Gulf Intracoastal Waterway – Beneficial Use of Dredged Material

Continuing Authorities Program Section 204 Aquatic Ecosystem Restoration

Aransas County, Texas

DETAILED PROJECT REPORT AND ENVIRONMENTAL ASSESSMENT

August 2024

P2: 455266

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Galveston District

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AQUATIC ECOSYSTEM RESTORATION FOR

GULF INTRACOASTAL WATERWAY – BENEFICIAL USE OF DREDGED MATERIAL, ARANSAS COUNTY, TEXAS

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Aquatic Ecosystem Restoration for GIWW, Texas
§204 Beneficial Use of Dredged Material Detailed Project Report

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ACRONYMS

AAHU	Average Annual Habitat Unit	**NFS**	Non-Federal Sponsor
AOR	Area of Responsibility	**NMFS**	National Marine Fisheries Service
BUDM	Beneficial Use of Dredged Material	**NWR**	National Wildlife Refuge
CAP	Continuing Authorities Program	**O&M**	Operations and Maintenance
CY	Cubic Yard	**OMRR&R**	Operation, Maintenance, Repair, Rehabilitation, and Replacement
DDPR/EA	Draft Detailed Project Report/Environmental Assessment	**PDT**	Project Delivery Team
DMMP	Dredged Material Management Plan	**PMP**	Project Management Plan
DU	Ducks Unlimited	**RSLC**	Relative Sea Level Change
ESA	Endangered Species Act	**SCC**	Social Cost of Carbon
E.O.	Executive Office	**TCEQ**	Texas Commission for Environmental Quality
FID	Federal Interest Determination	**TPWD**	Texas Parks and Wildlife Department
FWOP	Future Without Project	**TSP**	Tentatively Selected Plan
FWP	Future With Project	**TWDB**	Texas Water Development Board
GIWW	Gulf Intracoastal Waterway	**USACE**	U.S. Army Corps of Engineers
GLO	Texas General Land Office	**USFWS**	U.S. Fish and Wildlife Services
NED	National Economic Development	**WMA**	Wildlife Management Area
NER	National Ecosystem Restoration	**WRDA**	Water Resources Development Act

1. Study Information

1.1 Study Authority

The authority for this project is Section 204 of the Water Resources Development Act (WRDA) of 1992, as amended and administered under the U.S. Army Corps of Engineers (USACE) Continuing Authorities Program (CAP). This particular study purpose is for Environmental Protection and Restoration. This project has the authority “to protect, restore and create aquatic and ecologically related habitat including wetlands; and to transport and place suitable sediment for the purposes of improving environmental conditions in marsh and littoral systems, stabilizing stream channels, enhancing shorelines, and supporting State and local risk management adaptation strategies” (EP 1105-2-58 Continuing Authorities Program, 01 March 2019).

The State of Texas: Aransas County is the Non-Federal Sponsor (NFS) who recognizes the opportunity to support maintenance of navigation resources in combination with restoring coastal habitat in the region.

On 25 September 2023, Aransas County voted at the Commissioners’ Court to participate as the Non-Federal Sponsor for the Design and Implementation phase of the project, and the entity that will be signing the Project Partnership Agreement (PPA). The Texas General Land Office (GLO) will provide funding for the project through an interagency agreement with Aransas County. The GLO demonstrates its commitment to coastal restoration through multiple approaches, grants for restoration efforts, producing and updating the Coastal Resiliency Master Plan, and its leasing activities that balance active waterfronts with ecological sustainability. TPWD is an agency whose mission is to manage and protect wildlife, wildlife habitat, and natural resources in Texas, and has been actively engaged in this feasibility study.

1.2 Federal Policy and Procedures

The Federal Interest Determination (FID) was approved by the Southwestern Division Commander on September 3rd, 2021, indicating federal interest for the beneficial use of dredged materials (BUDM) from the Gulf Intracoastal Waterway (GIWW) on candidate parcels along GIWW. The material placement study area extends 379 miles along the GIWW from the Sabine River at the border with Louisiana to Brownsville, Texas. The Federal interest in the project is indicated as the benefits of habitat restoration in this section of the GIWW shoreline will be greater than the incremental cost of placing O&M dredge material dredged from the GIWW onto a degraded parcel without adverse environmental impacts.

1.3 Purpose and Need

The purpose of this DDPR-EA is to recommend a viable BUDM along the GIWW to restore habitat along the navigation resource and capture ecological output. The project purpose is to restore and protect valuable coastal ecosystems by creating ecologically relevant habitats in connection with regular operations and maintenance (O&M) dredging of an existing Federally authorized navigation action.

Critical coastal habitat has been degraded, converted, or lost along the GIWW as a result of eroding shorelines, altered hydrologic regimes, and reduced longshore sediment transport, due in part, to activity of the navigation channel. These stressors put coastal habitats at risk of degrading by either converting from brackish to saline marshes or from saline marshes to open water due to erosion and saltwater intrusion. As such, it is reasonable to use O&M material, if deemed of environmental quality, to replace and restore these habitats along the channel if determined to be in the Federal interest. Along the GIWW, salt marshes are one of the prominent coastal habitats facing temporal and spatial degradation.

Salt marshes are among the most productive ecosystems in the world (Deegan et al. 2012; Gedan et al. 2009); however, many are becoming unsustainable due to hydrologic alterations caused by natural degradation, often exacerbated by anthropogenic activities (Bouma et al. 2014; Bromber et al. 2009). This marsh loss can alter biological communities (Mathews et al. 2014; Temmerman et al. 2012; Kirwan et al. 2010; Day et al. 1995) and physical attributes that reduce overall productivity of the system (Delgado et al. 2013; Colon-Rivera et al. 2012; Turner and Neill 1983). Along the Texas coast, salt marsh loss is predominantly caused by wave action, subsidence, sea level-rise, and insufficient sediment supply (Ravens et al. 2009).

Restoration of salt marsh is a technique used to protect and improve degraded habitat quality (Billah et al. 2022), of which dredged material can be used. BUDM is a specific opportunity to demonstrate viability, and develop practices that facilitate, rather than challenge, the justification of BUDM efforts.

1.4 Location and Study Area

The GIWW runs parallel to the Gulf of Mexico's coastline, stretching more than 1,100 miles from St. Marks, Florida, to the southernmost tip of Texas in Brownsville (TXDOT, 2022).

In Texas, the main channel of the GIWW stretches 379 miles along the coastline from the Sabine River at the Louisiana border to Brownsville, Texas. The channel serves as the backbone of the state's inland water transportation system connecting Texas's 11 deep-draft and eight shallow-draft public ports, as well as numerous private facilities via its many tributaries and intersecting ship channels. Though only about one-third of the total length of the GIWW, the Texas segment handled more than 70 percent of all GIWW traffic in 2018—more than 77.7 million short tons.

The sites selected for evaluation start in the east with the Lower Neches Wildlife Management Area (WMA) and move southwest along the GIWW to Goose Island State Park (Figure 1). Lower Neches WMA is managed by TPWD and is comprised of 7,998 acres of open water marshes in Orange County that offers activities such as hunting, wildlife viewing, and fishing. The National Wildlife Refuge (NWR) sites are managed by the U.S. Fish and Wildlife Services (USFWS), which includes Texas Point, McFaddin, Anahuac, and San Bernard.

Texas Point NWR is in Jefferson County and consists of 8,952 acres of coastal wetlands. This primitive refuge does not contain paved trails or vehicle access and was designated by the American Bird Conservancy as a globally important bird area of the United States. McFaddin NWR is in Jefferson County and is the largest of the sites at 58,861 acres. The refuge features fresh water and intermediate marsh habitats and a Gulf shoreline dune system. It is home to the largest concentration of American alligators (*Alligator mississippiensis*) in Texas and serves as an important stopover for migrating songbirds and wintering grounds for waterfowl. Anahuac NWR is a 37,000-acre refuge in Chambers County, featuring brackish and saline marshes, coastal prairies, woodlands, and Chenier plains. This refuge is used as a stopover along the Central Flyway for millions of migrating birds and contains one of the last remnants of native coastal tallgrass prairie in the U.S. San Bernard NWR is a 57,700-acre refuge comprised of salt and freshwater marshes, ponds, coastal prairies, and bottomland forests across Brazoria and Matagorda counties. The Columbia bottomland forest is in this refuge and contains some of the largest live oak stands in Texas and provides habitat for wintering and nesting birds. The refuge was designated an internationally significant shorebird site and is popular for waterfowl hunting and recreational fishing.

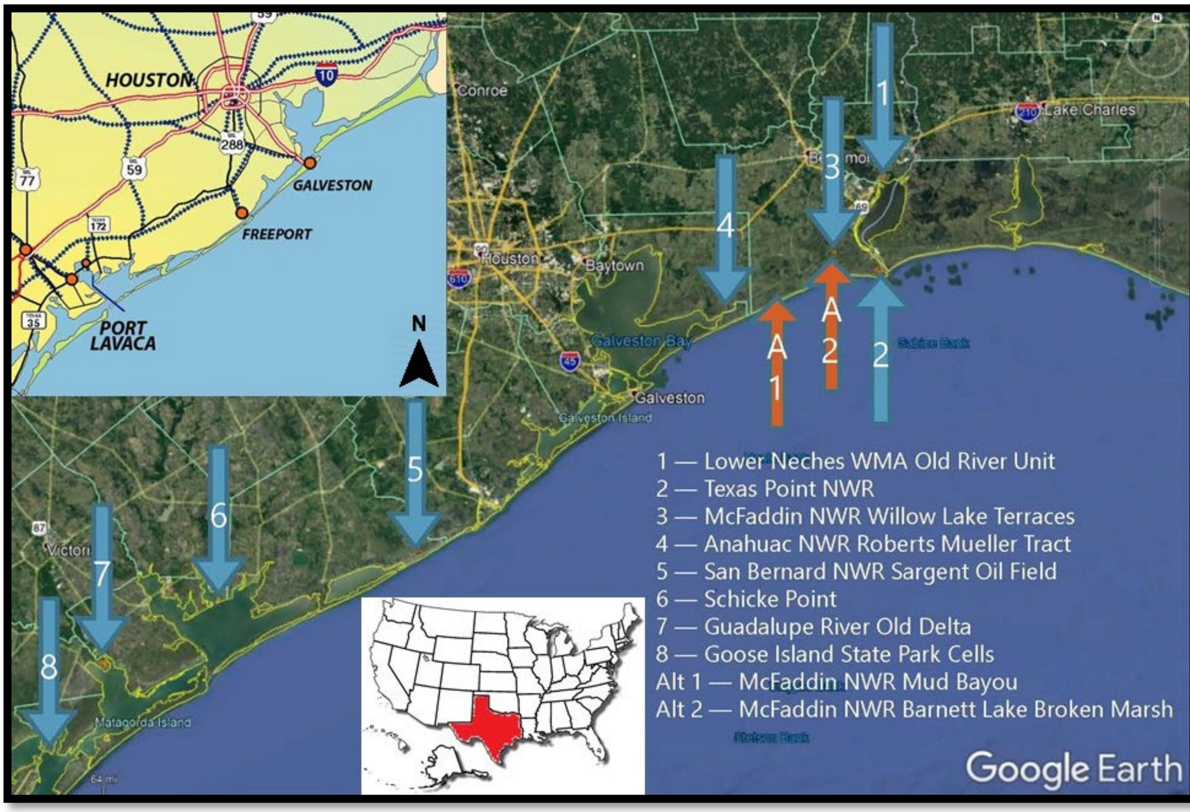

Figure 1: Array of Study Locations

Schicke Point is privately owned property in Calhoun County that features estuarine and coastal marsh habitats, tidal flats, and oyster reefs. It lies just east of Carancahua Pass that is the connection between Carancahua Bay and Matagorda Bay. Guadalupe River Delta is also privately owned property in Refugio and Calhoun counties and consists of marsh wetlands ranging in salinity influenced by proximity to the Guadalupe River. Goose Island State Park is in Aransas County and is managed by TPWD, featuring estuarine marshes, oak mottes, and tidal flats which boasts fishing, camping, and boating for recreationalists. One of the park's most notable attractions is the "Big Tree", one of the largest live oak trees in the nation that is more than 1,000 years old.

An initial FID effort identified many viable placement alternatives adjacent to the GIWW for BUDM. Those sites were screened through an iterative process to assess viable restoration sites with degraded and/or degrading conditions in proximity to scheduled Navigation O&M activities, followed by comparison and selection of the plan that reasonably achieves study goals. Widespread BUDM is limited by availability of sediment, aligning schedules for O&M efforts, and agency tolerance for cost risk that could result from alternative placement of O&M material. To reduce study risk, the first planning iteration limited site selection to only the subset of FID candidate sites within the O&M defined opportunities.

