland and intertidal wetlands. The coastal marsh geology of Fifi Island is characterized by Holocene back-barrier marsh and mangroves, with Scatlake series surface

soils and Scatlake muck substrates. The characteristics of these soils and substrates and the geology of the Barataria Basin are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.1).

Fifi Island provides wave and tidal erosion protections to inhabited Grand Isle, and both Fifi Island and Grand Isle provide storm surge protections to coastal Louisiana. Similar to other islands along the Louisiana coast, Fifi Island has experienced persistent degradation and erosion. Several restoration and stabilization efforts have occurred on and around the island including deposits of dredged sediments as part of USACE's Fifi Island dredged material placement plan, construction a rock breakwater structure on the northwest end of Fifi Island, and construction of a floating wave abatement facility on the northeast end of the breakwater structure that was destroyed in 2005 by Hurricane Katrina (FEMA 2012). Despite these efforts, the island continues to experience shoreline and land changes due to subsidence and sea level rise, resulting in less protections to the neighboring Grand Isle.

Environmental Consequences

The Fifi Island alternative would result in short-term, minor adverse impacts to substrates. The alternative would also result in long-term benefits to geology and substrates by restoring and supporting natural sediment dynamics and deltaic processes and improving overall coastal resiliency.

Offshore activities, including anchoring of vessels and the use of equipment, barges, and vessels to excavate, fill, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the desired configuration. The depth of disturbance in the excavated areas would be limited to depths needed to contour the area for intimate contact with the ground surface.

The disturbance of soils and sediments during construction would temporarily contribute to localized erosion and lead to localized soil compaction, resulting in localized, small, detectable disturbances but would not lead to changes to geologic features. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. Vegetation would be installed in the ridge creation areas to prevent exposure of soils and sediments and reduce erosion.

The placement of materials in the access channel, ridge, and breakwater areas would result in localized sediment disturbance and compaction and may affect sediment dynamics over the life of the alternative. Where the constructed breakwater segments overlap with shoreline or land, existing substrates and geology would be permanently covered to protect the area from shoreline erosion.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid disturbance to onshore geology and substrates. The alternative's design would implement BMPs, including those described in Appendix C under Geology and Substrates, to minimize impacts on geology and substrates by minimizing sediment disturbance, erosion, and compaction during and after construction. Adverse impacts to substrates from construction and implementation of the Fifi Island alternative would be short term and minor.

Once completed, the construction of the breakwater and ridge area would provide long-term benefits to geology and substrates. The depositions of sediments in the ridge creation area would raise substrate elevations, leading to increases in the resilience of the coastal wetlands to sea level rise and reducing coastal erosion. Placement of breakwaters would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive shoreline erosion and loss experienced on Fifi Island and increase the resiliency of coastal wetlands. The long-term benefits to geology and substrates from the alternative would help restore and support natural sediment dynamics and deltaic processes and improve overall coastal resiliency.

4.5.1.2 HYDROLOGY AND WATER QUALITY

Affected Environment

Basins and Impaired Waterbodies

The Fifi Island alternative is in the Barataria Basin in Barataria Bay (subsegment 021101). The hydrology and water quality conditions of the Barataria Basin and Barataria Bay are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.2). The Bay Des Ilettes is north of the island, and the Bayou Rigaud is south of the island. There are no aquifers underlying Fifi Island; the closest aquifer is the Mississippi River alluvial aquifer, approximately 40 miles north of the island (LDEQ 1988). Water levels in the ridge creation area vary with storm surges and tides and are on average approximately -5 feet NAVD88.

Wetlands and Floodplains

The wetlands of Fifi Island are part of the system of intertidal vegetated and coastal wetlands in Barataria Bay. The island is in a SFHA Zone VE with a BFE of 11 feet and is not in an area identified as a Coastal Barrier Resources System or Otherwise Protected Area (FEMA 2018). Tidal flows between Barataria Bay and the Gulf occur in the Barataria Pass, which separates Fifi Island and Grand Isle to the west from West Grand Terre Island to the east. Marshes on and around Fifi Island are often ponded or flooded. Wetland, tidal, and marsh systems are described in the affected environment of the West Grand Terre alternative (see Section 4.2.1.2).

Environmental Consequences

Construction and implementation of the Fifi Island alternative would result in short-term and minor adverse impacts to hydrology, water quality, and wetlands. Long-term benefits to hydrology, water quality, and wetlands would occur from the alternative by restoring and supporting natural hydrologic processes and improving overall coastal resiliency.

Anchoring and other offshore activities, including the use of barges to mobilize and demobilize all equipment and the use of barges and equipment to excavate, backfill, and construct the alternative, would disturb sediments as equipment and materials are moved and placed in the designed configuration. The disturbance of sediments during construction could lead to the movement of sediments and increased turbidity, resulting in measurable changes to hydrology and detectable changes to water quality. However, these changes would be temporary and localized, quickly becoming undetectable, and would not result in an exceedance of state water quality standards or change in wetland function. Construction and implementation of the alternative would not result in detectable changes to the natural floodplain.

If contaminated soils or sediments are released into waterbodies or in the event of an incidental spill of fuels, oils, or other hazardous materials, detectable changes to water quality could occur in the immediate area but would quickly become undetectable and would not exceed state water quality standards.

Using a barge to mobilize and demobilize all equipment rather than establishing and using a staging area on land would avoid surface disturbance that would cause sedimentation and lead to changes in hydrology and water quality. The access channel would be backfilled with sediments excavated during construction, returning both the access channel and spoils area to pre-alternative conditions. The alternative's design would implement BMPs, including those described in Appendix C for Hydrology and Water Quality, to minimize impacts on hydrology and water quality by minimizing sediment and pollutant loads into waterbodies. Therefore, construction of the Fifi Island alternative would result in short-term, minor adverse impacts on hydrology, water quality, and wetlands.

Once completed, the breakwater and ridge area would provide long-term benefits to hydrology, water quality, and wetlands. Creation of the ridge area would raise substrate elevations and re-establish natural hydrology needed to support the restoration of coastal wetland functions. Placement of breakwaters would reduce wave energies and currents acting on shorelines, stabilize substrates, and induce sediment deposition, thereby helping to counter extensive alterations to hydrology and degradations of water quality in the localized area. These long-term benefits to hydrology and water quality from implementation of the alternative would restore and support natural hydrologic processes and improve overall coastal resiliency.

The restoration of wetlands would provide long-term benefits to other resources, including improved stabilization of soils, improved water quality, increased storm and flood protections, and habitat restoration thereby helping support linkages within the broader coastal and nearshore ecosystem.

4.5.1.3 AIR QUALITY

Affected Environment

Fifi Island is uninhabited and only accessible by boat. As a result, air pollution sources on the island are limited to infrequent boat traffic. Activities on Grand Isle, which is less than 0.25 mile south of Fifi Island, including oil and gas pipeline and processing facilities and residential activities on the eastern side of Grand Isle, would contribute to air pollution; however, these would be limited because of the sparse nature of developed areas on Grand Isle compared to the more heavily populated urban-industrial corridor from New Orleans to Baton Rouge, which would be the major source of air pollution in the area, as described for the West Grand Terre alternative (see Section 4.2.1.3). The degradation of wetlands would also be a major source of air pollution in the area. Air quality conditions on Fifi Island are the same as those described for the affected environment of the Jefferson Parish portion of West Grand Terre alternative (see Section 4.2.1.3).

Environmental Consequences

Construction of the alternative would result in short-term, minor adverse impacts ton air quality. The alternative's in-water construction activities would require the use of machinery and vessels that would result in emissions. These emissions would be measurable but localized and temporary, quickly becoming undetectable, and would not exceed Clean Air Act de minimis criteria for general conformity (40 CFR 93.153). The alternative would not result in long-term impacts on air quality.

4.5.1.4 NOISE

Affected Environment

Because Fifi Island is uninhabited and accessible only by boat, noise in and around the ridge creation area is limited. Activities and associated vessel traffic at Grand Isle Tank Battery/Shorebase, transient vessel traffic, and nearby inhabited areas on Grand Isle are the only noise-generating sources in the immediate area. Noise from distant urban areas and other oil and gas production facilities contribute negligible noise impacts to the alternative.

Environmental Consequences

The Fifi Island alternative would result in short-term, minor adverse noise impacts. The Fifi Island alternative would generate temporary, intermittent noise associated with vehicles, vessels, and equipment and transport and placement of materials during construction. Noise during construction would be

localized. The closest residences and potentially sensitive noise receptors to the alternative are located on the adjacent shores of Grand Isle. However, the distance between the alternative and these receptors would help noise dissipate during construction, and short-term, minor adverse noise impacts would be limited to nearby users. If users are present in the local area during construction activities, noise may attract their attention but would not affect their activities. The alternative would not result in long-term noise impacts, and there would be no noise benefits from implementation of the alternative.

BMPs, including those described in Appendix C under Noise, would be implemented into the alternative's design as appropriate to minimize noise impacts.

4.5.2 Biological Resources

4.5.2.1 HABITATS

Affected Environment

The alternative is in the Barataria Basin at the southern extent of the Mississippi alluvial plain, located within the larger deltaic coastal marshes and barrier islands ecoregion, which is dominated by brackish and saline marshes (Daigle et al. 2006). Fifi Island is located behind Grand Isle, which is part of a barrier island chain the separates Barataria Bay from the Gulf of Mexico. Fifi Island makes up the north bank of Bayou Riguad, a navigational channel, which separates Grand Isle and Fifi Island. Portions of Fifi Island have been subject to restoration and construction activities since the early 1980s, and most recently a rock-armored containment levee was constructed at the northeast end of the island in 2004, and portions of a rock dyke/breakwater were constructed in 2014. Saltwater marsh, constructed armaments and breakwaters, and beaches are the prevalent ecologic features in of the island. Barataria Pass, a natural tidal channel, is located to the west of the island. Freshwater inputs to the Barataria Basin are primarily rainfall because the construction of levees along the Mississippi River has prevented freshwater and sediment inputs to the basin.

Habitats on Fifi Island include salt marsh, which is a regularly tidally flooded, flat, polyhaline area dominated by salt-tolerant grasses and few other species. Salt marsh in the area is largely dominated by smooth cordgrass broken up by areas of open water and intertidal zone. There are no CRMS sites on Fifi Island; however, a site is located approximately 6 miles northwest near Raccoon Bayou (CRMS 0178). Dominant vegetation on Fifi Island is smooth cordgrass (CPRA 2019a). Salt marsh is considered an important nursery area for shrimp, crabs, and a variety of fish species and enhances the production of marine organisms in adjacent waters (Holcomb et al. 2015). Pockets of black mangrove may also form stands in calm waters. Salt marshes and mangrove habitats are integral parts of the Louisiana coastal island system. Species distribution is generally determined by a combination of an elevation gradient and exposure to saltwater spray. Marine submergent aquatic vegetation may occur in the bays and lagoons behind barrier islands. The areas adjacent to the island and existing marshes may provide suitable conditions for SAV; however, no site-specific surveys have been conducted.

Environmental Consequences

Construction of a temporary access channel, breakwater, and ridge would result in minor, short-term adverse impacts to nearshore and benthic habitats. Access to the proposed breakwater and ridge area would require dredging to create a temporary access channel and permanent placement of sediment within the footprint of the ridge. An increase in turbidity of adjacent marine environments from dredging activities associated with trenching, sediment placement, and rock and breakwater placement may occur in the short term. In the access channel, minor, short-term adverse impacts to benthic resources would occur as the sediment is removed. Long term, benthic resources in disturbed areas would reestablish from

adjacent undisturbed areas. Following construction, the access channel would return to ambient conditions and be re-colonized by benthic populations within 1.0 to 2.5 years (Greene 2002; Michel et al. 2013). Therefore, these adverse impacts would be short term.

The construction of the proposed breakwater and forested ridge would result in minor, long-term adverse impacts via permanently altering the open water areas where these elements are proposed because of the reduction in marine habitat from rock placement. Although these adverse impacts would affect habitats in localized areas, the footprint of the breakwater and forested ridge would be limited in area, and the overall effects would be minor and long term. Disturbances to open water areas during construction would result in short-term, minor adverse impacts to terrestrial, nearshore, and marine habitats. Minor, long-term beneficial effects from placement of rock in marine environments would include a change of existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, changes to the benthic community may occur. Some mobile species may be able to move out of the disturbed area, and wildlife would likely use plentiful suitable habitats nearby during construction activities. Therefore, the alternative would not have adverse, long-term effects on terrestrial, estuarine, coastal nearshore, or marine habitats. Overall, the creation of approximately 22 acres of coastal live oak-hackberry forested ridge would benefit available terrestrial habitats.

Ground-disturbing activities could result in the spread of invasive species near the breakwater and ridge areas of the alternative, which would be a minor, long-term adverse impact to the surrounding environment. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize the potential for establishment and/or spread of invasive species.

4.5.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

Affected Environment

As discussed above in Section 4.2.2.2, Louisiana's coastal wetlands provide habitat for a diverse array of wildlife species. Wildlife species may inhabit the terrestrial and intertidal habitats on Fifi Island. Semiaquatic mammals include muskrat, mink, otter, and nutria. Terrestrial mammals include white-tailed deer, rabbit, raccoon, squirrel, and opossum. Species typically found in the Gulf salt marsh environments and that may be present on Fifi Island are the Gulf salt marsh snake, the Gulf Coast toad, and the diamondback terrapin (Abernethy 1987).

Because of its location along the Mississippi flyway, many families of birds may be present in the alternative and include waterfowl, wading birds, diving birds, colonial nesting birds, songbirds, shorebirds, migratory birds, seabirds, and raptorial birds. Most birds, however, are present in the area from approximately October until March or April. The habitats within the alternative support various migratory bird and waterfowl species. The shallow waters and beaches in the alternative serve as foraging habitat for a number of seabirds, wading birds, and other species. Beach and marsh environments may provide habitat for American golden-plover (*Pluvialis dominica*), American oystercatcher (*Haematopus palliatus*), long-billed curlew (*Numenius americanus*), upland sandpiper (*Bartramia longicauda*), and buff-breasted sandpiper (*Tryngites subruficollis*) during spring migration. Beaches provide habitat for gulls, terns, and shorebirds. Wooded areas on nearly Grand Isle support various songbird species such as vireos (*Vireo* spp.), thrushes (Turdidae), waterthrushes (*Parkesia* spp.) and other warblers (Parulidae), summer (*Piranga rubra*) and scarlet tanagers (*P. olivacea*), rose-breasted grosbeak (*Pheucticus ludovicianus*), and Baltimore oriole (*Icterus galbula*) (Gibbons et al. 2013). Many colonial waterbirds use mangroves as nesting areas. Predatory birds such as kestrel (*Falco sparverius*), owls (*Strix* spp.), and falcons (Falconiformes) also are found in the region. Although there is no official species list for the birds of Fifi Island, a species list from neighboring Grand Isle (located approximately 0.3 mile southeast of Fifi Island) reports 305 species (Lepage 2019).

Environmental Consequences

Short-term, minor adverse impacts to wildlife individuals may occur as a result of construction-related human noise and disturbance, available habitat change or loss, and ground-disturbing activities related to disruption, displacement, or entrapment of wildlife species. Wildlife in and around the alternative may be sensitive to changes in noise sources or levels due to construction. Noise from construction equipment may disturb migratory and shorebirds resulting in short-term, minor to moderate impacts. These noises could be slightly more disturbing to any resting or roosting birds that may use the site compared to baseline conditions. As previously discussed, the alternative would include BMPs described in Section 6, Appendix A of the Final PDARP/PEIS to reduce potential effects from construction-related activities, and coordination with LDWF as part of E&D to avoid and minimize effects to species would be conducted prior to construction. Potential short-term adverse impacts to wildlife would be minimal.

Several migratory bird species have the potential to occur within the alternative. However, much of the proposed work would occur in open water areas and would not involve vegetation clearing. BMPs as described in Section 6, Appendix A of the Final PDARP/PEIS would be implemented to avoid and minimize potential adverse impacts to resident and migratory birds. Therefore, adverse effects to these species would not be anticipated. Impacts to terrestrial wildlife would be similar to those described for migratory birds. Overall, long-term benefits from the creation of approximately 22 acres of coastal live oak-hackberry forested ridge habitat would include an increase in available habitat for terrestrial wildlife species, including resident and migratory birds.

4.5.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

Affected Environment

Aquatic habitats within the alternative include the subtidal areas around the island. Similar marine and estuarine species are anticipated to be present in and around Fifi Island as described for the West Grand Terre alternative in Section 4.2.2.3. The wetlands, flats, and subtidal habitat around Fifi Island provide nursery, foraging, and spawning habitat for numerous marine and estuarine species. Invertebrates such as crabs and clams also inhabit the intertidal zone. The marsh community provides highly productive nursery areas for shrimp, crabs, and fish. The cover and food mangroves provide excellent nursery areas for fish and shellfish. Freshwater mollusks and crustaceans found near Grand Isle include freshwater clam (Unionida) and brackishwater clam (*Rangia cuneata*), freshwater mussel (Unionidae), river shrimp (*Macrobrachium ohione*), and swamp crawfish (*Procambarus clarkii*). Oyster leases are present along the northern side of the island (LDWF 2019b).

The alternative is in EFH Ecoregion 4 (East Texas and West Louisiana), which extends from the Mississippi Delta to Freeport, Texas. The EFH components within the analysis area include emergent wetlands, soft bottoms, and WCA. In the alternative, EFH has been designated for the same species as described for the West Grand Terre alternative (GMFMC 2005; NMFS 2019; NOAA Fisheries 2019) (Figure 4.5-1). See Table 4.2-1 in Section 4.2.2.3 for a description of EFH. There are no HAPCs or EFHAs in the alternative.

Environmental Consequences

Minor, short-term adverse impacts to marine and estuarine species would be primarily associated with the dredging of the access channel and placement of fill and rock. In-water work associated with the construction of the breakwater and forested ridge would consist of dredging an access channel, filling the forested ridge area, and placing rocks for the breakwater in open water areas. Alternative elements would permanently affect the shoreline area and benthic habitats where the breakwater and ridge are proposed.

Short-term minor adverse impacts may include increased turbidity, siltation, entrainment of benthic species, temperature changes, increased biological oxygen demand due to the introduction of organic matter into water column, and decreased dissolved oxygen; however, impacts as a result of dredging and fill and rock placement would be short term. Minor, short-term adverse impacts to any slow-moving or sessile benthic organisms found within the access channel and breakwater and ridge footprints could occur through removal of sediment or burial from placement of sediment (as discussed in Section 4.2.2.3), respectively. More mobile benthic species would likely be displaced, whereas other impacts to the benthic fauna would be localized and confined to construction areas. Species within the access channel and ridge and breakwater footprints would experience localized disturbance and/or mortality from dredging and construction. However, BMPs, including those described in Appendix C (such as silt curtains, buffer zones, and water quality monitoring), would be used to minimize such adverse effects. Adjacent benthic populations would be expected to move into the borrow, fill, and overburden disposal sites and recolonize quickly, with recovery of abundance, diversity, and evenness relative to reference sites often generally within 1.0 year and achieving community composition similar to undisturbed sites within 2.5 years (Greene 2002; Michel et al. 2013). In the long term, the footprint of hard structures such as breakwaters changes existing habitat from a soft to a hard substrate. By adding habitat complexity and attracting new species of attached organisms, beneficial changes to the benthic community may occur, such as increased populations of oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

Although these adverse impacts may affect aquatic fauna and EFH in localized areas, the footprints of the breakwater and ridge are limited, and short-term, minor disturbances are expected to be limited in scope and duration. Temporarily disturbed aquatic fauna would likely find refuge in plentiful suitable habitats nearby. Therefore, the construction of the breakwater and ridge would result in short-term minor effects on aquatic fauna. Short-term, adverse impacts to EFH during dredging of the access channel and construction activities may occur. During these activities, species and their prey species may leave the disturbance area and vicinity, burial of benthic organisms may occur, and turbidity would increase, which could result in a temporary disturbance of feeding or spawning and other behaviors by some species individuals. The implementation of EFH BMPs, including those described in Appendix C, would reduce the potential for adverse impacts to habitat. Long-term adverse effects to EFH would not occur. Beneficial changes to the benthic community may occur in the long term from the construction of the breakwater and forested ridge, as adding habitat complexity may attract new species of attached organisms, such as increased populations of oysters and algae and the species that feed on them (Bulleri and Chapman 2010).

The timing of in-water, noise-producing activities would be planned to minimize disturbances to marine life. Potential impacts to estuarine and aquatic fauna and EFH would be considered and avoided or minimized to the extent practicable during design and construction.