Many viable restoration opportunities exist in the study area which were identified as priorities by the GLO but are either other federal agency lands or were proposed mitigation sites for USACE projects; thus, were not considered further. The USACE cannot perform ecosystem restoration on property owned by another Federal agency with a mission to restore ecosystem function, because those agencies are intended to receive separate federal dollars for their missions Thus, the NWR sites were screened from the final focused array of alternatives. Lower

Neches WMA is a proposed mitigation site for the Sabine Pass to Galveston Bay Coastal Storm Risk Management project and was screened from the final array as to not compete with another proposed USACE project. The focused array of alternatives was reduced to Schicke Point, Guadalupe River Delta, and Goose Island State Park. The final project location proposed for this study is Goose Island State Park. Additional details for site screening criteria can be found in Section 5.1 Planning Criteria.

Goose Island State Park is at the end of Lamar Peninsula, north of Rockport, Texas between St. Charles and Aransas Bays. The proposed project area is within the boundaries of the state park, which is currently composed of two semi-contained cells with primarily open water and small, scattered islands of salt marsh (Figure 2). Historically, Goose Island was much larger; however, decades of tidal erosion, rising sea levels, subsidence, and altered sediment supplies have reduced the area to its current footprint. Containment dikes and an offshore breakwater were constructed in 2008 during a previous attempt to restore the island encompassed by the two existing cells. The previous restoration attempt did not result in creating a functional marsh elevation, likely due to inadequate quantities of fill material provided opportunistically from a non-Federal channel during development of a community just north of the state park. Since 2008, no additional restoration attempts have been made at this location. This study comprehensively addresses the fill needed, considering settlement of dredged material, and has monitoring and adaptive management practices to increase the likelihood of long-term success.

Figure 2: Project location

Over the past decade, the containment dikes have undergone erosion due to tidal movement, wave energy, and storm impacts and the previously pumped material has settled substantially, as well as been lost. To successfully place new material, the existing containment dikes would be repaired by excavating sediment onsite to build up elevation an additional one foot. This project location is consistent with regional efforts to combat land and habitat loss through estuarine marsh restoration and is a priority for other cooperating agencies.

Section 1005 of the Water Resources, Reform, and Development Act (WRRDA) of 2014 requires the USACE to identify all Federal, State, and local government agencies and tribes that may have jurisdiction over, are required by law to conduct and/or issue a review for or may be required to decide on issuing a permit, license, or other approval decision for the project. As such, a resource agency coordination meeting was held virtually on 8 July 2022 and included stakeholders from:

- USFWS,
- TPWD,
- NOAA National Marine Fisheries Service (NMFS),
- DU,
- Texas Water Development Board (TWDB), and
- GLO.

Two subsequent meetings were held virtually on 29 July 2022 and 7 September 2022 to discuss ecological modelling for Goose Island State Park. During both meetings, representatives from the TPWD, USFWS, USACE, and GLO were in attendance.

1.5 Federal Navigation Project

1.5.1 Existing Navigation

Texas is one of the nation's top states for waterborne commerce, with Texas ports generating over $82.8 billion in economic value to the state. More than 500 million tons of cargo pass through Texas ports annually. Texas handled 15.8 percent of total U.S. cargo between 2007 and 2011. Texas ports also managed 20.1 percent of the nation's total export tonnage, making it the nation's leading export state. Texas ports also received 26 percent of the total foreign tonnage handled in the U.S.

Project planning and alternative formulation and screening applied relevant experiences from recent BUDM efforts within the USACE Galveston District. Although USACE's policy emphasizes increased commitment to capturing efficiencies of BUDM, the extensive O&M obligations require balancing navigational priorities and available funds. Therefore, the Project Management Plan (PMP) approved for this project prioritized the site screening and selection process. This was to ensure that the final array of alternatives identified as feasible for receipt of sufficient sediment within the project timeline, as informed by the Operations Division.

1.5.2 Operations & Maintenance Efforts

As of 2 June 2022, the following O&M considerations were documented for the focused array of potential project site location alternatives. It was confirmed that all three of the sites are within a feasible pumping distance from the candidate borrow area and the likely volume of sediment was estimated. The PDT took into consideration that 1-3 cycles from this dredge area could span 1-6 years. It was also confirmed that BUDM of a portion of the available sediment would pose no risk to O&M contracting method or timing.

Table 1: Dredging Constraints for the Project

SITE	Dredge Cycle/Freq	Vol Dredged	Sediment Source
Goose Island State Park	2 yr. cycle GIWW Matagorda to CC Bay reach	1,000,000	GIWW Matagorda to CC Bay Reach, ~5 miles pumping distance; Dredging may occur in the vicinity of critical habitat for whooping crane at this location
Guadalupe River Delta	1. CTV Dredge Cycle/ Freq – 2 yr. cycle 2. GIWW Matagorda to CC Bay (2 yr.)	1. CTV 600,000 – 800,000 2. GIWW (500,000 – 800,000 CY)	1. Channel to Victoria 2. GIWW Matagorda to CC Bay Reach Distance ~9 mi or more from channel to site ½ dredge availability. Will require Whooping Crane windows. Likely requires 1 booster pump
Schicke Point	1-2 years depending on available GIWW funding. Palacios is typically added as an Option on GIWW Freeport to Matagorda Bay reach. Can also be added to Matagorda to CC Bay Reach.	400,000 – 800,000 CY depending on available funding.	GIWW – Freeport to Matagorda, Option for Channel to Palacios; Likely requires 1 booster pump

1.5.3 Prior Reports and Existing Water Projects

In 2008, the TPWD erected a stone breakwater in front of Goose Island to attenuate wave energy to aid in the preservation of the island, as well as two containment dikes that encompassed an open-water area intended for marsh restoration. An initial restoration attempt did not provide enough sediment for marsh development within the cells, and instead resulted in small, concentrated mounds of vegetated marsh with mostly open water. The breakwater and containment dikes have generally performed well in protecting interior marsh. No additional restoration efforts have occurred at Goose Island since the initial attempt more than a decade ago. The GLO and DU has identified Goose Island as a priority for marsh restoration in a regional effort to combat land loss, build coastal resiliency, and restore natural ecosystems of the Texas coast.

The Project Delivery Team (PDT) reviewed available data and information deemed relevant to the planning process for this beneficial use study.

1.5.3.1 GLO Coastal Resiliency Master Plan

The Texas Coastal Resiliency Master Plan is a list of projects compiled by coastal and environmental experts and is an ongoing, state-led coastal planning effort coordinated by the GLO that seeks to restore, enhance, and protect our Texas coast. The Plan recommends specific coastwide and regional projects to provide solutions to restore, enhance and protect coastal habitats, infrastructure, and communities (GLO, 2022). This Resiliency Plan provides valuable data and information on areas relevant for projects such as this study on Goose Island with the goal of attaining protection from natural disasters (Coastal Master Plan, 2019).

2. Existing Conditions

This chapter presents a description of the environmental resources and the baseline conditions that could be affected from implementing the proposed alternative. The level of detail used to describe a resource is commensurate with the anticipated level of potential impact and information available at the time of the report.

2.1 Air Quality

The Clean Air Act (CAA), as amended in 1990, requires the Environmental Protection Agency (EPA) to assess and amend National Ambient Air Quality Standards (NAAQS) for six common air pollutants, herein referred to as criteria air pollutants. The criteria air pollutants are of concern because of their impact to the environment, human health, and property and include ozone, particulate matter, carbon monoxide, lead, sulfur dioxide, and nitrogen dioxide. The Texas Commission for Environmental Quality (TCEQ) is responsible for monitoring annually reported point source air emissions on waters that extend 9 nm from the Texas shoreline following criteria defined in the Texas Administrative Code 30 §101.10. The emission inventories are reported for criteria air pollutants and hazardous air pollutants (38 FR 8820; 57 FR 61992) including volatile organic compounds (VOC).

EPA designates a geographic area as nonattainment, attainment, or unclassifiable based on whether the air quality meets, exceeds, or does not meet the national standard for clean air. In 2015, the EPA revised its primary and secondary NAAQS for ozone to 0.070 ppm (80 FR 65292). In 2020, the EPA retained the 2015 standards without revision (85 FR 87256). Goose Island State Park is located in the Corpus Christi Air Quality Control Region and is in attainment for 8-hour ozone, as well as in compliance with all other criteria air pollutants (TCEQ 2021). CAA section 107(d)(1)(A)(i) defines an attainment as, “any area (other than an area identified in clause i) that meets the national primary or secondary ambient air quality standard for the pollutant”.

2.2 Climate

The Gulf of Mexico is a predominant geographical feature affecting the climate of the Texas coast, moderating seasonal temperatures, and providing the major source of precipitation (TWDB, 2012; Larkin and Bomar, 1983). Annual mean temperatures range from 50°F in the winter to 90°F in the summers (SRCC, 2022). The study area resides in the Gulf Coast region characterized by a sub-tropical humid climate with wet seasons (i.e., precipitation maxima) occurring from January through December and April through October (Perica et al. 2018). Average annual rainfall varies along the Texas coast but ranges in the study region from approximately 40 to 55 inches per year (SRCC, 2022).

Tropical depressions, tropical storms, and hurricanes are common in the Gulf of Mexico, with hurricane season extending from June through November. Historically, the landfall frequency along the Texas coast is one every six years, with annual probabilities of approximately 31% in any given year (Roth 2010). During these natural disasters, flooding is the most serious threat.

The TCEQ monitors temporal water temperature and salinity trends in lakes, streams, rivers, and bays throughout the State. To the best of their ability, the TCEQ samples water quarterly to capture seasonal trends. The two closest estuary systems influencing water temperature and salinity at Goose Island State Park are Copano and Aransas bays. Annual temperature and salinity readings were obtained from TCEQ’s Surface Water Quality Web Reporting Tool, segments 2471 and 2472. Annual mean water temperatures have remained stable since 1985, ranging from 66.2°F to 76.8°F. Annual mean salinity has fluctuated over time and experienced a much larger range from 9.7 psu to 35.3 psu (Figure 3). Large salinity ranges are expected in this region because of drought, low freshwater inflows, tidal fluctuations, and evaporation rates.

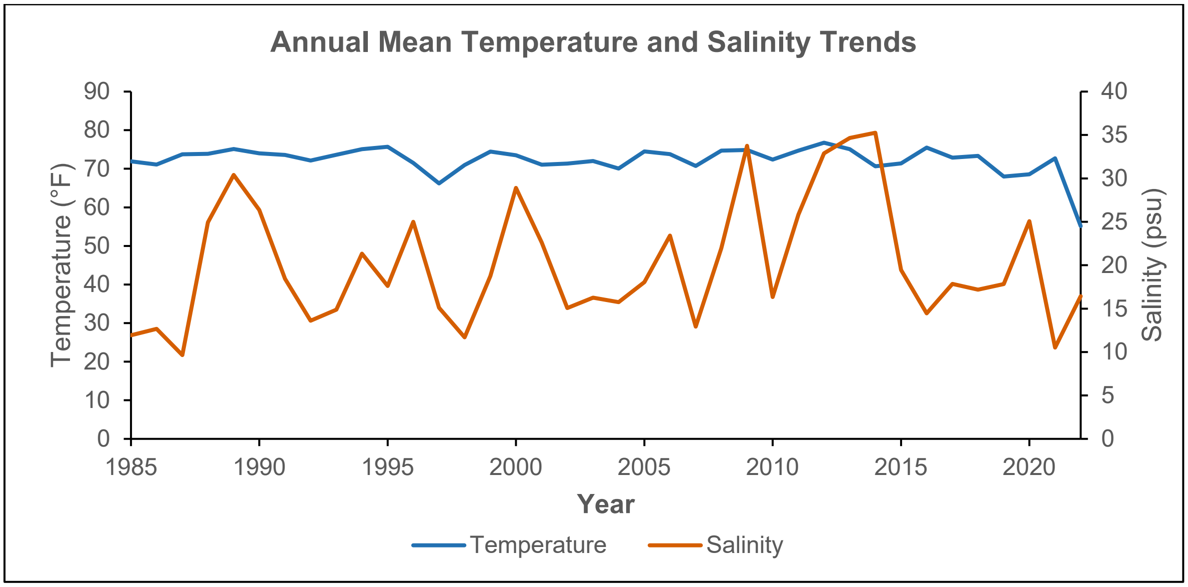

Figure 3: Annual mean water temperature and salinity trends near Goose Island State Park, 1985 to 2022. Mean temperature values are low in 2022 as a result of sampling being limited to February. Source: TCEQ 2022

2.3 Physical Oceanography

2.3.1 Tides, Currents, and Circulation

The study area resides in the Mission-Aransas (M-A) Estuary, named after the Mission and Aransas rivers that are the predominant sources for freshwater to the system, and encompasses several bays in the region (i.e., Mission, Copano, Port, St. Charles, Aransas, Mesquite, and Redfish Bays). Hydrological conditions in the estuary are governed by climatologic factors, freshwater inflows, and to a lesser extent tidal fluctuation (Smith and Dilworth, 1999; UTMSI, 2003; Chen, 2010). Circulation in the bays is strongly influenced by prevailing winds, rather than tides, because of their shallow nature (Montagna et al. 1998; Chen 2010), where mean low water varies from two to ten feet in depth (Chandler et al., 1981; UTMSI, 2015). Freshwater inflows to the M-A system predominantly come from the Mission and Aransas Rivers, coupled with the Copano, Cavasso, and Salt Creeks (Chen, 2010). Freshwater inflows often occur in a pulsed nature with seasonal differences; however, isolated freshwater inputs brought on by storms are also important for controlling the salinity in the region as direct precipitation constitutes 44% of the annual freshwater input (Chen, 2010). The estuary is separated from the Gulf of Mexico by San Jose Island but is hydraulically connected via Aransas Pass and Cedar Bayou. The estuary is also connected hydraulically to San Antonio Bay and Corpus Christi Bay, which coupled with the Gulf of Mexico, influence the saltwater flow into the study area. Additional information can be found in the Engineering Appendix A.