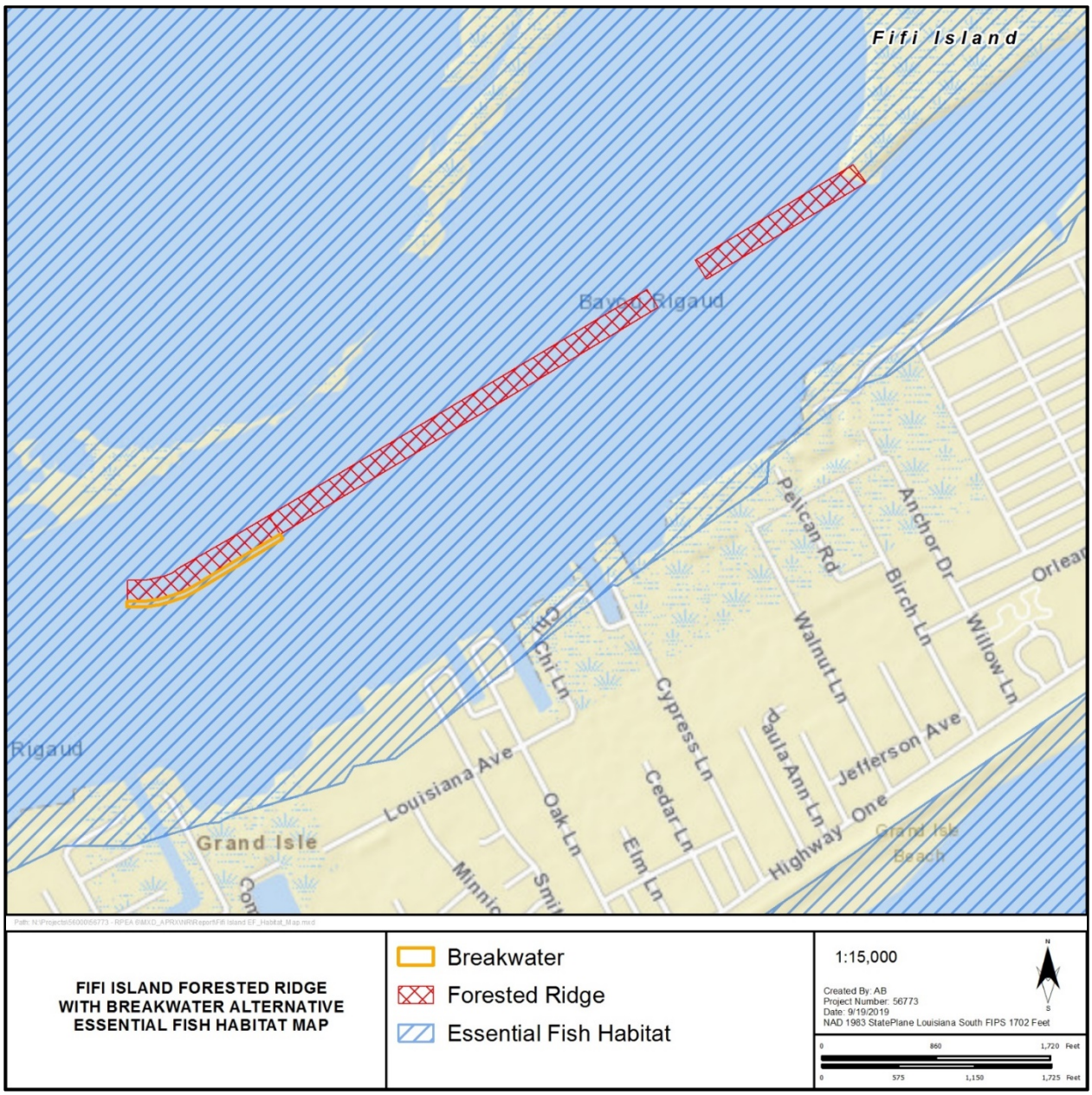

Figure 4.5-1. Essential fish habitat within the Fifi Island Forested Ridge with Breakwater alternative.

4.5.2.4 PROTECTED SPECIES

Affected Environment

The alternative includes portions of Jefferson Parish. The list of species listed as threatened or endangered within Jefferson Parish with the potential to be present within the alternative is the same as those described for West Grand Terre and described in Table 4.2-2.

Piping plover designated critical habitat is present on Grand Isle adjacent to the alternative (see Figure 4.2-2). Piping plover designated critical habitat is located all along the southeastern shoreline of Grand Isle (Unit LA-5) approximately 0.75 mile southeast of Fifi Island. This designation applies to suitable

overwintering habitats on the beaches, mudflats, and estuarine wetlands abutting and adjacent to the Gulf of Mexico. Primary constituent elements for piping plover overwintering habitat are those habitat components that support foraging, roosting, and sheltering and the physical features necessary for maintaining the natural processes that support those habitat components. The elements include intertidal flats, including sand and/or mudflats with no or very sparse emergent vegetation, and adjacent unvegetated or sparsely vegetated sand, mud, or algal flats above high tide, which are important for roosting plovers.

The common bottlenose dolphin (northern Gulf of Mexico bay, sound, or estuarine stock [NMFS 2018]) frequents the estuarine area near Fifi Island; therefore, this species may be present near the alternative (Hayes et al. 2019).

Bald eagles are known to breed and winter near the alternative.

Environmental Consequences

Potential temporary adverse and long-term beneficial impacts to protected species as a result of the Fifi Island alternative would be similar to those described for West Grand Terre (see Section 4.2.2.4); however, because the alternative does not propose beach nourishment activities, potential impacts to loggerhead sea turtle nesting habitat and piping plover (including designated critical habitat) and red knot would not be anticipated.

4.5.3 Socioeconomic Resources

4.5.3.1 SOCIOECONOMICS AND ENVIRONMENTAL JUSTICE

Affected Environment

The Fifi Island alternative is located within Jefferson Parish, Louisiana, and within Census tract 279.02. Socioeconomic data for this area are described for the West Grand Terre alternative in Section 4.2.3.1. Because minority and low-income populations in Census tract 279.02 are lower than the general populations, this Census tract is not identified as an environmental justice population.

Environmental Consequences

The Fifi Island alternative would not result in short- or long-term socioeconomic impacts because the alternative does not require displacements or demographic shifts from implementation of the alternative and the proposed activities would occur in uninhabited areas. Temporary closures made in the alternative during construction to protect public safety may result in decreased opportunities for tourism and recreation and associated spending. However, because construction would be temporary and closures would be limited in scope and duration, changes to expenditures from decreased tourism and recreation would not be readily apparently and would not have a noticeable effect on social or economic conditions.

Construction of the alternative would provide a small number of construction jobs, which would temporarily benefit the local economy through increases in employment and associated spending during that timeframe. These benefits would be short term and are not expected to substantively alter social or economic conditions. Once completed, the area would be accessible to recreational users. Expenditures from increases to tourism and recreation over the life of the alternative would not be readily apparent and would not have a noticeable effect on social or economic conditions.

The Census tract overlapping with the alternative is not identified as an environmental justice population. Furthermore, if members of an environmental justice population outside of the Census tract referenced above engages in subsistence fishing in or near Fifi Island, the fishing opportunities would continue in adjacent

areas during construction of the alternative. Therefore, environmental justice populations would not be disproportionally or adversely affected by construction and implementation of the Fifi Island alternative.

4.5.3.2 CULTURAL RESOURCES

Affected Environment

A marine archaeological investigation was conducted within the Fifi Island alternative on behalf of the USACE for proposed dredging, marsh creation, and breakwater construction along Bayou Rigaud near Fifi Island (Pelletier et al. 2005). R. Christopher Goodwin and Associates, Inc. conducted the survey in the fall of 2002 and spring of 2003. Overall, approximately 741 acres was investigated using a marine magnetometer, side-scan sonar, and a fathometer. Survey Block 4 (Fifi 3), measuring approximately 51.4 acres and Survey Block 6 (MOD), measuring approximately 197 acres, intersect the Fifi Island alternative (Pelletier et al. 2005: 2). The survey identified six magnetometer and/or side-scan sonar targets (Targets 147, 149, 154, 177, 178, and 179) that intersect the alternative (Pelletier et al. 2005: 100). Based on the results of the investigation, the original investigators concluded that all six of these targets consisted of modern debris scatters or buried pipelines, none of which were considered to be significant submerged cultural resources and none of which were recommended for further investigations (Pelletier et al. 2005: 145–153, 161–169). No direct investigations (probing) of any targets were conducted as part of the alternative, and no evaluation of submerged paleolandscapes was included in the analysis.

Based on this previous work, it appears that no cultural resources eligible for the NRHP are present within the alternative.

Environmental Consequences

Because no historic cultural sites or materials have been identified within the alternative, the Fifi Island alternative is anticipated to result in no impacts to cultural resources. BMPs listed in Appendix C would also be followed during E&D to avoid impacts to cultural resources. Consultation with the Louisiana SHPO and tribes to determine any additional requirements would occur prior to any ground- or substrate-disturbing activities under the alternative.

4.5.3.3 INFRASTRUCTURE

Affected Environment

Fifi Island is uninhabited so there is limited infrastructure on the island. Similar to West Grand Terre, there is no public infrastructure on Fifi Island. There are a few pipelines within the alternative. There is a 20-inch Chevron pipeline along Fifi Island, immediately adjacent to the existing breakwater. There is also a submerged waterline for Jefferson Parish that crosses the alternative and crosses Fifi Island coming from Grand Isle. Across Bayou Rigaud on Grand Isle is some industrial development approximately 0.10 mile from Fifi Island.

Environmental Consequences

Construction of the Fifi Island alternative would result in short-term, minor adverse impacts to infrastructure. There would be no long-term adverse impacts to infrastructure. Construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure that traverses the alternative. Potential impacts may include unintended interruptions to service and outages as well as reduced access for the utilities to conduct maintenance activities. Impacts to utilities and public service would likely be localized and within operational

capacities. The ridge would be constructed over a buried 20-inch Chevron pipeline, which follows the length of the proposed ridge location. This pipeline is estimated to be at least 6 feet below the water line and would be protected during construction (Averill 2019). To minimize potential impacts during construction, BMPs, including those discussed in Appendix C under Infrastructure, would be implemented to avoid impacts to infrastructure. The contractor would coordinate authorized activities with the pipeline owners prior to construction. Although construction activities from traffic and construction equipment may result in short-term, minor adverse impacts to the existing oil and gas infrastructure in the alternative, there would be no long-term adverse impacts to infrastructure as a result of the alternative.

4.5.3.4 LAND AND MARINE MANAGEMENT

Affected Environment

Fifi Island is located within Jefferson Parish, Louisiana, and within the Jefferson Parish CZM Program and Grand Isle Management Unit, as described for the West Grand Terre alternative in Section 4.2.3.4. In addition, the alternative is included in the 2017 coastal master plan (CPRA 2017a) for restoration of barrier islands. On Grand Isle near Fifi Island is Sand Dollar Marina, which is approximately 0.25 mile away and serves as a marina, restaurant, and hotel. On Grand Isle near the northern part of Fifi Island is a USCG Station Grand Isle, which encompasses 29 acres and 25,000 square feet of operational and multi-purpose buildings. The USCG station serves as critical infrastructure for the safety of the surrounding area (FEMA 2012). The alternative would occur primary on state-owned bottom waters. Louisiana's State Water Bottom Management (as defined in Louisiana RS 41:1701–1714, revised January 2003) provides for the permitting and leasing of structures and facilities on non-eroded waterways and for reclamation and fill of non-eroded areas. It also requires permits and leases to construct and maintain bulkheads and flood-protection structures on navigable water bottoms. The State of Louisiana owns the beds and bottoms of many waterways where the ownership generally extends to the average low water shoreline in rivers and other streams. The ownership in most lakes, bays, sounds, and similar waterbodies and in the Gulf of Mexico extends to the mean high-water line. Work planned in state-owned water bottoms requires coordination with the Louisiana Office of State Lands, Division of Administration.

Environmental Consequences

This alternative would result in no short-term or long-term adverse impacts to land and marine management. Implementation of the Fifi Island alternative would also result in long-term benefits to land and marine management. The alternative is consistent with the goals of state, parish, and local coastal management plans, particularly with respect to consistency with restoration and protection objectives. The alternative would require modifications to an existing USACE permit (MVN 2014-0433 EMM) and CUP (P20140028), which allows placement of approximately 6,000 linear feet of rock dikes in open water. A portion of the rock dike that was permitted has been constructed, and the permit holders have already received a time extension (Jefferson Parish Coastal Management Department 2019). The alternative would comply with land use regulatory codes, would not adversely impact nearby or adjacent land uses and zoning, and would not represent an incompatible land use with near and adjacent uses. Therefore, the alternative would not result in any changes to land and marine management because the alternative would be consistent with the current parish and coastal management, practices, and plans. The alternative would also assist Jefferson Parish in achieving CZM goals of protecting and improving shorelines.