2.3.2 Bathymetry

NOAA navigation charts were utilized to review bathymetry data. While this is not optimal, it was the only method available until project authorization and funding. More advanced surveys of the project area will be conducted, and the analysis and quantities will be refined to better define the bathymetry of the final design and quantities.

2.3.3 Relative Sea Level Change

The change in ocean height relative to coastal lands, called relative sea level rise, is a combination of three factors: eustatic sea level rise, local variations in sea level rise, and relative land motion. Eustatic sea level rise is the change in global mean ocean height (global mean sea level [GMSL]) and is primarily the result of increasing temperatures that cause thermal expansion and melting glaciers and ice sheets. Scientific research indicates that GMSL has risen by about 7-8 inches since 1900 and could rise between 3.6-7.2 inches by 2030 and 15-51.6 inches by 2100 (Sweet et al. 2017). Local variations are produced by changes in wind patterns and ocean currents and are minor for the Gulf of Mexico (Nielsen-Gammon 2009). Relative land motion in coastal Texas is dominated by coastal subsidence, or the gradual lowering of land-surface elevation, and is the result of the extraction of groundwater, oil, or gas or increasing sediment loading or infrastructure construction. The Relative Sea Level Change graph, produced using the USACE Sea level rise calculator, considers both Global Eustatic Sea Level Change and Ground Subsidence, which are captured in the Tide Gauge Record. The USACE Sea Level Rise Calculator uses tide gauge record to forecast low, intermediate, and high sea level rise scenarios for the 50-to-100-year planning horizon.

RSL and water surface elevations throughout the life of the project were calculated using the USACE RSL calculator (https://cwbi-app.sec.usace.army.mil/rccslc/slcc_calc.html) using the closest active tide gage located at the Rockport TX. Figure 4 and Figure 5 are presented assuming a 50-year life span with a project start date of 2023, and a mid-point epoch of 1992 by taking into account the sea level rise from the mid-year epoch 1992 and moving the data to create a new 0 at 2023. Using the USACE intermediate curve we see that 50-year sea level rise is 1.35 ft. At this point 1.35 ft is not something of concern due to the nature of the design and the purpose of the project, but it has been considered for dike crest height determination. During the PED phase, the USACE will continue to refine the engineering design to by including three sea level rises to promote broader resilience, improve climate preparedness, and reduce vulnerabilities due to climate change. For adaptation to 100-year planning horizon, it is relatively easy to adapt the marsh cells to sea level change. Additional sediment can be included to offset losses from sea level rise. The containment dike elevation will need to be raised in response to sea level rise to maintain the design performance. As a rule of thumb, it is recommended that the crest elevation be increased in 1-foot increments in the future to accommodate sea level rise. For additional information, please reference the Engineering Appendix A.

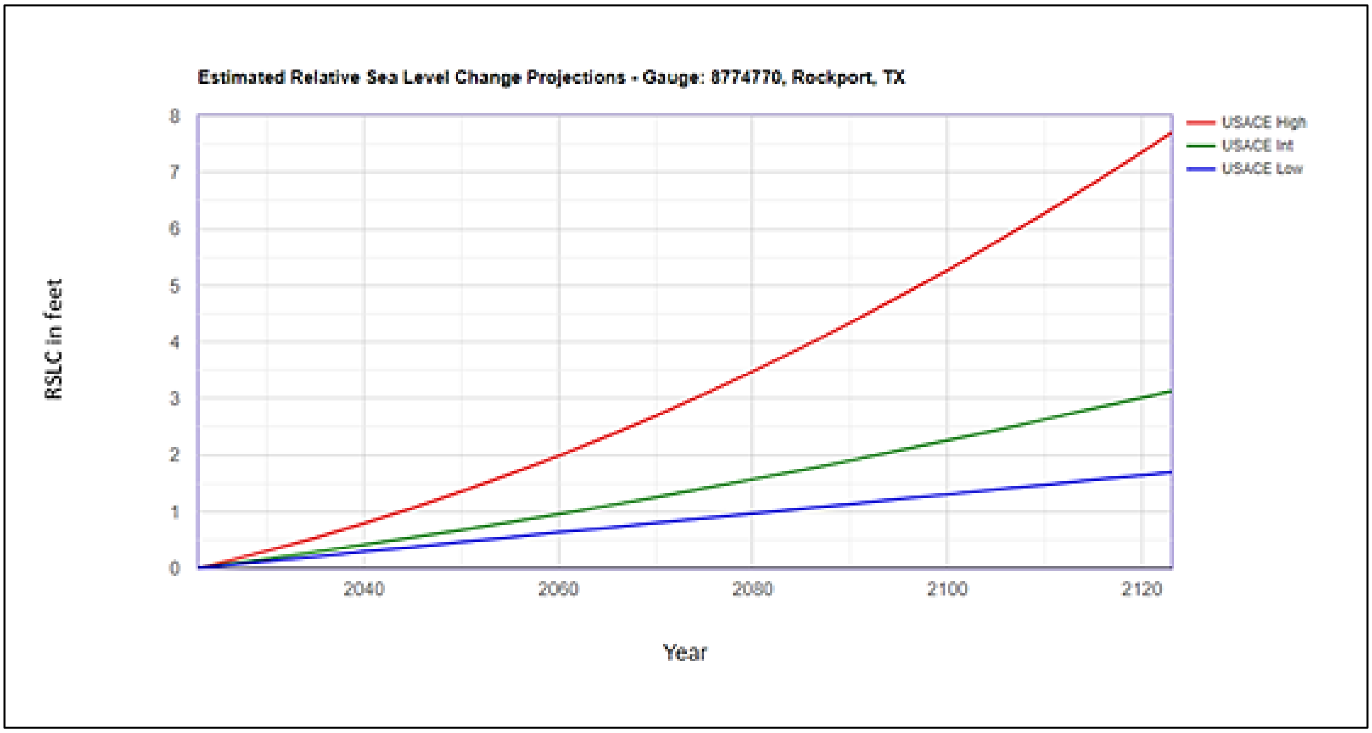

Figure 4: Estimated Relative Sea Level Change Graph (Rockport Gauge)

Estimated Relative Sea Level Change from 2023 To 2073
8774770, Rockport, TX
NOAA's 2006 Published Rate: 0.01693 feet/yr
All values are expressed in feet
Gauge Status: Compliant

Year	USACE Low	USACE Int	USACE High
2023	0.00	0.00	0.00
2025	0.03	0.05	0.08
2030	0.12	0.16	0.30
2035	0.20	0.28	0.53
2040	0.29	0.41	0.79
2045	0.37	0.54	1.06
2050	0.46	0.67	1.35
2055	0.54	0.81	1.66
2060	0.63	0.95	1.98
2065	0.71	1.10	2.33
2070	0.80	1.25	2.69
2073	0.85	1.34	2.92

Figure 5: Estimated Relative Sea Level Change Table (Rockport Gauge)

2.4 Geomorphology

The coastal belt of the Texas Coastal Plain extends from Galveston Bay to Nueces Bay, located just north of Corpus Christi Bay, and includes the study area. The coastal belt is a gently sloping area bordering the Gulf of Mexico underlain by two principal Pleistocene age formations, the younger Beaumont (clays) and the older Lissie. Geophysical data from these two formations suggests more than 20 full or partial glacial-interglacial cycles resulted in deposition, erosion, and soil formation which created the strata of the Texas Coastal Plain (Paine et al., 2018). Recession and advance of Pleistocene era glaciers caused sea level changes and created rivers and valleys throughout the area. As sea level rose to its current height during the Holocene, the historic river valleys were flooded, and sediments dispersed from deltaic headlands. The drowned river valleys became the current bays and estuaries of the Texas coast (Paine et al., 2018).

2.5 Sediments

The most common sediment type in the M-A Estuary is mud comprised of silt and clay. Aransas Bay contains a higher proportion of clay, while Copano Bay features areas with up to 75% shell material (mostly near oyster reefs). The margins of Aransas and Copano bays have a greater percentage of sand than either of the two bays (NOAA 2006).

Sediment samples from the Texas Coastal Sediment Geodatabase (TxSed), compiled by the TGLO, were reviewed to estimate sediment composition of the study area. One core sample was completed in 1976, which reported sediment distribution as 48% sand, 45% silt, 6% clay, and 1% gravel.

Sediment data for O&M dredge materials in the GIWW near the project site can be found in the "GIWW – Across Aransas Bay Contaminant Assessment Report, Aransas Bay Sampling and Analysis Results" (2017) document prepared by Lloyd Engineering, Inc. and located in Attachment A of the Engineering Appendix. Dredge materials from the GIWW reach from Sta. 1160+000 to Sta. 1225+000 are planned to be used for marsh creation.

A geotechnical investigation was not performed given budgetary and scheduling constraints. Limited analyses were conducted consistently and primarily on bearing capacity of the containment berm. Based on the geological maps it appears the subsurface data comprises of loamy sands. Loamy sands in the area are normally a sand mix with silts and clay and/or interbedded thin layer of this material within the upper 5 feet of the extent mudline. An online search was performed on the GLO Tx SED website (https://cgis.glo.texas.gov/txsed/index.html). There is only **one** historical boring, performed by a private entity Rock Engineering & Testing Lab to a depth of 15 feet for a proposed boardwalk project in Goose Island and can be considered close to the project limits.

Based on the information shown on the boring log, subsurface strata generally consist of a 3-foot-thick upper layer of loose poorly graded sand (SP) underlain by about 2.5 feet of very soft Fat Clay with sand (CH) then sandy lean clays (CL) to the boring termination depth. Standard Penetration Test blow counts per foot (N) for the clays ranged from 1 to weight of hammer (WOH). No additional strength test results were available for the boring B-1 samples. In summary, the data indicates the presence of 3 feet of loose loamy sand underlaid by 12 feet of very soft compressible clays. It is recommended that additional soil investigation be completed during the design and implementation phases to characterize the soil strata more completely in the project area. For additional information, see the Geotechnical Analysis in the Engineering Appendix A.

2.6 Shoreline Erosion

The shorelines of Aransas and adjacent Copano Bays are in a state of erosion. The erosion is caused by relative sea level rise and a lack of new sediment entering the system (Evans et al. 2012). The University of Texas Bureau of Economic Geology reports long-term (1930 – 2010) shoreline change rates along Goose Island State Park that range from -1.00 to -5.00 feet per year[1] (UTBEG 2022). Shoreline movement has predominately been erosional in the project area over the last 80 years, with retreat rates at Copano Bay averaging -2.03 feet per year. The project area is moderately to highly susceptible to shoreline retreat with RSLC (Paine et al., 2016). TPWD determined that 17.1 acres of Goose Island eroded away between 1969 and 1995, and an additional 8.5 acres eroded between 1995 and 2002. Most of the 25 acres that have become submerged at Goose Island since 1969 were originally high marsh and intertidal emergent marsh habitats (Jenkins 2011).