4.5.3.5 TOURISM AND RECREATIONAL USE

Affected Environment

Because of the uninhabited nature of Fifi Island, there are limited opportunities for tourism and recreational use. Similar to West Grand Terre in Section 4.2.3.5, the waters around the island provide opportunities for recreational angling but do not provide attractions for recreational snorkeling or SCUBA diving. Recreationally important fish species such as spotted seatrout, red drum, black drum, and southern flounder use the barrier island habitats and are the target species for anglers. Grand Isle State Park and Sand Dollar marina are close to the island and support other recreational boating activities (FEMA 2012).

Environmental Consequences

The alternative could result in short-term, minor adverse impacts in the immediate area through limits on recreational activities near the construction areas. There would also be long-term beneficial impacts to tourism and recreation. Construction of the alternative could result in temporary localized impacts to recreationists from interruptions to recreational activities or visual interference or obstruction at Grand Isle State Park and/or Sand Dollar from construction. These short-term adverse impacts to recreation and tourism would be limited to the construction period and are expected to be minor. When construction is completed, the alternative would result in long-term benefits to recreation through habitat restoration and creation along Fifi Island. Shoreline protection features could provide important habitat for migratory birds and assist species and types of habitats directly impacted by the DWH Oil Spill, which could result in increased recreational opportunities for users. The temporary construction impacts would be offset by the potential long-term benefits to tourism and recreation from the creation of coastal habitat and the forested ridge.

4.5.3.6 FISHERIES AND AQUACULTURE

Affected Environment

Fisheries and aquaculture for this area are as described for the West Grand Terre alternative in Section 4.2.3.1. The Sand Dollar Marina also supports economically important commercial and recreational fishing industry (FEMA 2012).

Environmental Consequences

The Fifi Island alternative would have short-term, minor adverse impacts to fisheries during construction, but long-term benefits to fisheries and aquaculture would occur. The noise and increased turbidity of surface waters arising from earth-moving activities during alternative construction could cause a temporary dispersal of mobile fish and shellfish from resulting in a minor, temporary impact. Colonization of the rock breakwaters by existing populations of fish and benthic organisms would be expected within a few weeks or months. Rock breakwater habitat would allow for a more diverse habitat than open waters, and the creation of breakwaters would be expected to benefit local managed fisheries. During construction, a few fisherman or businesses could be affected; however, these impacts would be small and localized and not expected to substantially alter social or economic conditions for commercial fisherman or the industry within the alternative. In the long term, the alternative would benefit fisheries and aquaculture by slowing the erosion of marsh, which could provide benefits to fishery resources in the form of new habitat and spawning grounds near Grand Isle because saltwater marsh habitat is highly productive for a variety of marine fishes and invertebrates.

4.5.3.7 MARINE TRANSPORTATION

Affected Environment

Fifi Island is easily accessible by boat from Grand Isle, which is located across Barataria Pass to the west. The island is only accessible by boat. Barataria Pass is a deep tidal inlet that is managed as part of the BWW for navigation by the USACE. Fifi Island serves as a wave break to protect the Bayou Rigaud navigational channel and the northeast shoreline of Grand Isle from wave action when severe weather from the north produces high-energy waves in Barataria Bay (FEMA 2012).

Environmental Consequences

The alternative could result in short-term, minor adverse impacts to marine transportation during construction, but no long-term adverse impacts to marine transportation would occur. The alternative is unlikely to impact marine transportation because current marine transportation levels in the area are low. Construction of the ridge and breakwater may cause short-term, minor adverse interference to navigation. There could be negligible increases in local daily marine traffic volumes, resulting in perceived inconvenience to operators but no actual disruptions to marine transportation. The temporary access channel and ridge would not impede existing navigation channels or marine transportation. The creation of the ridge and breakwater would not result in long-term impacts to marine transportation because they would not interfere with or impede marine transportation routes.

4.5.3.8 AESTHEICS AND VISUAL RESOURCES

Affected Environment

Visual resources are the visible, physical features of a landscape that have an aesthetic value to viewers from viewpoints such as residences, recreational areas, rivers, and highways. Physical features that make up the visible landscape include land, water, vegetation, and human-made features (i.e., roadways, buildings, and structures), all of which contribute to the overall landscape and visual character of an area. A view refers to a direct and unobstructed line-of-sight to an on- or off-site aesthetic resource, which may take the form of panoramic viewpoints from particular vantages. Existing views may be obstructed or blocked by modifications to the environment (e.g., grading, landscaping, and building construction).

Fifi Island is uninhabited, and much of it is surrounded by existing breakwaters. There are opportunities for public viewing of the Fifi Island alternative from boat users as well as from the residences, marinas, and public docks located on the bay side (west) of Grand Isle. Currently from this vantage point, viewers would see undeveloped, open marshy lands across the bay with approximately 1,400 feet of existing rock dike constructed along the Fifi Island coast. Vegetation and topography in the Grand Isle and Fifi Island allow for long-distance views to the alternative. The current viewshed is characterized as an undeveloped natural area along the water.

Environmental Consequences

The Fifi Island alternative could result in short-term, minor adverse impacts to aesthetics and visual resources during construction; however, long-term benefits to aesthetics and visual resources would be expected. Modifications to the existing environment may create or enhance view opportunities. All land has inherent visual values that warrant different levels of management. Aesthetic judgment, especially related to landscape views, is often considered subjective.

Viewers would be able to see much of the forested ridge from locations on the bay side of Grand Isle. The public would also be able to see portions of the restoration area from the open water of Bayou Rigaud, between Fifi Island and Grand Isle. During construction, impacts to visual resources from the alternative

would be adverse, moderate, and short term because of the presence of construction personnel, equipment, vehicles, and partially completed shoreline habitat and forested ridge. After construction, the alternative would result in an improvement to visual resources and aesthetics because the back-barrier marsh and protected beach would create a diversity of natural landscape elements within the viewshed. The breakwaters and ridge creation could assist in restoring visual resources to previous shoreline conditions. Furthermore, the creation of the new coastal habitat and the ridge would be perceived as a moderate beneficial visual impact and could result in an improved viewshed for viewers. New habitat is anticipated to attract additional birds and wildlife, thereby adding to the enjoyment of the area by recreational users and the general public. Beneficial impacts to aesthetics and visual resources from the alternative would be moderate and long term.

4.5.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

Affected Environment

A reference search for records of hazardous waste locations was made, and no such records were found (FEMA 2012). Over the years, Fifi Island has experienced rapid land loss, especially on its eastern tip, leaving the Bayou Rigaud navigation channel and the northeast shoreline of Grand Isle unprotected (FEMA 2012). Information about flood and shoreline loss for Fifi Island is similar to West Grand Terre as discussed in Section 4.2.3.9.

Environmental Consequences

Short-term, minor adverse impacts to public health and safety may occur during construction of the Fifi Island alternative, but no long-term adverse impacts to public health and safety would occur. Construction projects involving the use of boats, barges, and associated equipment for the placement of materials to create habitat could cause oil, fuel, or hazard material spills in surface waters, resulting in short-term, minor adverse impacts. Construction contractors are required to implement BMPs, including those described in Appendix C under Hydrology and Water Quality and under Public Health and Safety, to prevent oil, fuel, or other hazardous substances from entering the air or water. Construction contractors are also required to have a spill contingency plan for hazardous, toxic, or petroleum products in place to be implemented in the unlikely event of an occurrence. Because of 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. There would be no long-term impacts to public health and safety from the alternative.

There would be no short-term adverse impacts to flood and shoreline protection during construction of the Fifi Island alternative, and long-term benefits to flood and shoreline protection would result. The alternative would result in the creation of 22 acres of new habitat and 6,000 linear feet of forested ridge on Fifi Island to protect Grand Isle and other barrier islands from storm surges. The coastal ridge would serve as a barrier to protect against impacts on Louisiana's only accessible and inhabited barrier island by reducing storm surge in Caminada Bay. Previous storms have demonstrated that a forested ridge on Fifi Island protects infrastructure on Grand Isle during a storm, especially when winds and surge come from the north. The alternative may decrease the risk of potential hazards (e.g., decreased likelihood of storm surge) to visitors, residents, and workers from increased shoreline integrity, which would be temporary and localized. The alternative would also provide benefits to coastal populations and infrastructure through improved shoreline protection, thereby improving coastal resiliency and providing a long-term beneficial impact to flood and shoreline protection.

4.6 No Action Alternative

Section 1502.14(d) of the Council on Environmental Quality (CEQ) regulations requires the alternatives analysis to "include the alternative of No Action." The CEQ states that in some cases "No Action" is "no change" from current management direction or level of management intensity. Therefore, the No Action Alternative may be thought of in terms of continuing with the present course of action until that action is changed. Impacts of proposed actions would be compared to those impacts for the existing actions. Under the No Action Alternative, the LA TIG would not, at this time, select and implement the alternatives related to wetlands, coastal, and nearshore habitats in this RP/EA intended to compensate for lost natural resources or their services resulting from the DWH Oil Spill. Accordingly, the No Action Alternative would not meet the purpose and need for implementing alternatives that address lost natural resources and their services as described in Section 5.3.2 of the Final PDARP/PEIS and in Section 1.5 of this RP/EA. The No Action Alternative would not meet the DWH Trustees' goals of restoring a variety of interspersed and ecologically connected coastal habitats 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. If this plan is not implemented, none of the alternatives would be selected for implementation, and restoration benefits and services associated with these alternatives would not be achieved at this time.

4.6.1 Physical Environment

4.6.1.1 GEOLOGY AND SUBSTRATES

The No Action Alternative would not have any direct adverse effects to geology, soils, or substrates because it would not involve any activities (construction, structure placement, etc.) that could result in effects; however, ongoing coastal erosion would likely continue unabated resulting in long-term minor adverse impacts. The No Action Alternative would not result in any beneficial effects to geology, soils, or substrates that may occur from implementation of some of the alternatives; these beneficial effects include features that would prevent or reduce existing erosion conditions (e.g., breakwater, ridge and marsh restoration features that help reduce coastal erosion).

4.6.1.2 HYDROLOGY AND WATER QUALITY

The No Action Alternative would not result in direct adverse effects to hydrology or water quality because it would not involve any activities that could affect these resources. However, ongoing water quality effects from coastal erosion would likely continue unabated resulting in long-term minor adverse impacts. The No Action Alternative would not result in any beneficial effects to hydrology and water quality that may occur as a result of implementation of the alternatives. The alternatives are intended to reduce erosion and sedimentation from entering receiving waterbodies and to improve overall hydrologic cycling in the nearshore environment, which would benefit water quality. Additionally, infrastructure features in the alternatives would result in reducing long-term erosion and sedimentation of receiving waterbodies (e.g., placement of breakwaters, forested ridge and marsh creation to reduce erosion in coastal areas). These benefits would not be realized under the No Action Alternative.