2.7 Water Quality

Under the authority of the CWA (Section 305(b) and Section 303(d)) and the Texas Water Code (Section 26.023), the TCEQ develops the Texas Surface Water Quality Standards, codified in the Texas Administrative Code (Title 30 §307), to establish explicit goals for the quality of streams, rivers, lakes, and bays throughout the State. The TCEQ prepares a list of impaired

[1] Negative values indicate erosion/loss of shoreline.

waters based on Total Maximum Daily Loads (TMDL) of pollutants and identifies corrective actions to remedy their presence.

Degraded water quality was recorded in Copano Bay in 1998 through detection of bacteria in oyster waters; however, no water quality impairment has been recorded in Aransas Bay. Aransas Bay waters are rated excellent for aquatic life (30 Texas Administrative Code 307.10 (1)). At this time, the TCEQ requires additional data and information be collected or evaluated before a TMDL management action can be decided for Copano Bay.

In 2002, the TCEQ determined Aransas Bay, which includes the study area, fully supported aquatic life and oyster waters. Goose Island State Park supports a diverse array of aquatic organisms including invertebrates (e.g., blue crab, brown and white shrimp), fish (e.g., Atlantic croaker, southern flounder), and shellfish (e.g., oysters).

2.8 Biological Communities

Goose Island State Park contains several habitats, including live-oak thickets, tidal salt marshes, and mud flats, seagrass beds, and oyster reefs. Saline marshes and shallow open water are the primary habitats within the project area. These habitats are critical for a variety of plants, fish, birds, and other wildlife. Wetlands act as nurseries to hundreds of non-commercial species that comprise a large portion of the estuarine food web.

2.9 Threatened and Endangered Species

The Endangered Species Act of 1973 (ESA) was enacted to provide a program for the preservation of endangered and threatened species and to provide protection for the ecosystems upon which these species depend for their survival. The U.S. Fish and Wildlife Service (USFWS) is the primary agency responsible for implementing the ESA and oversees protection of non-marine species (i.e., birds, terrestrial species, freshwater species), while the National Marine Fisheries Service (NMFS) protects marine species. An endangered species is one in danger of extinction throughout all or a significant portion of its range. A threatened species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range, while proposed species are those that have been formally submitted to Congress for official listing. The USFWS's Information for Planning and Consultation (IPaC) database lists the threatened and endangered species and trust resources that may occur within the study area boundary under USFWS protection (Appendix C). NMFS provides an online species directory used to determine those protected species that may occur in the project area (https://www.fisheries.noaa.gov/species-directory/threatened-endangered). Based on the IPaC report and species directory, there are thirteen USFWS listed species (threatened, endangered, or candidate), four additional NMFS listed species, and one designated critical habitat (CH) found to potentially occur within the study area (Table 2).

Table 2: Federal threatened, endangered, or candidate species identified by USFWS and NMFS that may occur in the Goose Island State Park project area. Sea turtle jurisdiction is shared jointly by USFWS (inland waters and nesting beaches) and NMFS (offshore marine environment). A superscript CH indicates critical habitat for a species.

Species **Common Name** ***Scientific Name***	**Federal Status**	**Jurisdiction**
BIRDS		
Attwater's Greater Prairie chicken *Tympanuchus cupido attwateri*	Endangered	USFWS
Piping plover *Charadrius melodus*	Threatened	USFWS
Rufa red knot *Calidris canutus rufa*	Threatened	USFWS
Eastern black rail *Laterallus jamaicensis ssp. Jamaicensis*	Threatened	USFWS
Whooping crane^{CH} *Grus americana*	Endangered	USFWS
Northern aplomado falcon *Grus americana*	Endangered	USFWS
MAMMALS		
West Indian manatee *Trichechus manatus*	Threatened	USFWS
Sperm whale *Physeter macrocephalus*	Endangered	NMFS
Rice's whale *Balaenoptera ricei*	Endangered	NMFS
REPTILES		
Loggerhead sea turtle *Caretta caretta*	Threatened	USFWS/NMFS
Green sea turtle *Chelonia mydae*	Threatened	USFWS/NMFS
Atlantic hawksbill sea turtle *Eretmochelys imbricata*	Endangered	USFWS/NMFS
Leatherback sea turtle *Dermochelys coriacea*	Endangered	USFWS/NMFS
Kemp's ridley sea turtle *Lepidochelys kempii*	Endangered	USFWS/NMFS
INSECTS		

Species Common Name *Scientific Name*	Federal Status	Jurisdiction
Monarch butterfly *Danaus plexippus*	Candidate	USFWS
FISH		
Oceanic whitetip shark *Carcharhinus longimanus*	Threatened	NMFS
Giant manta ray *Mobula birostris*	Threatened	NMFS

For more detailed discussion on the habitat requirements, historic and current occurrence, and threats to each species, refer to the Biological Assessment (BA) prepared for this study (Appendix C).

2.9.1 Texas State Listed Species

In Texas, animal or plant species of conservation concern may be listed as threatened or endangered under the authority of state law and/or under the ESA. Species may be listed as state threatened or endangered without being federally listed. The state list of species only addresses the status of species in Texas. The state has listed 87 species as threatened or endangered in Aransas County, which includes amphibians, birds, fish, mammals, reptiles, insects, mollusks, and plants.

Twenty-one of the 87 species have also been federally listed as threatened or endangered under ESA including: wood stork (*Mycteria americana*), northern aplomado falcon, Eastern black rail, whooping crane, piping plover, rufa red knot, oceanic whitetip shark, sperm whale (*Physeter macrocephalus*), sei whale (*Balaenoptera borealis*), blue whale (*B. musculus*), Rice's whale, humpback whale (*Megaptera novaeangliae*), North Atlantic right whale (*Eubalaena glacialis*), mountain lion (*Puma concolor*), ocelot (*Leopardus pardalis*), West Indian manatee, loggerhead sea turtle, green sea turtle, Atlantic hawksbill sea turtle, Kemp's Ridley sea turtle, and leatherback sea turtle. Only ten of these federally listed species were identified as potentially occurring in the study area and were further considered in the BA (Appendix C), which includes all species of sea turtles, piping plover, rufa red knot, whooping crane, Eastern black rail, and West Indian manatee. For the other species listed, the study area occurs outside the species known range and/or suitable habitat does not exist.

After reviewing species descriptions and occurrence data from the Texas Natural Diversity Database (TXNDD 2023), and consulting with resource agencies, the PDT concluded that the study area is outside the known range or does not provide suitable habitat for 22 of the 30 species including:

- Birds: white-faced ibis (*Plegadis chihi*), wood stork (*Mycteria americana*), swallow-tailed kite (*Elanoides forficatus*), white-tailed hawk (*Buteo albicaudatus*), northern aplomado falcon, black rail, rufa red knot;
- Mammals: sperm whale, sei whale, blue whale (*Balaenoptera musculus*), Gulf of Mexico Bryde's whale, humpback whale (*Megaptera novaeangliae*), North Atlantic right whale (*Eubalaena glacialis*), white-nosed coati (*Nasua narica*), ocelot (*Leopardus pardalis*);
- Reptiles: loggerhead sea turtle, Atlantic hawksbill sea turtle, Kemp's ridley sea turtle, leatherback sea turtle, Texas tortoise (*Gopherus berlandieri*);

- Amphibians: sheep frog (*Hypopachus variolosus*);
- Fish: shortfin mako shark (*Isurus oxyrinchus*), oceanic whitetip shark.

Eight species have been identified as occurring in the focused study area and for which suitable habitat is available (Table 3).

Table 3: Descriptions for Texas-state listed species that have been identified with the potential to occur in the study area

Species Common Name Species Name	Texas State Status	Species Description
BIRDS		
Whooping crane *Grus americana*	Endangered	Breed, migrate, and forage in coastal marshes and estuaries, inland marshes, lakes, open ponds, shallow bays, salt marsh, and sand or tidal flats, upland swales, wet meadows and rivers, pastures, and agricultural fields. Forages on berries and blue crabs found in coastal wetlands. This species is likely to occur in the focused study area, but nesting is unlikely.
Piping plover *Charadrius melodus*	Threatened	Prefer habitat such as bayshore tidal sand and algal flats, ocean side beaches, washover passes, and mainland tidal mud flats. May occur in the study area between August and May foraging or roosting, but not nesting. Likely to occur in adjacent habitats of the study area.
Reddish egret *Egretta rufescens*	Threatened	Often observed on brackish and intermediate marshes of the study area. Preferred habitats include shores, lagoons, saltmarshes, and salt flats primarily for foraging fish. Reddish egrets are colonial nesters in which breeding activity generally occurs on coastal islands. The species is likely to occur in the focused study area, but nesting is unlikely.

MAMMALS		
West Indian manatee *Trichechus manatus*	Threatened	Occur in marine, brackish, and freshwater systems in coastal and riverine areas with preference near the shore featuring underwater vegetation like seagrass and eelgrass. May occur in the action area transiting or foraging in open water.
REPTILES		
Green sea turtle *Chelonia mydas*	Threatened	Occur in shallow habitats such as lagoons, bays inlets, shoals, estuaries, and other areas with abundant marine algae & seagrass. High-energy beaches with deep sand for nesting, usually coarse to fine grain sizes, with little organic content. Green sea turtles could be encountered in the action area swimming or foraging.
AMPHIBIANS		
Black-spotted newt *Notophthalmus meidionalis*	Threatened	Prefer shallow-water habitats with thick terrestrial and/or submerged vegetation. Typically burrow underground during the dry season. Breeding occurs year-round but is typically linked to rainfall and eggs are laid on submerged aquatic vegetation. This species is not likely to be encountered in the focused study area because of the marsh salinity.

2.9.2 Migratory Birds

The Texas Gulf coast is an important seasonal pathway for migratory birds and has plentiful habitat for migratory wading birds, seabirds, shorebirds, and waterfowl. Wading birds and shorebirds utilize the mudflats and shallow marsh ponds located throughout the area, while seabirds and waterfowl use saline marshes and shallow open water within the project area.

According to the eBird database managed by the Cornell Lab of Ornithology (ebird.org), the most abundant species observed at Goose Island State Park include:

- Wading birds: Great blue heron (*Ardea herodias*), Great egret (*Ardea alba*), Tricolored heron (*Egretta tricolor*), Snowy egret (*Egretta thula*), Little blue heron (*Egretta caerulea*), White ibis (*Eudocimus albus*), Roseate spoonbill (*Platalea ajaja*), Reddish egret (*Egretta rufescens*);
- Seabirds: Brown pelican (*Pelecanus occidentalis*), American white pelican (*Pelecanus erythrorhynchos*), Double-crested cormorant (*Nannopterum auritum*);
- Shorebirds: Laughing gull (*Leucophaeus atricilla*), Wilson's plover (*Charadrius wilsonia*), Willet (*Tringa semipalmata*), Ruddy turnstone (*Arenaria interpres*), Forster's tern (*Sterna forsteri*), Royal tern (*Thalasseus maximus*), Ring-billed gull (*Larus delawarensis*), American oystercatcher (*Haematopus palliatus*), Black skimmer (*Rynchops niger*), Herring gull (*Larus argentatus*), Black-bellied plover (*Pluvialis squatarola*), Sanderling (*Calidris alba*), Caspian tern (*Hydroprogne caspia*), Least sandpiper (*Calidris minutilla*), Greater yellowlegs (*Tringa melanoleuca*), Semipalmated plover (*Charadrius semipalmatus*);
- Waterfowl: Black-bellied whistling-duck (*Dendrocygna autumnalis*), American coot (*Fulica americana*), Redhead (*Aythya americana*), Northern pintail (*Anas acuta*), Common loon (*Gavia immer*).

According to the planning aid letter (PAL) provided by USFWS on April 5, 2023, eight species of migratory and non-migratory birds may utilize the habitats within the study area that were listed on the USFWS's Birds of Conservation Concern in 2021. These include reddish egret, American oystercatcher, Gull-billed tern (*Sterna nilotica*), sandwich tern (*Thalasseus sandvicensis*), Forster's tern, black skimmer, lesser yellow legs (*T. flavipes*), and willet. Additionally, the wetland habitats within the study area provide important wintering and migratory habitat whose continental populations are below goals established under the North American Waterfowl Management Plan including Northern pintail, lesser scaup (*A. affinis*), and ring-necked duck (*A. collaris*).

2.9.3 Essential Fish Habitat

The Magnuson-Stevens Fisheries Management Act (MSFMA) defines EFH as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. Specific habitats include all estuarine water and substrate (mud, sand, shell, and rock) and all associated biological communities, such as subtidal vegetation (seagrasses and algae) and the adjacent intertidal vegetation (marshes and mangroves). Of the fish species considered by NMFS to potentially occur within the project area, EFH habitat for these species consists of tidally influenced waters and tidally influenced marsh. Table 4 provides a list of managed EFH species in the project area, habitat preference, and expected life stage of occurrence (NMFS 2021; GMFMC & NMFS 2016).

Table 4: EFH for estuarine habitats within the Goose Island State Park project area

Species		**Life Stage**				
Common Name	**Scientific Name**	**Larvae/Eggs**	**Post-Larvae**	**Juvenile**	**Sub-Adult**	**Adult**
Brown shrimp	*Farfantepenaeus aztecus*	x		x	x	
White shrimp	*Litopenaeus setiferus*		x	x	x	x
Pink shrimp	*Farfantepenaeus duorarum*			x	x	

Species		Life Stage				
Red drum	*Sciaenops ocellatus*	x	x	x		x
Spanish mackerel	*Scomberomorus maculatus*			x		x
Gray snapper	*Lutjanus griseus*			x		x
Lane snapper	*Lutjanus synagris*	x	x	x		
Cobia	*Rachycentron canadum*	x				

2.9.4 Marine Mammals

Marine mammals are protected under the Marine Mammal Protection Act (MMPA), and in some cases the ESA and the Convention on International Trade in Endangered Species of Wild Fauna and Flower (CITES).

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

2.10 Cultural Resources

Human habitation along the central coast has only been identified in the region as early as 7,500 BP. The study area is characterized by upland coastal prairies dissected by streams and rivers and extensive bay and estuarine systems along the coast. The Colorado, Lavaca, San Antonio, and Guadalupe rivers are the major drainages in the region. Sediments in the region consist of fluvial deposits and delta formations overlying Pleistocene aged clay. Prehistoric sites are commonly found within these upper sediments along streams and rivers and adjacent to brackish estuarine systems, close to prime areas for resource exploitation. These sites include campsites, dense shell middens, and cemeteries, containing projectile points, stone, bone, and shell tools, aquatic and terrestrial faunal remains, hearth features, ceramics, and in some cases, human remains and associated funerary objects. Shell midden sites are especially common in the region along the shorelines and upland areas adjacent to rivers and bays and on the barrier islands. Historic age resources in the region consist of farmsteads, plantations, and ranches, houses, buildings, bridges, cemeteries, lighthouses, shipwrecks, and the ruins of these buildings and structures. Although historic age resources can occur anywhere, these sites tend to be concentrated in small towns and urban areas, along roads, and within current and historic navigation paths. Shipwrecks may also occur in numerous locales due to the dynamic nature of the sea floor and bay bottoms and the lack of navigation improvements until the latter part of the 19th century. These dynamic conditions can result in shifting shoals and reefs that endanger ships as well as bury their wrecks as shorelines and bars migrate through time.

There are over 1200 cultural resources recorded within this region of the central Texas Coast. These cultural resources include National Register of Historic Places (NRHP) listed properties, archeological sites, cemeteries, historical markers, and shipwrecks and submerged resources. A preliminary assessment of the cultural resources within one mile of the project area was conducted using a desktop review of the databases maintained by the Texas Historical Commission and the Texas Archeological Research Laboratory for terrestrial and marine cultural resources as well as the shipwreck and obstruction databases of the National Oceanic and Atmospheric Administration and the Bureau of Ocean Energy Management. This assessment identified seven previously recorded cultural resources including five archeological sites, one cemetery, and one historic shipwreck. There are no recorded National Register properties or State Historic Landmarks within the study area. All five archeological sites and Lamar Cemetery are located on the mainland, outside of the proposed project area. The single shipwreck is reported as the *Lizzie Baron*, a Confederate sloop which sank during the Civil War, is presumed to be located approximately 300 meters west of the project area. There are no previously recorded cultural resources within the proposed footprint of the recommended plan, Alternative 3D.

Only one previous archeological survey covers the proposed project area and was conducted in 1927 George Martin and Wendell Potter for the Witte Museum. Terrestrial archeological surveys in the area include two surveys for the USACE in 1985 east of the community of Lamar, a survey of the Goose Island State Park Bridge by the Federal Highway Administration in 1993, a survey for utility lines and a proposed residential development by Archaeology Consultants in 2008. Other terrestrial surveys were conducted by the Texas Department of Transportation on Lamar Point for the replacement of the Copano Bay Causeway in 2009 and 2010 (Ecological Communications Corporation), a survey of Site 41AS27 by Prewitt and Associates in 2005, and a survey of the southeastern end of Lamar Point in 2004. The only previous marine cultural resources investigation in the project area was conducted by Bio-West in 2010 as part of the Copano Bay Causeway replacement project.

The primary considerations concerning cultural resources are threats to submerged resources from new dredged material placement in marine environments. The upland portion of the study area is a dynamic, dunal landform that has only been partially stabilized since the construction of breakwaters along the southern bank. Due to the dynamic nature of this landform, the probability for intact archeological sites to occur in this upland area is low. For the marine portions of the project area, a privately maintained navigation channel has been dredged north of the study area and the water depth across the study area is an average of two feet. Therefore, the potential for encountering submerged cultural resources, such as shipwrecks, is also low to moderate. Additional information can be found in the Environmental Appendix C.

2.11 Socioeconomics/Economics

Socioeconomics is defined as the basic attributes and resources associated with the human environment, particularly population, demographics, economic status, and development. Demographics entail population characteristics and include data pertaining to race, gender, income, housing, poverty status, and education. Economic development or activity typically includes employment, wages, business patterns, an area’s industrial base, and its economic growth.

The economy in Aransas County is based around retail trade (14.2%), accommodation and food services (13.9%), and construction (11.4%); median household income is $47,924 (DataUSA 2020). There are no natural barriers to interchange between cities and other areas, and to some extent natural geographic features have benefited economic growth through access to Aransas Bay and the Aransas NWR.

The smallest census designation that contains the study area is census block 9501.01. Based on aerial imagery, the residential structures, and hence concentration of population, is in the central and southeastern portion of the census block in the coastal towns of Fulton and Rockport. Much of the census block is comprised of wildlife refuge and San Jose Island, which do not contain residential structures.

All data were obtained using the 2020 U.S. Census Bureau of Statistics (https://data.cencus.gov/) and The Census Reporter (https://censusreporter.org/profiles/05000US48007-aransas-county-tx/).

2.11.1 Population, Housing, and Community

Aransas County has an estimated population of 24,462 individuals (DataUSA 2020), comprising less than 1% of the state's population. Approximately 49.8% of residents are male and 50.2% are female, similar to the State (Table 5). Census block group 9501.01 has a population of 1,447 individuals across 174.3 square miles, forming a populating density of 8.3 people per square mile. More women (60%) comprise the population in this census tract than men (40%; Table 5).

Table 5: Population by sex. Data were gathered from the U.S. Census Bureau.

Sex	Texas	Aransas County	Census Block 9501.01
Total Population	29,145,505	24,462	1,447
Male	49.6%	50.2%	40%
Female	50.4%	49.8%	60%

The majority of people in Aransas County are over the age of 40, with the median age being 50 (DataUSA 2020). This age demographic is older than compared to the State where the greatest proportion of the population is between the ages of 20-64. Similarly, the majority of people residing in census tract 9501.01 are over the age of 40, with a median age of 50 (Table 6).

Table 6: Population by age group.

Age Group (years)	Texas	Aransas County	Census Block 9501.01
Total Population	29,145,505	24,462	1,447
< 5	7.0%	4.7%	20%
5-19	21.2%	16.7%	2%
20-39	28.2%	18.4%	18%
40-64	29.7%	32.4%	36%
> 65	13.9%	27.8%	24%

In all instances, the majority of the population was comprised of white individuals, followed by Hispanic or Latinos and those who identified to be two or more races (Table 7). For Aransas County, there was a lower percentage of Black/African Americans than compared to the State. In the census block that contains the project area, there were more American Indians/Alaska natives than reported for the State (Table 7).

Table 7: Population by race.

Race	Texas	Aransas County	Census Block 9501.01
Total Population	29,145,505	24,462	5,981
White alone	50.1%	75.5%	79.8%
Hispanic or Latino	39.3%	25.8%	15.4%
Black/African American	12.2%	1.1%	0.4%
American Indian/Alaska Native	1.0%	1.0%	1.2%
Asian	5.4%	2.1%	3.3%

Race	Texas	Aransas County	Census Block 9501.01
Native Hawaiian/Pacific Islander	0.1%	0.1%	0.08%
Other	13.6%	6.5%	3.8%
Two or more races	17.6%	13.6%	11.1%

2.12 Environmental Justice

Executive Order (E.O.) 12898 directs federal agencies to identify and address any disproportionately high and adverse human health or environmental effects of their actions on minority and low-income populations, to the greatest extent practicable and permitted by law. CEQ guidance states that minority populations should be identified where either: a) the minority population of the affected area exceeds 50% or b) the minority population percentage of the affected area is meaningfully greater than the minority population percentage in the general population or other appropriate unit of geographic analysis. Low-income populations should be identified with the annual statistical poverty thresholds from the Bureau of the Census' data. Agencies may consider a community as either a group of individuals living in geographic proximity to one another, or a geographically dispersed/transient set of individuals (such as migrant workers or Native American), where either type of group experiences common conditions of environmental exposure or effect when identifying minority and low-income communities (CEQ 1997).

The EPA maintains an environmental justice mapping and screening tool (EJSCREEN) that provides users with a nationally consistent dataset and approach for combining environmental and demographic indicators. EJSCREEN can be used as a first-level screening tool to help determine the level of analysis needed. This analysis uses two of the six demographic indicators available in the tool:

- Percent Low-Income: percent of individuals whose ratio of household income to poverty level in the past 12 months was less than 2.
- Percent Minority: percent minority as a fraction of population, where minority is defined as all but Non-Hispanic or White alone.

Additionally, the tool estimates a Demographic Index, based on the average of the two demographic indicators used for this analysis.

Census block group 9501.01 is the smallest geographical census boundary that includes the study area and was used to evaluate environmental justice with EJSCREEN (Figure 6). The demographic index of the census block group relative to the U.S. is 31%, falling in the "less than 50th percentile" classification. Less than 50% indicates the concentration of minority and low-income populations were small compared to the region and would not be adversely impacted to a greater degree than the general population.

Minority percentiles show similar results, with 8% of the census group being minority as compared to the State at 58%. Data showed the census block is in the 2nd percentile when compared to the State. For there to be environmental justice concerns, the census block would need to be in the 50th percentile or greater (Table 8).

Low-income results for the census group are 54% as compared to 34% for the State, placing this area in the 78th percentile. Values above the 50th percentile generally require additional analysis to investigate the potential impacts a project could have on the local population. However, this project proposes to conduct ecosystem restoration in a deteriorating marsh system at Goose Island State Park. Ecosystem restoration has an important beneficial impact on a region's socioeconomic characteristics, including raising awareness of environmental protection and willingness to participate and/or support restoration efforts (Sheng et al., 2019). Ecosystem restoration also increases satisfaction of communities that benefit from their services such as protection, aesthetics, recreation, etc. (Sheng et al., 2019).

Figure 6: Map of census block 9501.1 (red and green) and study area (red arrow) from the EJSCREEN tool.

Table 8: EJSCREEN tool data for demographic indices for census block 9501.01 in Aransas County, Texas, and the State.

Indicator	Census block 9501.01		Texas	
	Average	Percentile	Average	Percentile
Demographic Index	31%	31	46%	
Minority	8%	2	58%	
Low-income	54%	78	34%	

There is a relatively small population that lives near the project area that has a minority below the 50th percentile compared to the State; however, the low-income population lies above the 50th percentile. Because this project proposes ecosystem restoration, and improvement of natural resources generally improves socioeconomic characteristics, there is no indication that the impacts of the project are likely to fall disproportionately on minority and/or low-income members of the community.

2.13 Noise, Aesthetics and Recreation

The project is located between Aransas and St. Charles Bays and is adjacent to Copano Bay. The surrounding area is residential and agricultural. Recreational fishing and boating are popular around the site; thus, Goose Island State Park experiences ambient noise of marine transportation and recreational use. Additionally, recreational traffic is common around the state park.