4.6.1.3 AIR QUALITY

The No Action Alternative would have no effect on air quality or GHGs because no activities that have potential emissions would occur.

4.6.1.4 NOISE

There would be no noise effects as a result of the No Action Alternative because no noise-producing activities would be proposed.

4.6.2 Biological Environment

4.6.2.1 HABITATS

The No Action Alternative would not result in direct effects to terrestrial, coastal, nearshore, or marine habitats because no restoration activities would occur under the alternative. Alternatives considered under this RP/EA may benefit habitats by reducing erosion and land loss in coastal areas and increasing available high-quality habitats. Under the No Action Alternative, potential benefits to these habitats would not occur.

4.6.2.2 WILDLIFE SPECIES (INCLUDING BIRDS)

The No Action Alternative would not result in direct effects to terrestrial wildlife or migratory birds because no activities would occur under the alternative. Some alternatives may have indirect benefits to wildlife and birds, particularly those alternatives that result in reducing erosion and land loss in coastal areas such as beaches that provide habitat for many species. Marsh creation in nearshore habitats from the alternatives would benefit wildlife and migratory birds by improving areas for feeding and resting. Under the No Action Alternative, potential benefits to wildlife and migratory birds would not occur.

4.6.2.3 MARINE AND ESTUARINE FAUNA (FISH, SHELLFISH, BENTHIC ORGANISMS)

The No Action Alternative would not result in direct effects to marine and estuarine fauna because no activities would occur under the alternative. Some alternatives may have indirect benefits to these species, particularly alternatives that result in reducing erosion and sedimentation of waterbodies that provide habitat for coastal, nearshore, marine, and estuarine species. Under the alternatives, marsh creation would improve areas that may be presently used by marine and estuarine fauna for feeding, breeding, or resting. Under the No Action Alternative, potential benefits to these coastal, nearshore, marine, and estuarine species would not occur.

4.6.2.3.1 Protected Species

Protected Aquatic Species

The No Action Alternative would not result in direct effects to protected aquatic species because no activities would occur under the alternative. Some alternatives may have indirect benefits to protected aquatic species by reducing erosion and improving habitat quality. In addition, creation of marsh habitats under the alternatives would provide habitat for protected aquatic species by improving water quality and by increasing available habitat upon which some protected aquatic species (such as Gulf sturgeon) rely on for foraging, spawning, and resting. Under the No Action Alternative, potential benefits to these protected aquatic species would not occur.

Protected Terrestrial Species

The No Action Alternative would not result in direct effects to protected terrestrial species because no activities would occur under the alternative. Some alternatives may have indirect benefits to protected terrestrial species by reducing land loss in coastal areas such as beaches that provide habitat for piping

plover and red knot. In addition, creation of beach and marsh habitats would provide habitat for protected terrestrial species by increasing available habitat for foraging and resting upon which protected terrestrial species may rely. Under the No Action Alternative, potential benefits to protected terrestrial species would not occur.

4.6.3 Socioeconomic Environment

4.6.3.1 SOCIOECONOMIC RESOURCES AND ENVIRONMENTAL JUSTICE

The No Action Alternative would have no effect on socioeconomic resources or environmental justice communities. The alternatives could result in small benefits to the local economy as a result of temporary construction jobs.

4.6.3.2 CULTURAL RESOURCES

There would be no effect to cultural resources as a result of the No Action Alternative because no activities which could affect cultural resources are proposed.

4.6.3.3 INFRASTRUCTURE

The No Action Alternative may result in long-term, minor adverse impacts to infrastructure as a result of ongoing coastal erosion and land loss. Many of the alternatives include activities to address coastal land loss and erosion that may affect infrastructure in the future. Under the No Action Alternative, potential benefits to infrastructure from alternatives that would provide protection to coastal areas would not occur, and these potential benefits would not be realized.

4.6.3.4 LAND AND MARINE MANAGEMENT

There would be no effect to land use or agricultural resources as a result of the No Action Alternative. Many of the alternatives include activities on existing agricultural lands intended to improve those resources and overall management. Under the No Action Alternative, these improvements would not be realized.

4.6.3.5 TOURISM AND RECREATIONAL USE

The No Action Alternative would have no effect on tourism and recreational use including fishing and hunting. Some of the alternatives could result in improved recreational access and use. Under the No Action Alternative, these recreational use benefits would not be realized.

4.6.3.6 FISHERIES AND AQUACULTURE

Under the No Action Alternative, no direct impacts to fisheries and aquaculture would occur because no activities would occur. Benefits from alternatives including placement of structure such as breakwaters and improved habitat in MCAs that could benefit fisheries would not occur nor would placement of the oyster reef. Under the No Action Alternative, these benefits would not be realized.

4.6.3.7 MARINE TRANSPORTATION

The No Action Alternative would not result in any impacts to marine transportation. Impacts from the alternatives to marine transportation from placement of breakwaters and oyster reefs would occur, but these effects are not substantial and NAVAIDS would be placed to alert vessel operators of their presence.

4.6.3.8 AESTHETICS AND VISUAL RESOURCES

The No Action Alternative would not alter any of the existing conditions at any of the alternatives. There would be temporary visual impacts from construction of alternatives, and some features would be visible from nearby areas (the breakwater, forested ridge, oyster reef, etc.). However, these effects would not be adverse.

4.6.3.9 PUBLIC HEALTH AND SAFETY (INCLUDING FLOOD AND SHORELINE PROTECTION)

The No Action Alternative may result in long-term, minor adverse impacts to public health and safety because of the ongoing coastal erosion and land loss. The alternatives may provide benefits to coastal populations and infrastructure through improved shoreline protection, thereby improving coastal resiliency to the local areas where alternatives would be implemented. Under the No Action Alternative, these potential benefits to public health and safety would not be realized.

4.7 Comparison of Impacts of the Alternatives

The alternatives would result in some adverse impacts to several environmental resources, mainly during construction. Most of these adverse impacts are expected to be short term and minor.

Long-term impacts to several of the environmental resources are expected to be beneficial because hydrology and water quality, terrestrial habitats, and land use components would be improved with implementation of the alternatives.

A summary of the environmental consequences for each resource for each alternative and the No Action Alternative is provided in Table 4.7-1.

Table 4.7-1. Comparison of Impacts for the Alternatives and No Action Alternative

Alternatives	Physical Resources				Biological Resources				Socioeconomic Resources								
	Geology and Substrates	Hydrology and Water Quality	Air Quality	Noise	Habitats	Wildlife Species (including birds)	Marine and Estuarine Fauna (fish, shellfish, benthic organisms)	Protected Species	Socioeconomics and Environmental Justice	Cultural Resources	Infrastructure	Land and Marine Management	Tourism and Recreational Use	Fisheries and Aquaculture	Marine Transportation	Aesthetics and Visual Resources	Public Health and Safety (including flood and shoreline protection)
No Action	l -	l -	NE	NE	NE	NE	NE	NE	NE	NE	l -	NE	NE	NE	NE	NE	l -
West Grand Terre Beach Nourishment and Stabilization	s +	s +	s	s	s l +	s +	s l +	s +	NE	C	s	+	s +	s +	s	s +	s +
Golden Triangle Marsh Creation	s +	s +	s	s	s l +	s +	s l +	s +	NE	C	s	+	s +	s +	s	s +	s +
Biloxi Marsh Living Shoreline	s +	s +	s	s	s l +	s +	s +	s +	NE	C	s	+	s +	s +	s	s +	s +
Fifi Island Forested Ridge with Breakwater	s +	s +	s	s	s l +	s +	s +	s +	NE	C	s	+	s +	s +	s	s +	s +

Notes:
Adverse effect: -
Beneficial effect: +
Short-term minor adverse effect: s
Short-term moderate adverse effect: S
Short-term major adverse effect: **S**
Long-term minor adverse effect: l
Long-term moderate adverse effect: L
Long-term major adverse effect: **L**
No effect: NE
C: Consultation with the Louisiana SHPO to determine any additional requirements may be necessary if any ground-disturbing activities are proposed outside the existing infrastructure footprints under the alternative.

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4.8 Preferred Alternatives

As discussed in Section 3.1.1, alternatives were initially screened based on OPA-defined criteria. Alternatives were also analyzed, per NEPA, to determine the type and severity of potential environmental impacts that could result from the implementation of the alternatives.

The OPA and NEPA analyses were conducted for the reasonable range of four wetlands, coastal, and nearshore habitat restoration alternatives that would provide benefits to the physical environment, biological environment, and socioeconomics resources. Although there would be minor to moderate adverse effects to water quality, geology, recreation, marine transportation, fisheries, wildlife, and protected species, these effects would be short term and would not persist after construction is completed. Therefore, the preferred alternatives can be implemented without causing substantial adverse impacts. Ultimately, the LA TIG identified alternatives that are preferred for implementation in this Final RP/EA based on the OPA evaluation of cost-effectiveness, likelihood of success, and scale of the restoration benefits. The Fifi Island Forested Ridge with Breakwater Alternative is small in scale (22 acres) in comparison to the West Grand Terre, Golden Triangle, and Biloxi March alternatives; therefore, the net benefits are also smaller in scale.

As a result of the OPA evaluation, three alternatives are proposed by the LA TIG as preferred for implementation (Table 4.8-1). As stated in the Final PDARP/PEIS, the No Action Alternative "does not meet the purpose and need for restoration of injured resources and services" and therefore is not identified as a preferred alternative.

Table 4.8-1. Preferred Alternatives

West Grand Terre Beach Nourishment and Stabilization
Golden Triangle Marsh Creation
Biloxi Marsh Living Shoreline

5 CUMULATIVE IMPACTS

5.1 Introduction

Cumulative impacts are defined 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 nonfederal) or person undertake such other actions" (40 CFR 1508.7). The CEQ regulations to implement NEPA require the assessment of cumulative impacts be taken into consideration in the decision-making process for federal projects, plans, and programs. Cumulative impacts need to be analyzed in a meaningful manner that considers the specific resource, ecosystem, and human community being affected by the alternatives and should be considered for all alternatives, including the No Action Alternative (CEQ 1997).

The cumulative impacts analysis conducted for this RP/EA is consistent with CEQ regulations and considers the environmental impacts of the alternatives when added to impacts of past, present, and reasonably foreseeable future actions in each alternative's impact zone.

5.1.1 Discussion of Regional Restoration Programs

The goals of this cumulative analysis are to support the determination of each alternative's ability to meet the purpose and need for the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type, as described in Section 1.4, Restoration Purpose and Need. The methods and resources used for the Final PDARP/PEIS cumulative analysis (Section 6.6, Cumulative Impacts) serve as the basis for this cumulative analysis and are incorporated by reference. In addition, the Final PDARP/PEIS informed the general anticipated impacts and benefits from different restoration project types that may combine with impacts and benefits from construction and implementation of each alternative analyzed in this RP/EA.