2.14 Hazardous, Toxic and Radioactive Waste

To complete a feasibility level Hazardous, Toxic, and Radioactive Waste (HTRW) evaluation, a report was completed following the rules and guidance of ER 1165-2-132: HTRW Guidance for Civil Works Projects and ASTM E1527-13 Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process. This search is used to identify any sites with recognized environmental conditions (REC’s) where hazardous substances or petroleum products have been released or are likely to have been released to soil, groundwater, or surface water in the proposed project area. Examples of RECs include prior use of petroleum storage tanks, historical use as a landfill, reported spills of hazardous material, etc.

A desktop records review was conducted to determine the presence of HTRW sites on or near the project footprint, focusing on active cleanup sites and sites with reasonable risk of HTRW release. Several databases were manually searched including EPA Cleanups in my Community, EPA Envirofacts, TCEQ web map of Underground Storage Tanks (UST)/Aboveground Storage Tank’s (AST), TCEQ Central Registry, and the Texas Railroad Commission’s oil and gas well Public GIS Viewer. The records review analyzed REC’s that would affect the proposed project or need further investigation given the proposed project measures.

No sites were identified within one mile of the project area or adjacent areas that could be reasonably expected to affect the BUDM project, or vice versa. Although not classified as HTRW under USACE regulations, multiple pipelines, plugged oil wells, and dry well sites were identified within the surrounding area. As a result of these findings, project construction should consider their proximity to the footprint to avoid them, and a thorough pipeline/well search should be initiated during design to ensure no interaction with the existing oil and gas infrastructure occurs. Additional details and information can be found in the Hazardous, Toxic and Radioactive Waste Appendix B.

3. Future Without-Project Conditions

Future Without Project Conditions (FWOP) describes the forecasted conditions of the study area expected during the period of analysis if no plan of action was in place. Additionally, the FWOP conditions provides the basis from which alternative plans are formulated and risks are analyzed. This study forecasted the expected conditions for the Aquatic Ecosystem Restoration and BUDM at Goose Island State Park, Aransas County, Texas.

<u>FWOP:</u> The dredged material is not to be used for ecosystem restoration at Goose Island State Park. Federal O&M dredging of the GIWW occurs according to the Authorized Depth and material is placed and spread between upland and open water placement areas (PAs) 131-136 (Figure 7). The formation processes that currently negatively affect the natural wetland building process as well as the ecological integrity of habitat in the area will continue into a future without the project. This may result in partial or, over time, complete loss of shoreline and critical coastal habitat. Critical habitat will still be at risk of degradation and/or conversion.

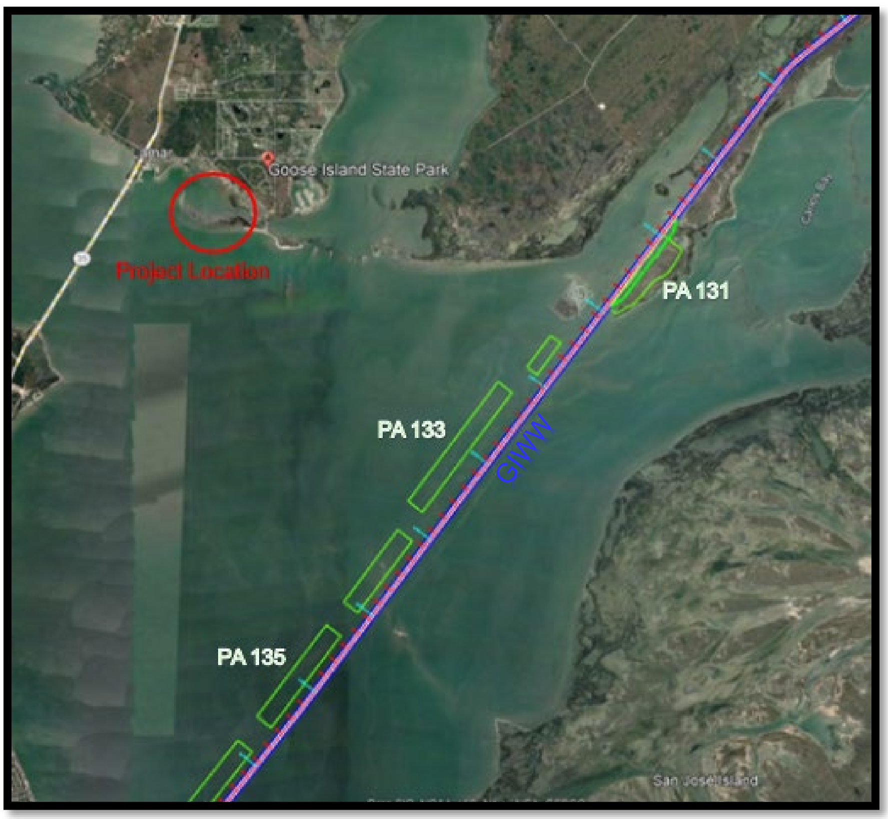

Figure 7: Future Without Project Plan Area Map

4. Plan Formulation

4.1 Problems and Opportunities

The relevant problems and opportunities within this BUDM study were thoroughly assessed and intricated during the plan formulation process. BUDM is a nationally recognized priority for the USACE, and the problems and opportunities have motivated the Agency Commander to set a BUDM goal of 70% of all O&M work for environmental benefit (Texas Coastal Resiliency Master Plan, 2023).

Problems:

Critical coastal habitats along the GIWW are at risk from eroding shorelines, powerful storms, and sedimentation which contribute to habitat loss or conversion and impaired water quality. Specific study problems on the GIWW include:

- Shoreline loss due to erosion, subsidence, storms, development, and relative sea level change (RSLC) threatens the geomorphic structure and hydrologic function of coastal marsh systems;
- Altered hydrologic conditions are contributing to the conversion of saline marshes to open water systems;
- Longshore sediment transport is significantly reduced, limiting the sustainability of the coastal ecosystem.

Opportunities exist in the study area to:

- Restore marshes in a manner that complements existing restoration efforts in the study area and regionally to improve landscape-scale ecological benefits;
- Improve longshore sediment transport in the Texas coastal shoreline system;
- Design the restoration to be a resilient and self-sustaining natural system with focus on nutrient cycles, succession, hydrologic function, and sediment dynamics;
- Restore marsh habitat within the watershed and broader landscape affected by adjacent land uses;
- Manage physical attributes (e.g., original sediment) and natural function (e.g., nutrient fluxes, hydrological regime, bottom elevation);
- Improve current sediment management practices to maximize the quantity and effective use of dredged material;
- Improve recreation opportunities in the wildlife areas such as bird watching, and recreational and commercial fishing.

4.2 Planning Goals and Objectives

Federal Objective

The Federal objective of water and related land resources project planning is to contribute to the national economic development (NED) consistent with protecting the Nation's environment, pursuant to national environmental statutes and applicable executive orders, and other federal planning requirements. The USACE objective in ecosystem restoration is to contribute to the Nation's ecosystem restoration (NER) purpose and mission.

Planning Objectives

- Reinforce the natural wetland building process at study location;
- Re-establish ecological integrity of the habitat;
- Restore marsh area while maximizing use of dredged material to the greatest extent achievable.

4.3 Specific Planning Constraints

Constraints are important to consider as they identify the limitations to contemplate in the formulation of alternatives. Study specific planning constraints include:

- Availability of suitable dredged material;
- Available dredge locations and timing of dredging;
- Study location cells' size and capacity for dredge material.

4.4 Uncertainties and Their Risks

- Potential to eliminate or significantly impact special aquatic sites
  - Risk – Low. During the plan formulation process, the PDT collaborated with the Resource Agencies using prior knowledge of where special aquatic sites are located in the study area and screened alternatives, based on their designs, that would overlap with known special aquatic site presence.
    - Mitigation – Environmental surveys will be conducted during PED.
- Estimated 550,000 cubic yards (CY) of available dredged material
  - Risk – Low. Estimation of available dredged material and project location capacity to maximize its use.
    - Mitigation – Alternatives formed and analyzed based upon approximate availability of material, and maximizing the amount used while meeting study objectives, all of which can be refined in later study phases when/if necessary.

4.5 Management Measures Considered

- Containment Berm – Raised embankments constructed to contain its contents or mitigate water flow into an area;
- Placement Contouring – Shaping and process of distributing dredged material or sediment;
- Breakwater – Structure created for protection against storm related tides, waves, and currents;
- Riprap – Structure consisting of rock or other material with the purpose of shoreline protection;
- Thin Layer Placement – Strategic placement of dredged material that creates a layer of sediment to a specific level of thickness or elevation;
- Upland Creation – Addition of upland habitat characterized with appropriate vegetation;
- Saline Marsh Creation – Addition of new low and high elevation emergent marsh planted/seeded with species typical of a marsh;

- Living Shoreline – Infrastructure using native plantings or other environmental elements used for added protection or stability.

4.6 Management Measures Removed

- Riprap – This measure was removed once Alternative 3E was eliminated. This measure was not considered for the other alternatives as it was discussed as a PDT that the possible use of riprap in relation to channel protection was unnecessary, and not a cause of concern.
- Breakwater – The existing breakwater was determined by the PDT to be in sufficient condition to continue offering protection to the site. An additional breakwater was proposed during the development of Alternative 3E to reduce shoaling into a non-Federal channel; however, it was determined this was unnecessary and possibly cost-prohibitive.
- Upland Creation – It was determined by the PDT in collaboration with resource agencies that upland habitat was not appropriate and would likely not be viable at this site. The purpose of the proposed action was to restore ecologically significant coastal marsh habitat; thus, this habitat was screened.
- Thin Layer Placement – This measure was removed once discussed by the PDT and resource agencies as it would eliminate essential fish habitat protected by the Magnuson-Stevens Fishery Management Act and replace it with less suitable habitat. Federal agencies are responsible for minimizing or avoiding adverse impacts to fish habitat; thus, implementation of this measure would have resulted in the need for mitigation to essential fish habitat.

4.6.1 Measure Dependencies, Interdependencies, and Objectives

The measures considered in alternative plan formulation were not dependent on the actions of others, or the implementation of another measure. All the measures help to reach the study objectives.

4.7 Plan Formulation Phases and Process

The FID assessed the initial problems and opportunities, identified potential sites for restoration, and confirmed that a solution on one of those sites is likely to be in the Federal Interest.

To reduce study and cost risk in the Feasibility Study, and to avoid delays and revisions in response to O&M dredging constraints after formulation has advanced, the PDT approached plan formulation in phases to best use the structure of the six-step planning process while moving through the process needed specific to this study, of screening site locations, and then formulating alternatives based on the final selected location. The first phase emphasized the identification of viable dredge material sources. The second and third phases were more typical formulation phases to screen problems, opportunities, and assess viability of specific candidates. Once alternative plans were formulated, the alternatives were then evaluated and compared to accurately select the tentatively selected plan (TSP) that successfully addresses the study objectives.

Plan Formulation Phases

Phase 1	Operations provided PDT information regarding available sites and volumes to limit formulation to feasible locations and scales of alternatives.
Phase 2	The team compared the sites provided by Operations in Phase 1 and select the most viable site for BUDM from the viable locations.
Phase 3	The team formulated and screened potential alternatives for the best sites determined in Phase 2.

4.8 Phase 1: Eliminating Infeasible Borrow Sources

The navigation system within the Area of Responsibility (AOR) of Galveston District is comprised of a network of interconnected channels that support vessel traffic within the region. Recent BU efforts that have prioritized site selection based on area conditions have been delayed after consideration of the potential timing and volume of dredge material to implement the project.

The preliminary evaluation emphasized identification of O&M constraints for the preliminary sites. The data provided by the Operations Division is presented in Table 1, Section 1.5.2 Operations & Maintenance Efforts. The most feasible restoration sites should be adjacent to a channel that has a dredging cycle from two to four years to allow construction within the CAP timeframe, and sufficient volumes to achieve restoration that will be sustainable over the period of analysis.

Candidate sites were screened out as they were other federal agency owned lands or conflicted with other USACE projects and were not considered further. It was determined by the PDT and Resource Agency representatives that three of the potential sites should be considered moving into the next phase of plan formulation to create the Focused Array, which included Schicke Point, Guadalupe River Delta, and Goose Island State Park, as highlighted in Table 1 and described in Section 4.9 Phase 2 Formulating Alternatives: Most Viable Sites for Action.

4.9 Phase 2 Formulating Alternatives: Most Viable Sites for Action

The plan formulation and screening were undertaken with the intent of maximizing the opportunity to achieve meaningful restoration within the study area. The items considered included the site-specific details, the regional needs, surrounding uses, and the opportunity to complement, rather than displace, restoration opportunities under other programs and authorities. The site selection criteria were developed to include conditions that capture the specific characteristics of each site, as well as the potential regional contribution of each.

Further screening of these sites followed an iterative process to assess viable restoration sites with degraded and/or degrading conditions in proximity to scheduled Navigation O&M activities, followed by comparison and selection of the plan that reasonably achieves study goals. Widespread BUDM is limited by availability of sediment, aligning schedules for O&M efforts, and agency tolerance for cost risk that could result from alternative placement of O&M material to reduce study risk. The first planning iteration limited site selection to only the subset of FID candidate sites within the O&M defined opportunities.

To reiterate, three sites were considered viable and included Schicke Point, Guadalupe River Delta, and Goose Island State Park. After further screening, the final selected project location proposed for this study is Goose Island State Park. A summary of project location screening from the preliminary list of potential sites to the remaining three is provided below (Table 9).

Table 9: Potential Sites (Figure 1)

SITE	Already Proposed Mitigation Site or Other Federal Agency Land?	Potential Ecological Disturbances or Impacts?	Dredging Constraints?	Screened Out?
Lower Neches WMA Old River Unit	X			X
Texas Point NWR	X			X
McFaddin NWR Willow Like Terraces	X			X
Anahuac NWR Roberts Mueller Tract	X			X
San Bernard NWR Sargent Oil Field	X	X		X
Schicke Point				Carried Forward
Guadalupe River Old Delta				Carried Forward
Goose Island State Park Cells				Carried Forward
McFaddin NWR Subset 1 – Mud Bayou	X			X
McFaddin NWR Subset 2 – Barnett Lake Broken Marsh	X			X

4.9.1 Most Viable Sites

Preliminary alternatives were developed for each location in the Focused Array to be discussed amongst the PDT and in coordination with resource agencies. To formulate conceptual alternatives for the three remaining site locations (Figure 8) a desktop exercise was conducted (Table 10). The three sites ranged in scale based upon the physical conditions of each location. Those conceptual alternatives were then refined, retained, or screened out following agency consultation and a site visit. A visual summary of the screened site selection considerations for Schicke Point, Guadalupe River Delta, and Goose Island are presented in Table 11. This table visually displays the preliminary alternatives for the Focused array, for each location, that were beginning to be developed soon after the PDT determined that these three locations remain as potential sites. The other candidate sites were screened out as these describes the preliminary alternatives in the focused array developed by the PDT to discuss with resource agencies. The preliminary alternatives differed in the total acreage proposed for restoration (acres), as well as, included varying elevations (1 to 3 ft) with the estimated dredge quantities (volume). The intended restoration method was the same for Schicke Point and Guadalupe River Delta alternatives, in that, saline marsh would be created using a 60:40 ratio for vegetated to non-vegetated areas (method). The Goose Island State Park alternatives would follow this same ratio of vegetated to non-vegetated areas but presented a greater diversity of habitat types (living shoreline, low and high elevation marsh, upland habitat) due to the small size of the original project site (i.e., 23 acres at Goose Island vs. 120 acres and Schicke Point or 1,000 acres at Guadalupe River Delta).

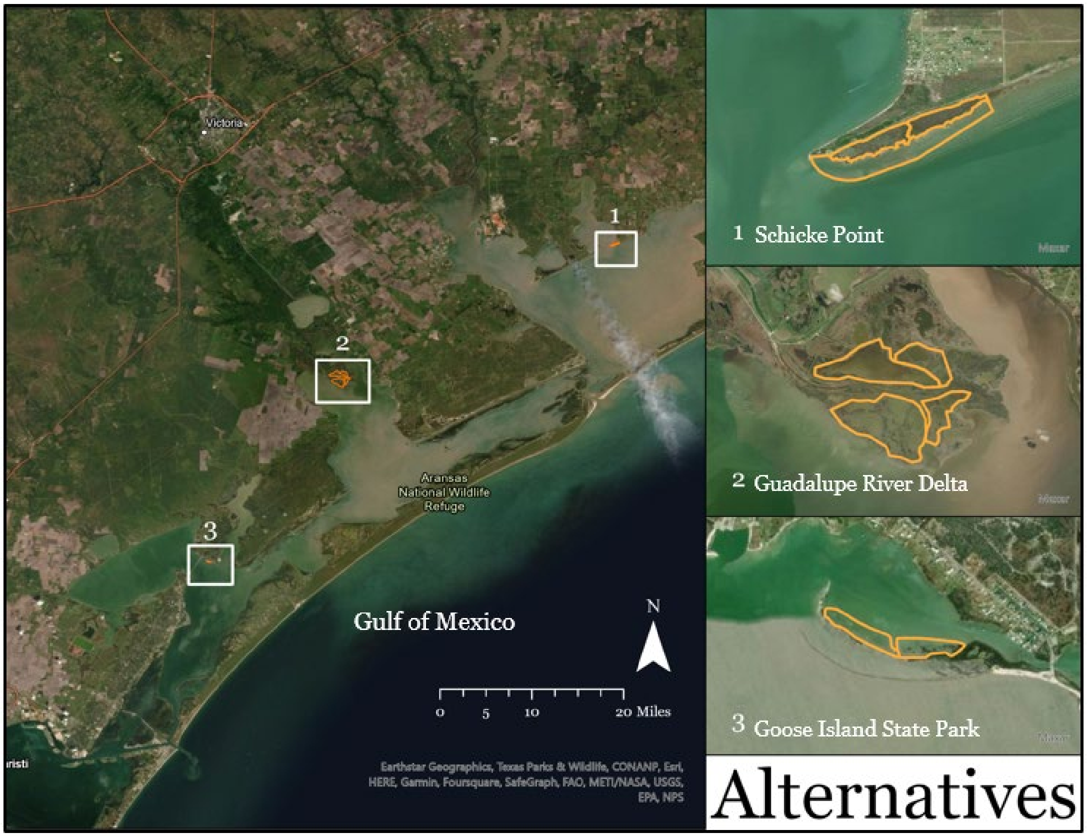

Figure 8: Alternatives 1, 2, and 3

Table 10: Preliminary Alternatives

Alternative	Acres	Volume	Method
Site 1 - Schicke Point – Dredge Cycle 2 Years; 400,000-800,000 cy			
1A	120 acres	340,000 cy @ 2 ft	60:40 vegetated to non-vegetated areas
1B	120 acres	95,000+ cy @ 3ft; 240,000 cy @ 1ft	60:40 vegetated to non-vegetated areas
1C	50 acres	95,000+ cy @ 3 ft	60:40 vegetated to non-vegetated areas; Complex elevations
Site 2 - Guadalupe River Delta – Dredge Cycle 2 Years; 500,000-800,000 cy			
2A	<1,080 acres	900,000 cy @ 1 ft	60:40 vegetated to non-vegetated areas
2B	340 acres	850,000 cy @ 2 ft	60:40 vegetated to non-vegetated areas
2C	720 acres	730,000+ cy @ 2 ft	60:40 vegetated to non-vegetated areas
2D	580 acres	460,000+ cy @ 3 ft; 130,000 cy @ 2 ft	60:40 vegetated to non-vegetated areas

Alternative	Acres	Volume	Method
Site 3 - Goose Island State Park – Dredge Cycle 2 Years; 550,000 cy			
3A	23 acres	52,500 cy	Saline marsh creation in existing cells + Placement Contouring
3B	29.5 acres	82,500 cy	Saline marsh creation in existing cells + Living shoreline + Placement Contouring
3C	39 acres	193,000 cy	Saline marsh creation in existing cells + addition of new low and high elevation marsh cells + Containment Berm + Placement Contouring
3D	39 acres	196,500 cy	Saline marsh creation in existing cells + addition of new low and high elevation marsh cells + Containment Berm + Placement Contouring
3E	77 acres	414,670 cy	Saline marsh in existing cells + addition of new low and high elevation marsh cells + living shoreline + Containment Berm + Placement Contouring

Table 11: Screened Site Selection Considerations

SITE	Ownership Constraints?	Potential Ecological Disturbances or Impacts?	Dredging Constraints?	Screened Out?
Alternative 1 – Schicke Point	No	Yes – Already accreting sediment; sediment placement would disturb already growing marsh	No	Yes
Alternative 2 – Guadalupe River Old Delta	Yes – Constraints and litigation issues with NFS at the time (GLO) and the private landowners	No	No	Yes
Alternative 3 – Goose Island State Park Cells	No	No	No	No

Site 1 - Schicke Point

Preliminary alternatives were developed for Schicke Point based upon the physical conditions at the site, the potential volumes available and the best restoration approach (Table 10). After further communication with the PDT and Resource Agency representatives, it was determined that pursuing this location would cause a lack of ecological benefit for each alternative and the action would not meet the study objectives. The site is currently accreting sediment and appears viable, and any sediment placement could smother the growing marsh and therefore Alternative 1 was screened from further analysis in this iteration.

Site 2 - Guadalupe River Delta

The Guadalupe River Delta site capacity far exceeds the dredge material quantities available per cycle of placement. However, different alternatives within cells or a combination of cells were discussed and are provided Table 10. Resource agencies favored this location as it provided a diverse array of BU opportunities. However, ownership constraints became evident after Resource Agency meetings. Guadalupe River Delta is privately owned property that has undergone substantial subsidence, converting once vegetated habitat to submerged land. Submerged land is defined in the Texas Administrative Code § 33.203 (15) as "land located under waters under tidal influence or under waters of the open Gulf of Mexico, without regard to whether the land is owned by the state or a person other than the state". Through communication with the GLO, the USACE learned the private landowner is in litigation with the GLO over land-ownership disputes of the submerged land. It was decided this posed too much risk to the study and thus, Alternative 2 was screened from further analyses.

Site 3 - Goose Island State Park

Goose Island Site was determined as the most viable site to analyze fully and is the proposed location for this study. After Resource Agency meetings, additional alternatives (3C and 3D) were added to the preliminary array for Goose Island State Park. The fifth alternative, Alternative 3E, was developed by PDT engineers to maximize use of dredged material, as described in Section 4.10.1 Alternative 3E – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells, and Living Shoreline.

4.10 Focused Array of Alternatives

1. No Action Alternative

2. Alternative 3A – Saline Marsh Creation in Existing Cells + Placement Contouring

3. Alternative 3B – Saline Marsh Creation in Existing Cells + Living Shoreline + Placement Contouring

4. Alternative 3C – Saline Marsh Creation in Existing Cells + Addition of New Low and High Elevation Marsh Cells + Containment Berm + Placement Contouring

5. Alternative 3D – Saline Marsh Creation in Existing Cells + Addition of New Low and High Elevation Marsh Cells + Containment Berm + Placement Contouring

6. Alternative 3E – Saline Marsh Creation in Existing Cells + Addition of New Low and High Elevation Marsh Cells + Containment Berm + Living Shoreline + Placement Contouring

4.10.1 Alternative 3E – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells, and Living Shoreline

Alternative 3E was developed to maximize utilization of source material to meet the project dredging capacity of 550,000 cy (Figure 9). Development occurred prior to receiving input on environmental considerations from resource agencies and once their input was provided, it was evident the presence of seagrasses in the area presented multiple challenges to the acceptability of Alternative 3E. Most notably, Alternative 3E would convert an existing seagrass restoration site within a State Park to a saltwater marsh, against the wishes and recommendations of multiple resource agencies. A qualitative evaluation of Alternative 3E can be found in Section 5.1.2 of this report. Alternative 3D captures the full footprint of potential BU without impacting the seagrasses and should be considered the maximum practicable footprint for consideration. Specifically, Alternative 3E cells 1 and 2 would be constructed to target +3.07

ft NAVD88 (4 ft MLLW) for 23 acres, sloping outwards to meet -0.93 NAVD88 (0 ft MLLW). A marsh cell would be created to the North (3), totaling 6.1 acres, with target elevation +.07 to +1.07 NAVD88 (1 to 2 ft MLLW), and another to the South (4) totaling 14 acres. Another two marsh cells would be constructed adjacent to cells 3 and 4 with target elevations of -0.93 NAVD88 (0 ft MLLW), the north (5) being a 10-acre marsh and southern marsh (6) 9.1 acres. Finally, a living shoreline would be constructed along the outer edge of the marsh system with 7.1 acres on the northern side and 8.1 acres on the southern side.