The Final PDARP/PEIS analyzes regional restoration projects and programs specific to the Gulf Coast region of Louisiana as well as other actions for consideration in cumulative impacts (PDARP/PEIS Appendix 6.B Additional Actions for Consideration in Cumulative Impacts Analysis). These actions include Habitat Conservation and Protection Programs, Restoration Programs, Water Quality Improvement projects, Military Activities and Projects, Shipping and Maritime Port Projects, Tourism and Recreational Programs, Dredged Material Disposal Projects, and Outer Continental Shelf Projects. Regional restoration projects and programs are expected to result in cumulative and synergistic beneficial effects to coastal habitats across the Gulf Coast and were analyzed on a programmatic level in the Final PDARP/PEIS. This RP/EA is tiered from that programmatic analysis, and the intent of this analysis is to focus on a narrower set of specific projects (alternatives) and provide an analysis of cumulative impacts that would be applicable to the Restore and Conserve Wetlands, Coastal, and Nearshore Habitats restoration type. The multistep approach used for evaluating cumulative impacts for this RP/EA is consistent with the methodology used in the Final PDARP/PEIS and subsequent documents and is described below.

5.1.2 Methods for Assessing Cumulative Impacts

The analysis of potential cumulative impacts from the alternatives described in this RP/EA was completed through the following four steps, which are based on the methods used in Section 6.6, Cumulative Impacts of the Final PDARP/PEIS.

Step 1: Identify Resources. In this step, resources that would be directly or indirectly impacted or benefited by each of the alternatives, as described in Section 4, Environmental Assessment, were identified. These impacted resources are carried

forward for the cumulative impact analysis of each alternative. Resources that are not present in the alternative or are not impacted by implementation of an alternative were not carried forward for cumulative impact analysis. Resources carried forward or excluded from analysis are described for each alternative below.

Step 2: Establish Boundaries. Consistent with CEQ guidance (CEQ 1997), spatial and temporal boundaries must be established to capture resources that would be affected by past, present, and reasonably foreseeable future actions in combination with each of the alternatives for consideration in the cumulative impact analysis. For this analysis, a 1-mile buffered spatial area around each alternative was selected to capture the magnitude and extent of impacts that would be expected from these types of projects (Figure 5.1-1). This buffered area was selected through a review of cumulative impacts analysis areas (CIAAs) defined in previously published RP/EAs, agency consultation, and subject matter expert input. The existing conditions from which this analysis is based, as described in Section 4, Environmental Assessment, captures projects that have occurred in the past that may lead to impacts on resources within the CIAAs. Therefore, the temporal boundary for this cumulative impact analysis is approximately 12 years from the signing of this RP/EA decision, to capture present and future actions that could occur within the estimated remaining time remaining approved funding would be available for Restore and Conserve Wetlands, Coastal, and Nearshore Habitat alternatives.

Step 3: Identify Cumulative Action Scenarios. The cumulative action scenarios describe the types of past, present, and reasonably foreseeable future actions (projects) that are included in the cumulative impact analysis for each affected resource identified under an alternative and the anticipated impacts and benefits from these projects. These projects fall within the spatial and temporal boundaries established for the analysis. For the purposes of this analysis, these projects are grouped consistent with the categories considered in the Final PDARP/PEIS and subsequent RP/EAs, as summarized in the Summary of Potential Impacts to Resources from Alternatives in this Restoration Plan and Environmental Assessment (Table 5.1-1) and detailed in Appendix F, Cumulative Action Scenario. Appendix F also includes detailed figures by alternative showing the location of projects described in the cumulative action scenarios. Table 5.1-1 includes impacts by resource and project type that are applicable to all alternatives, except where noted. Because actions are grouped by general project type, the impact assessment for each project reflects the types of short- and long-term impacts that can be expected from the activities generally associated with that type of action. There are no marine mineral mining or dredged material disposal projects within the CIAA for any alternative.

Step 4: Cumulative Impacts Analysis. The final step in the cumulative impacts analysis is determining the incremental impact of each alternative (X) in combination with impacts from applicable past, present, and reasonably foreseeable future actions (Y), therefore providing the potential cumulative impacts from each alternative and applicable actions on an affected resource (Z). Consistent with the Final PDARP/PEIS and subsequent RP/EAs, this is simply stated as X + Y = Z.

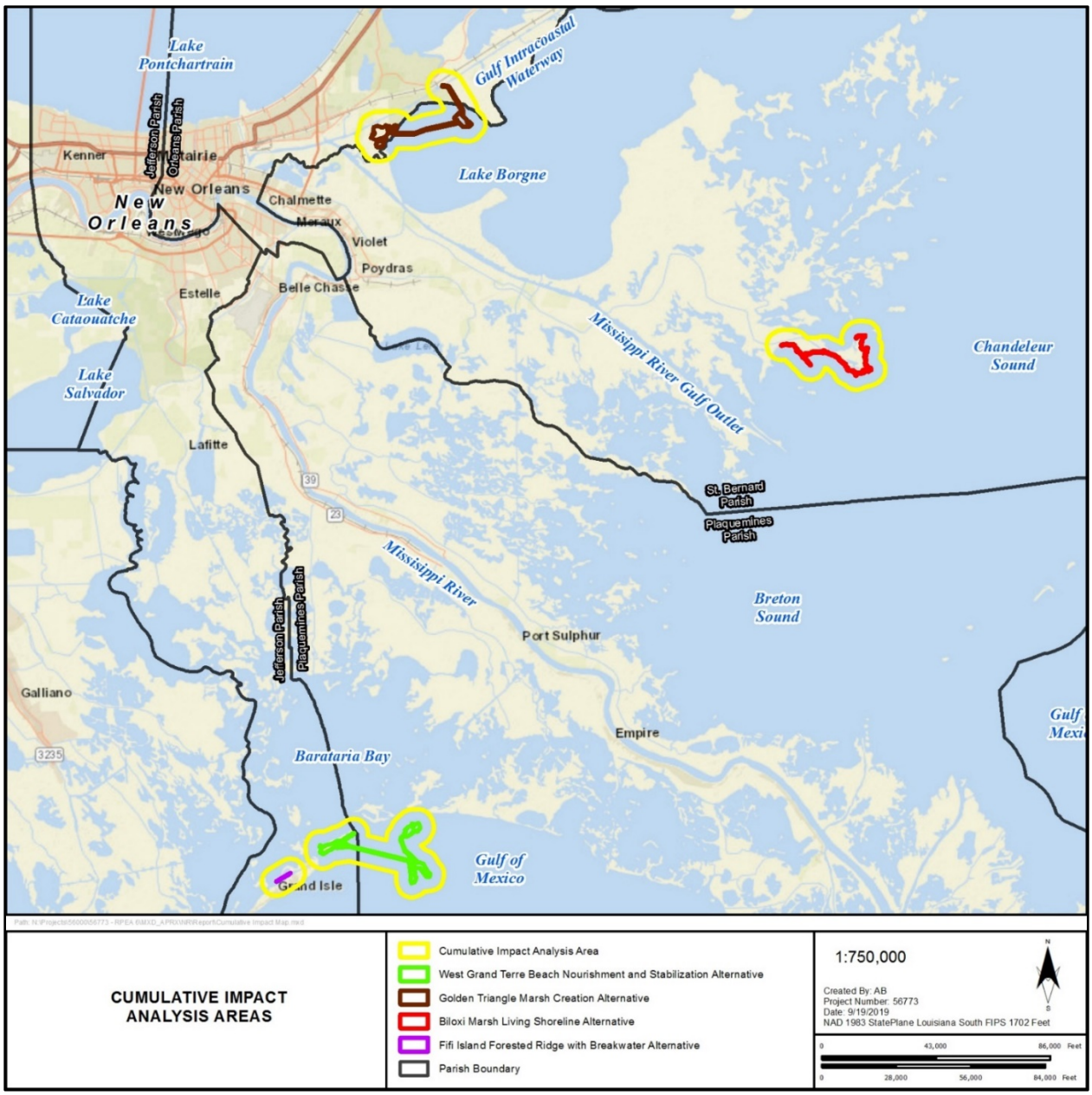

Figure 5.1-1. Cumulative impact analysis areas for all alternatives.

Table 5.1-1. Summary of Potential Impacts to Resources from Alternatives in this Restoration Plan and Environmental Assessment

Resource	Coastal Restoration and Improvements	Energy Activities	Tourism and Recreation
Physical Resources			
Geology and substrates	X	X	X
Hydrology and water quality	X	X	X
Air quality	X	X	X
Noise	X	X	X
Biological Resources			
Habitats	X	X	X
Wildlife species (including birds)	X	X	X
Marine and estuarine fauna (fish, shellfish, benthic organisms)	X	X	X
Protected species	X	X	X
Socioeconomic Resources			
Socioeconomics and environmental justice*	X	X	X
Cultural resources†	X	X	X
Infrastructure	X	X	X
Land and marine management	X	X	X
Tourism and recreational use	X	X	X
Fisheries and aquaculture	X	X	X
Marine transportation	X	X	X
Aesthetics and visual resources	X	X	X
Public health and safety (including flood and shoreline protection)	X	X	X

* There are no significant areas of environmental justice populations and/or no disproportionate impacts on environmental justice populations for any of the alternatives, so this resource was not carried forward for cumulative analysis.

† There are no cultural resources identified for the Biloxi Marsh alternative or Fifi Island alternative, so this resource was not carried forward for cumulative analysis for these alternatives.

5.2 West Grand Terre Beach Nourishment and Stabilization Alternative

5.2.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the West Grand Terre alternative carried forward in the cumulative analysis are described in Section 4.2 with the exception of environmental justice for which a no effect determination was made.

5.2.2 Cumulative Impacts Analysis Area

The CIAA for the West Grand Terre alternative (see Figure 5.1-1 and Figure F-2 in Appendix F) includes portions of Jefferson Parish and Plaquemines Parish within the Barataria Basin, and the eastern-most portion of Grand Isle. Basin subsegments that fall within this CIAA include the Barataria Bay (subsegment 021101), Barataria Basin coastal bays and Gulf waters to state 3-mile limit (subsegment 021102), and Bay Sansbois and Lake Washington (subsegment 020907).

5.2.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the West Grand Terre alternative CIAA include CPRA and non-CPRA restoration projects for coastal development and land use, energy activities, and tourism and recreational resource improvements (Appendix F). The anticipated resources impacted from implementation of these projects are summarized in Table 5.1-1. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

Because of the nature of the projects detailed in Appendix F, many of which are restoration focused, impacts from their implementation would be limited in temporal and spatial scale. Most of these projects are located on or near barrier islands and in offshore waters, which include large uninhabited areas, thereby causing the greatest changes to physical and biological resources. Some projects, specifically those related to oil and gas, would result in the creation of permanent structures in the CIAA. As a result, long-term impacts from implementation of these projects could include changes to or degradations of geologic characteristics and substrates, hydrology, infrastructure, fisheries and aquaculture, and aesthetics and visual resources.

Projects focused on restoration could provide benefits to geology and substrates, hydrology and water quality, air quality, biological resources, socioeconomics, cultural resources, land and marine management, tourism and recreational use, fisheries and aquaculture, marine transportation, and aesthetics and visual resources. These benefits would result from actions that stabilize soils, sediments, and substrates; increase sediment deposition; restore hydrology; improve water quality; increase flood and shoreline protection; re-establish native plant communities; and implement habitat and tourism and recreation improvements.

5.2.4 Cumulative Impacts Analysis

The West Grand Terre alternative would result in short-term adverse impacts on all the physical, biological, and socioeconomic resources discussed in this RP/EA. Overall, the West Grand Terre alternative would result in an incremental beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the West Grand Terre alternative, within the CIAA are restoration focused and could result in synergistic effects (Appendix F). The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem and the West Grand Terre alternative would result in an incremental contribution to overall benefits within the CIAA when combined with other past, present, and reasonably foreseeable future actions.

5.3 Golden Triangle Marsh Creation Alternative

5.3.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Golden Triangle alternative carried forward for cumulative analysis are described in Section 4.3 with the exception of environmental justice for which a no effect determination was made.

5.3.2 Cumulative Impacts Analysis Area

The CIAA for the Golden Triangle alternative (see Figure 5.1-1 and Figure F-3 in Appendix F) includes portions of Orleans Parish and St. Bernard Parish within the Pontchartrain Basin. Basin subsegments that fall within this CIAA include Bayou Bienvenue (subsegment 042004), Lake Borgne (subsegment 042001), Intracoastal Waterway (subsegments 041601 and 041703), New Orleans East leveed waterbodies (subsegment 041401), and Bayou Sauvage (subsegment 041702). Census tracts within this CIAA include 17.34, 17.51, 302.04, 9801, and 9900.

5.3.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Golden Triangle alternative CIAA include CPRA and non-CPRA restoration projects for coastal development and land use, energy activities, and tourism and recreation (Appendix F). The anticipated resources impacted from implementation of these projects are summarized in Table 5.1-1. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

Because of the nature of the projects detailed in Appendix F, many of which are restoration and mitigation (including structural and hurricane protection) focused, impacts from their implementation would be limited in temporal and spatial scale. Most of these projects are along the coast and in offshore waters, thereby causing the greatest changes to physical and biological resources. Some projects, specifically those related to oil and gas, would result in the creation of permanent structures in the CIAA. As a result, long-term impacts from implementation of these projects could include changes to or degradations of geology and substrates, hydrology and water quality, infrastructure, marine transportation, fisheries and aquaculture, and aesthetics and visual resources.

Restoration projects could provide benefits to geology and substrates, hydrology and water quality, air quality, biological resources, socioeconomics, cultural resources, land and marine management, tourism and recreational use, fisheries and aquaculture, marine transportation, and aesthetics and visual resources. Restoration projects would also contribute to providing benefits to public health and safety through increased coastal resiliency and reduced risk from hurricanes and floods. These benefits would result from actions that stabilize soils, sediments, and substrates; increase sediment deposition; restore hydrology; improve water quality; increase flood and shoreline protection; re-establish native plant communities; and implement habitat and tourism and recreation improvements.

5.3.4 Cumulative Impacts Analysis

The Golden Triangle alternative would result in short-term adverse impacts on geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species and critical habitat, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, and public health and safety.

However, these short-term impacts would be temporally and spatially limited, quickly becoming undetectable or unmeasurable. In addition, BMPs implemented as part of the alternative's design, as discussed throughout Section 4 of this analysis, would minimize or avoid short-term impacts.

Overall, the Golden Triangle alternative would result in an incremental beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the West Grand Terre alternative, within the CIAA are restoration focused and could result in synergistic benefits. The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem, and the Golden Triangle alternative would result in an incremental contribution to overall benefits within the cumulative analysis are when combined with other past, present, and reasonably foreseeable future actions.

5.4 Biloxi Marsh Living Shoreline Alternative

5.4.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Biloxi Marsh alternative carried forward for cumulative analysis are described in Section 4.4, with the exception of environmental justice for which a no effect determination was made and cultural resources, which were not found in the alternative.

5.4.2 Cumulative Impacts Analysis Area

The CIAA for the Biloxi Marsh alternative (see Figure 5.1-1 and Figure F-4 in Appendix F) includes portions of St. Bernard Parish within the Pontchartrain Basin, and the eastern half of Grand Isle. Basin subsegments that fall within this CIAA include the Bayou La Loutre MRGO to Eloi Bay (subsegment 042003), Eloi Bay (subsegment 042206), and Morgan Harbor (subsegment 042205).

5.4.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Biloxi Marsh alternative CIAA are the same as those described for the Golden Triangle alternative (see Section 5.3.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, the anticipated resources and impacts would be the same as those described for the Golden Triangle alternative. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

5.4.4 Cumulative Impacts Analysis

The Biloxi Marsh alternative would result in short-term adverse impacts on geology and substrates, hydrology and water quality, air quality, noise, habitats, wildlife species, marine and estuarine fauna, protected species, infrastructure, tourism and recreational use, fisheries and aquaculture, marine transportation, aesthetics and visual resources, and public health and safety. However, these short-term impacts would be temporally and spatially limited, quickly becoming undetectable or unmeasurable. In addition, BMPs implemented as part of the alternative's design, as discussed throughout Section 4 of this analysis, would minimize or avoid short-term impacts.

Overall, the Biloxi Marsh alternative would result in a beneficial contribution to geology and substrates, hydrology and water quality, wetlands and floodplains, biological resources, land and marine management, tourism and recreational use, fisheries and aquaculture, aesthetics and visual resources, and public health and safety. Many of the past, present, and reasonably foreseeable future projects, including the Biloxi Marsh alternative, within the CIAA are restoration focused and could result in synergistic benefits. The overall benefits they provide to improve shorelines and coastal resiliency and support linkages within the broader coastal and nearshore ecosystem, and the Biloxi Marsh alternative would result in an incremental contribution to overall benefits within the CIAA when combined with other past, present, and reasonably foreseeable future actions.

5.5 Fifi Island Forested Ridge with Breakwater Alternative

5.5.1 Resources Carried Forward for Analysis

Resources analyzed for potential direct and indirect impacts from construction and implementation of the Fifi Island alternative carried forward for cumulative analysis are described in Section 4.5, with the exception of environmental justice for which a no effect determination was made and cultural resources, which were not found in the alternative.

5.5.2 Cumulative Impacts Analysis Area

The CIAA for the Fifi Island alternative (see Figure 5.1-1 and Figure F-5 in Appendix F) includes portions of Jefferson Parish within the Barataria Basin, and the eastern half of Grand Isle. Basin subsegments that fall within this CIAA include the Barataria Bay (subsegment 021101) and Barataria Basin coastal bays and Gulf waters to state 3-mile limit (subsegment 021102).

5.5.3 Cumulative Scenario

The types of past, present, and reasonably foreseeable projects and actions identified in the Fifi Island alternative CIAA are the same as those described for the West Grand Terre alternative (see Section 5.2.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, the anticipated resources impacted from implementation of these projects and impacts and benefits that could result from implementation of these projects would be similar to as those described for the West Grand Terre alternative. Additional details on past, present, and reasonably foreseeable projects and actions including a description of the alternative and summary of project type, location, status, and timing are included in Appendix F.

5.5.4 Cumulative Impacts Analysis

Impacts to resources as a result of the Fifi Island alternative would be the same as those described for the West Grand Terre alternative (Section 5.2.2, Cumulative Impacts Analysis Area, and Appendix F). As a result, impact contributions of the Fifi Island alternative would be the same as the West Grand Terre alternative. Therefore, the Fifi Island alternative would provide incremental benefits to geology and substrates, hydrology and water quality, wetlands and floodplains, air quality, biological resources, and socioeconomics but would not substantially contribute to short- or long-term cumulative impacts on any resource when analyzed in combination with other past, present, and reasonably foreseeable future actions.

6 COMPLIANCE WITH OTHER LAWS AND REGULATIONS

In addition to the requirements of OPA and NEPA, other laws may apply to the alternatives in this Final RP/EA. The LA TIG would ensure compliance with these relevant authorities, which are listed in Sections 6.1 and 6.2. Whether, and to what extent, an authority applies to a future alternative depends on the specific characteristics of a particular alternative and the presences of specific resources.

Examples of applicable federal and state laws or federal executive orders (EOs) include those listed in this section. Additional federal laws may apply to the alternatives considered in this Final RP/EA. Legal authorities applicable to restoration alternative development are fully described in the context of the DWH restoration planning in the Final PDARP/PEIS, Section 6.9, Compliance with Other Applicable Authorities, and Final PDARP/PEIS Appendix 6.D, Other Laws and Executive Orders, which are incorporated by reference in this section.

Federal environmental compliance responsibilities and procedures follow the Trustee Council SOPs, which are laid out in Section 9.4.6 of that document (Trustee Council 2016). Following this SOP, the Implementing Trustees for each alternative will ensure that the status of environmental compliance (e.g., completed versus in progress) is tracked through the DWH project portal. The Implementing Trustees will keep a record of compliance documents (e.g., ESA letters, permits) and ensure that they are submitted for inclusion in the administrative record. The current status of environmental compliance by alternative can be viewed at any time on the Trustee Council's website (http://www.gulfspillrestoration.noaa.gov/environmental-compliance/).

6.1 Additional Federal Laws

Additional federal laws may apply to the preferred alternatives considered in this Final RP/EA. Federal laws, regulations, and EOs that may be applicable include the following:

- ESA (16 USC 1531 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act (16 USC 1801 et seq.)
- MMPA (16 USC 1361 et seq.)
- Coastal Zone Management Act (16 USC 1451 et seq.)
- National Historic Preservation Act (16 USC 470 et seq.)
- BGEPA (16 USC 668 et seq.)
- Clean Air Act (42 USC 7401 et seq.)
- Federal Water Pollution Control Act (Clean Water Act) (33 USC 1251 et seq.) and/or Rivers and Harbors Act (33 USC 401 et seq.)
- Marine Protection, Research and Sanctuaries Act (16 USC 1431 et seq. and 33 USC 1401 et seq.)
- Estuary Protection Act (16 USC 1221–1226)
- Archaeological Resource Protection Act (16 USC 470aa–470mm)
- National Marine Sanctuaries Act (16 USC 1431 et seq.)
- Farmland Protection Policy Act (7 USC 4201–4209)
- Rivers and Harbors Act (33 USC 401 et seq.)

- EO 11988: Floodplain Management (augmented by EO 13690, January 30, 2015)
- EO 11990: Protection of Wetlands
- EO 12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- EO 12962: Recreational Fisheries
- EO 13007: Indian Sacred Sites
- EO 13112: Safeguarding the Nation from the Impacts of Invasive Species
- EO 13175: Consultation and Coordination with Indian Tribal Governments
- EO 13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- EO 13693: Planning for Federal Sustainability in the Next Decade

For the alternatives under this RP/EA, the LA TIG has requested initiation of the necessary consultations and reviews with the regulatory agencies.

6.2 State and Local Laws

The LA TIG would ensure compliance with all applicable state and local laws and other applicable federal laws and regulations relevant to the State of Louisiana. Additional laws and regulations are as follows:

- Archeological Finds on State Lands (RS 41:1605)
- Coastal Wetlands Conservation and Restoration Authority (RS 49:213.1)
- Coastal Wetlands Conservation and Restoration Plan (RS 49:213.6)
- Louisiana State and Local Coastal Resources Management Act (RS 49:214.21–214.42)
- Louisiana Oil Spill Prevention and Response Act (RS 30:2451 et seq.)
- Management of State Lands (RS 41:1701.1 et seq.)
- Louisiana Coastal Resources Program (Louisiana Administrative Code [LAC] 43:700 et seq.)
- Louisiana Surface Water Quality Standards (LAC 33.IX, Chapter 11)
- Management of Archaeological and Historic Sites (RS 41:1605)
- Oyster Lease Relocation Program (LAC 43:I, 850–859, Subchapter B)
- Louisiana Scenic Rivers Program (RS 56:1856)

6.3 Summary and Next Steps for Preferred Alternatives

The LA TIG ensures compliance with all applicable state and local laws and other applicable federal laws and regulations relevant to the proposed restoration alternatives, including technical assistance from appropriate regulatory agencies, to identify any compliance issues. The LA TIG has started coordination and technical assistance reviews for protected species and their habitats under the ESA, for EFH protected under the Magnuson-Stevens Fishery Conservation and Management Act, for marine mammals under the MMPA, for eagles under the BGEPA, for cultural resources under the National Historic Preservation Act, for permits under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act, and

for other federal statutes, where appropriate. CZMA consistency reviews have been completed for the three preferred alternatives. Ongoing coordination with NMFS is underway regarding formal ESA consultation for the Golden Triangle preferred alternative due to proposed dredging within Gulf sturgeon designated critical habitat. The LA TIG will ensure that compliance reviews/approvals under all applicable state and local laws and other applicable federal laws and regulations relevant to the selected design alternative are complete before implementation.

Wherever pre-existing consultations or permits are present, they will be reviewed to determine if the consultations or permits are still valid or if a re-initiation of the consultations is necessary. Implementing Trustees are required to implement the BMPs included in Appendix C of this RP/EA as well as alternative-specific mitigation measures or terms and conditions identified through consultations or issuance of permits. Oversight, provided by the Implementing Trustees, will conduct due diligence with regard to ensuring no unanticipated effects to listed species and habitats occur, including ensuring that BMPs are implemented and continue to function as intended. A summary of environmental compliance status is provided in Appendix G, Table G-2.

7 RESPONSE TO PUBLIC COMMENT

The public comment period for the *Louisiana Trustee Implementation Group Draft Restoration Plan/Environmental Assessment #6: Restore and Conserve Wetlands, Coastal, and Nearshore Habitats* (Draft RP/EA) opened on December 20, 2019, and closed on January 21, 2020. During the public comment period, the LA TIG hosted one public webinar on January 8, 2020.

The LA TIG hosted a web-based comment submission site and provided a mailing and email address for the public to provide comments. These comment methods were disclosed in the notice of availability published in the *Federal Register* on December 20, 2019 (EPA 2019b). The LA TIG received comments during the public webinar and through web-based submissions, emailed submissions, and mailed-in submissions.

In all, seven non-duplicate submissions from private citizens; businesses; federal, state, and local agencies; and non-governmental organizations were received by the LA TIG. Similar or related comments contained in the submissions have been grouped and summarized for purposes of this response. All comments submitted during the public comment period were reviewed and considered by the LA TIG prior to finalizing this RP/EA. All comments submitted are represented in the summary comment descriptions listed in this section, and all public comments, whether written or oral, will be included in the administrative record (DOI 2020). DOI is the federal trustee that maintains the administrative record, which can be found online at http://www.doi.gov/deepwaterhorizon/adminrecord (DOI 2020).

7.1 Comment Analysis Process

Comment analysis is a process used to compile similar public comments into a format that can be addressed efficiently. Comments were sorted into logical groups by topics and issues, consistent with the range of topics applicable to the Draft RP/EA. The process was designed to capture and condense all comments received rather than to restrict or exclude any comments. The comment analysis process allows the LA TIG to provide an organized and comprehensive response to public comments, consistent with OPA and NEPA regulations. The DOI's Planning, Environment and Public Comment database was used to manage public comments. The database stores the full text of all submissions and allows each comment to be grouped by topic and issue. All comments were read and analyzed, including those of a technical nature; those that contained opinions, feelings, and preferences for one element over another; and comments of a personal or philosophical nature. All public comments received for the Draft RP/EA are retained in the administrative record (DOI 2020).

7.2 Comment Summary

Below is a summary of the comments received by the LA TIG during the public comment period and the LA TIG's response.

7.2.1 General Comments Received on the Draft Restoration Plan and Environmental Assessment #6

1. **Comment:** Commenters expressed support for the LA TIG's three preferred alternatives. Commenters expressed appreciation toward the LA TIG for the clear explanation of the alternatives screening process and the transparency and public involvement in the projects. Commenters also cited the benefits of the proposed alternatives such as repairing damage, providing habitat to support wildlife, and providing storm surge risk and enhanced resiliency.

   Response: The LA TIG acknowledges and thanks the commenters for their support.

2. **Comment:** One commenter requested that the LA TIG work with the DOI to negotiate a fair solution to fund the three alternatives and that the funding should be shared by the State of Louisiana and the federal government.

   Response: The LA TIG acknowledges this comment and refers the commenter to Section 1.2 of the RP/EA, which explains the composition of the LA TIG, including the DOI, as well as allocation of funding by state. The LA TIG comprises five Louisiana state agencies (CPRA, LDEQ, LDNR, LDWF, and LOSCO) and four federal trustee agencies (NOAA, DOI, USDA, and EPA). On February 19, 2016, the DWH Trustees issued the Final PDARP/PEIS detailing a specific proposed plan to fund and implement restoration projects across the Gulf of Mexico region into the future as restoration funds become available. The Final PDARP/PEIS describes restoration types, approaches, and techniques that meet the Trustees' programmatic restoration goals, and the Consent Decree includes specific monetary allocations to each of the Final PDARP/PEIS restoration types by state. The DWH settlement allocation for the LA TIG by restoration type is described in Section 5.10.2 of the Final PDARP/PEIS.

3. **Comment:** One commenter expressed concerns about the unintended consequences of navigation along the Red River and offered solutions to facilitate coastal environmental restoration.

   Response: The LA TIG acknowledges this comment. However, this area is outside the scope of analysis for this RP/EA.

4. **Comment:** One commenter noted that money cannot rewind the clock on events resulting from the DWH Oil Spill and that responsible parties need to be held accountable.

   Response: The LA TIG acknowledges this comment.

5. **Comment:** One commenter noted that backfilling canals costs less than one-tenth of $1 per acre to restore. The alternatives proposed in the Draft RP/EA are far more costly, and using approaches such as backfilling as applied in Jean Lafitte National Park would allow ten times more restoration to occur. The commenter also questioned why the RESTORE Council could not fund a program to backfill canals across the coast.

   Response: Backfilling of canals is eligible under the Create, Restore, and Enhance Coastal Wetlands restoration type. Future RP/EAs prepared by the LA TIG could include alternatives that propose restoration activities referred to by the commenter. It should be noted that the LA TIG is responsible for implementing restoration under NRDA, as specified in the Consent Decree arising from the DWH Oil Spill and discussed in the Final PDARP/PEIS, and has no authority or discretion over expenditures for or implementation of restoration activities conducted by the RESTORE Council under the RESTORE Act.

7.2.2 Comments Specific to Proposed West Grand Terre Alternative

1. **Comment:** One commenter was concerned about the impact that the creation of barrier marsh habitat association with the West Grand Terre alternative may have unanticipated negative consequences for nesting birds. Audubon Louisiana's monitoring efforts in Cameron, Lafourche, and Jefferson Parishes have demonstrated increased use of renourished beaches by least terns (*Sternula antillarum*) (and to a lesser degree by black skimmer [*Rynchops niger*]), and high rates of nest depredation. The commenter requested a predator management program be included to reduce depredation and improve least tern breeding productivity.

Response: Although studies have identified depredation as a concern for nesting shorebirds (as described by the commenter, some species in particular the least tern and black skimmer), the increase in predator populations and predation rate has been linked to the presence of humans or human infrastructure. Many populations of predators have increased due to the availability of human-provided foods (such as trash, hand-feeding, road-kill, and bird feeders), which allows populations to exist at higher densities than under natural ecological conditions. In addition, human manipulations of the physical beach environment (such as bridges or other links that connect islands to the mainland) allow predator populations to move into previously isolated areas. In some cases, beach and dune restoration activities may result in an increase of these predator-attractant elements and/or connect previously isolated beach segments and allow overland dispersal of predators into the restoration areas, which may facilitate an increase in predator populations.

Because West Grand Terre Island is not physically connected to the mainland and/or other inhabited islands that would provide travel corridors, because it lacks human habitation and associated features (such as trash) that would attract predators to the beach and dune restoration area, and because of the implementation of BMPs, as described in Section 6, Appendix A of the Final PDARP/PEIS, the likelihood of an increase in predator populations and thus predation pressure to increase from current conditions is low. Therefore, a predator management plan for nesting shorebirds (including least tern and black skimmer) is not anticipated to be necessary. Project success would be subject to monitoring, as described in Appendix D. Monitoring and Adaptive Management Plans.

7.2.3 Comments Specific to Proposed Biloxi Marsh Alternative

1. **Comment:** One commenter indicated support of the Biloxi Marsh alternative and its extensive restoration capabilities.

   Response: The LA TIG acknowledges and thanks the commenter for this comment.

2. **Comment**: One commenter offered expanded support of the Biloxi Marsh alternative as a priority project.

   Response: The LA TIG acknowledges and thanks the commenter for this comment.

8 LIST OF PREPARERS AND REVIEWERS

Table 8.1-1. List of Preparers and Reviewers

Agency/Firm	Name
State of Louisiana	
Louisiana CPRA	Vida Carver
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	Meggan Dugan
	Laura Klewicki
	Jen Wynn
	Linda Tucker Burfitt
	Kerri Linehan
	Debbi Smith

9 LIST OF REPOSITORIES

Table 9.1-1. List of Repositories

Library	Address	City	Zip Code
St. Tammany Parish Library	310 West 21st Avenue	Covington	70433
Terrebonne Parish Library	151 Library Drive	Houma	70360
New Orleans Public Library, Louisiana Division	219 Loyola Avenue	New Orleans	70112
East Baton Rouge Parish Library	7711 Goodwood Boulevard	Baton Rouge	70806
Jefferson Parish Library, East Bank Regional Library	4747 West Napoleon Avenue	Metairie	70001
Jefferson Parish Library, West Bank Regional Library	2751 Manhattan Boulevard	Harvey	70058
Plaquemines Parish Library	8442 Highway 23	Belle Chasse	70037
St. Bernard Parish Library	1125 East St. Bernard Highway	Chalmette	70043
St. Martin Parish Library	201 Porter Street	St. Martinville	70582
Alex P. Allain Library	206 Iberia Street	Franklin	70538
Vermilion Parish Library	405 East St. Victor Street	Abbeville	70510
Martha Sowell Utley Memorial Library	314 St. Mary Street	Thibodaux	70301
South Lafourche Public Library	16241 East Main Street	Cut Off	70345
Calcasieu Parish Public Library Central Branch	301 West Claude Street	Lake Charles	70605
Iberia Parish Library	445 East Main Street	New Iberia	70560
Mark Shirley, LSU AgCenter	1105 West Port Street	Abbeville	70510

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