Figure 9: Alternative 3E

The PDT evaluated the remaining final array of alternatives (3A-3D) through the Cost Effectiveness/Incremental Cost Analysis (CE/ICA) and “Is It Worth It?” analyses. From these analyses, the No Action Plan (by default) and Alternative 3D were the only Best Buy Plans out of the four remaining alternatives. In addition to this result, the PDT determined that Alternative 3D best fulfills the study objectives and overall purpose, while maintaining policy compliance. Additional information for this phase of the plan formulation can be found in Section 5 Comparison of Final Plans.

4.11 Phase 3 Formulating Alternative Plans Continued: Final Array of Alternative Plans

The Focused Array of alternatives was screened to the Final Array based, in part, on Resource Agency input at the initial meeting and subsequent discussions in July 2022. As described in earlier sections, alternatives were formulated to include transport and placement of O&M material to achieve a target elevation to establish saline marsh. Target elevations for the marsh were established in collaboration with Resource Agencies using elevations from existing reference marshes in the region. The target elevations are high enough to sustain the marsh under intermediate sea-level rise conditions (approximately 3-feet) without exceeding the elevation tolerance of a salt marsh. The alternatives for Goose Island State Park were formulated to vary the scale of saline marsh considering the existing physical conditions and features at the site, to create features to accommodate larger volumes of material and to maximize potential ecological benefit. There are currently four Future With Project (FWP) alternatives being considered in addition to the FWOP alternative. A fifth FWP alternative was introduced after alternatives 3A through 3D were developed (4.10.1 Alternative 3E – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells, and Living Shoreline), but was eliminated from the Final Array of alternatives after it was discovered to have a high probability of negatively impacting seagrass in the area, triggering one of the planning constraints (Section 4.3 Specific Planning Constraints). A description of Alternative 3E is still provided below showing that maximizing the amount of dredge material used was considered during the planning process. Additional details and information on alternative quantities, design criteria and analysis, and assumptions are included in the Engineering Appendix A.

4.11.1 FWOP Alternative – No Action Plan

Under the FWOP, the saline marsh would degrade over the 50-year period of analysis due to loss through inundation, RSLC, and erosion from wave action. As such, open water would increase, thereby increasing HUs for open water and decreasing HUs for emergent vegetation. Overall, this would result in lower suitability for the saline marsh habitat. The No Action Alternative consists of continued subsidence and erosion of critical ecosystems along the GIWW and would result in dredge material being placed between PAs 131-136 (Figure 7).

4.11.2 Alternative 3A – Saline Marsh in Existing Cells

The dikes constructed in 2008 provide containment for the existing cells (labelled 1 and 2; Figure 10) at Goose Island, encompassing approximately 23 acres. This alternative proposes filling cells 1 & 2 to create 23 acres of saline marsh with target elevations between 0.6 and 0.8 feet (ft) NAVD88 (1.5 to 1.7 feet Mean lower low water [MLLW]) herein referred to as low elevation marsh. It is estimated to require approximately 52,500 cy of dredge material considering losses, bulking, and settlement. This alternative needs to raise the existing containment dike (7,220 ft) an additional foot by excavating material onsite which requires a volume need of 13,700 cy.

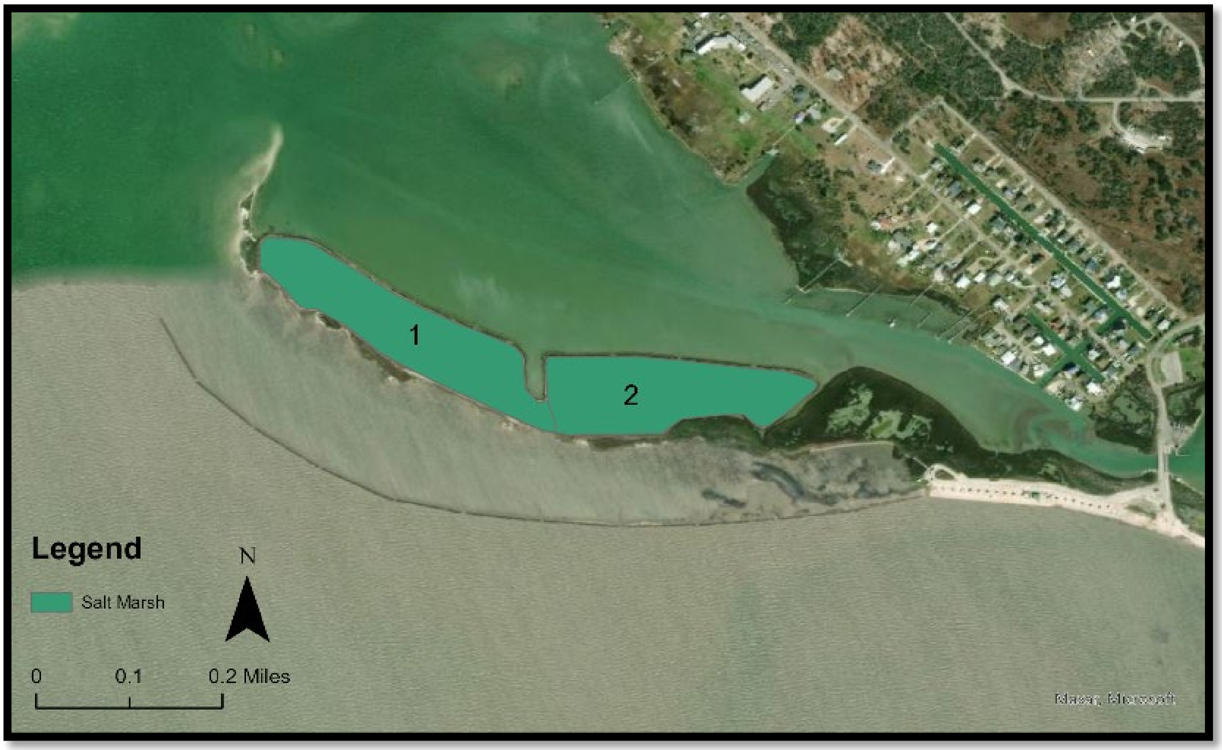

Figure 10: Alternative 3A builds 23 acres of saline marsh targeting 0.6 to 0.8 ft final elevation.

4.11.3 Alternative 3B – Saline Marsh in Existing Cells and Living Shoreline

The existing cells 1 and 2 would be filled to create 23 acres of saline marsh with final target elevations being 0.6 and 0.8 feet (ft) NAVD88 (Figure 11). A living shoreline would be added around the existing containment dike, comprised of approximately 6.5 acres of sediment. The living shoreline would be constructed to begin at the containment dike (2-ft NAVD88 [2.9 feet MLLW]) and slope outwards until reaching sea-level. This alternative is expected to use approximately 82,500 cy of dredge material total. The existing containment dike would need to be raised an additional foot by excavating existing material onsite, similar to Alternative 3A, requiring 13,700 cy of sediment.

Figure 11: Alternative 3B builds 23 acres of saline marsh (final elevation = 0.6 to 0.8 ft NAVD88) with a living shoreline

4.11.4 Alternative 3C – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells

Alternative 3C builds a low elevation marsh (0.6 to 0.8 ft NAVD88 final elevation) in the existing cells 1 and 2 and includes additional features (Figure 12). Two new units (cells 3 and 4) are built to the North of the existing cells, to add 9.5 acres and 6.5 acres, respectively. Cells 3 and 4 would be low elevation marsh, which would require the construction of a new containment dike around each of the cells using existing material excavated onsite. The new containment dike would have a cross-sectional area of 128 square feet and require 36,000 cy of sediment. Additional specifications and schematics of the proposed containment dike can be found in the Engineering Appendix A. Along the southern area of cells 1 and 2, dredged material would be placed and contoured to target between 1.5 and 2.0 ft NAVD88 (2.4 to 2.9 feet MLLW) to create a 5-acre and 1.5-acre high elevation marsh, respectively. The high elevation marsh in cells 1 and 2 would be gradually sloped to meet the low elevation marsh at less than ≤ 1.0 ft NAVD88. This would require a total of 193,000 cy of material. As described in Alternative 3A and 3B, this alternative needs to raise the existing dike's elevation by one foot.

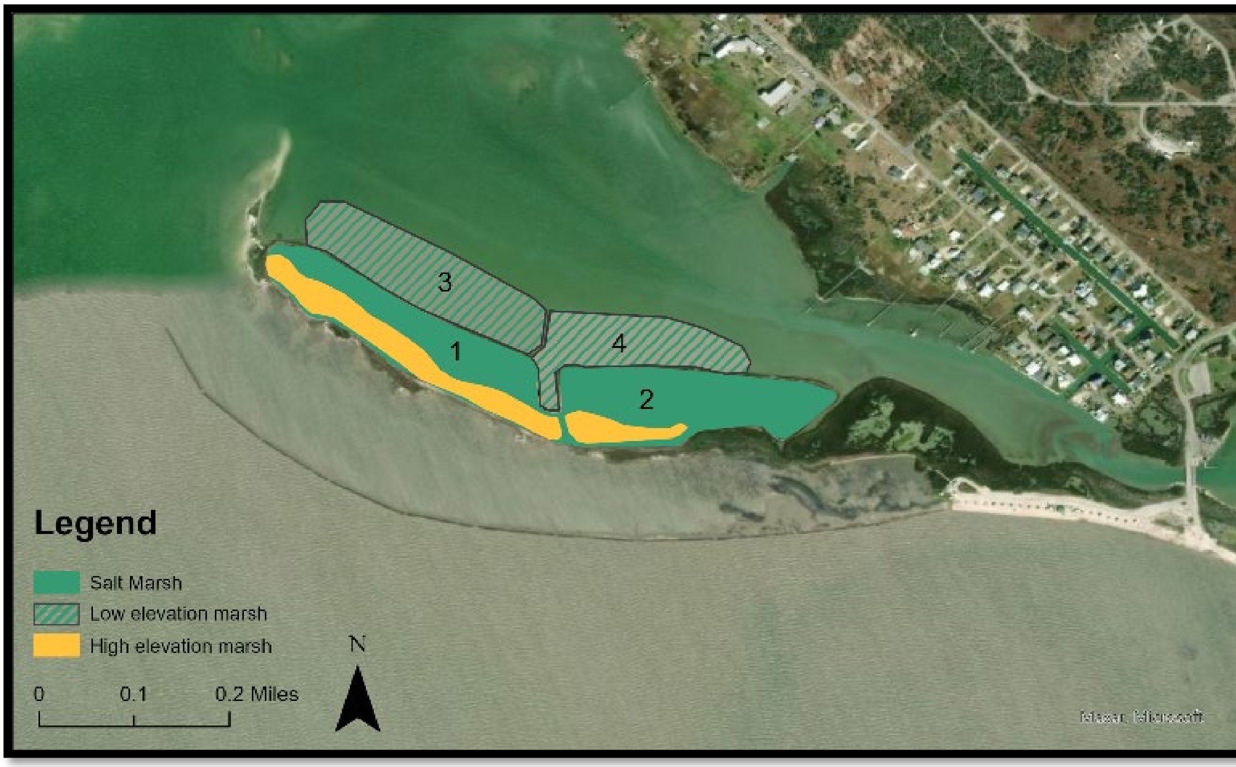

Figure 12: Alternative 3C constructs a 32.5 acres of low elevation marsh (0.6 to 0.8 ft NAVD88) and 6.5 acres of high elevation marsh (1.5 to 2.0 ft NAVD88)

4.11.5 Alternative 3D – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells

This alternative is similar to Alternative 3C in that low and high elevation marsh is created and new cells are added but differs in the location of the high elevation marsh. This design builds the existing cells 1 and 2 to a low elevation marsh with a target elevation between 0.6 and 0.8 feet (ft) NAVD88 (Figure 13). Cells 3 and 4 are built to the North of the existing cells, as described in Alternative 3C, to add 9.5 and 6.5 acres, respectively. Within cells 3 and 4, along the southern area, fill material would be constructed to target between 1.5 and 2.0 ft NAVD88 to create a 3.7-acre and 2.5-acre high elevation marsh, respectively. The remaining area in cells 3 and 4 (9.8 acres) would be filled to low elevation marsh that would be contoured to have a gradual transition to the high elevation marsh. A new containment berm would be constructed around cells 3 and 4 as described in Alternative 3C. Additionally, the existing containment berm would need to be elevated one foot as described in the three previous alternatives. In total, this alternative is expected to require approximately 196,500 cy of dredge material.

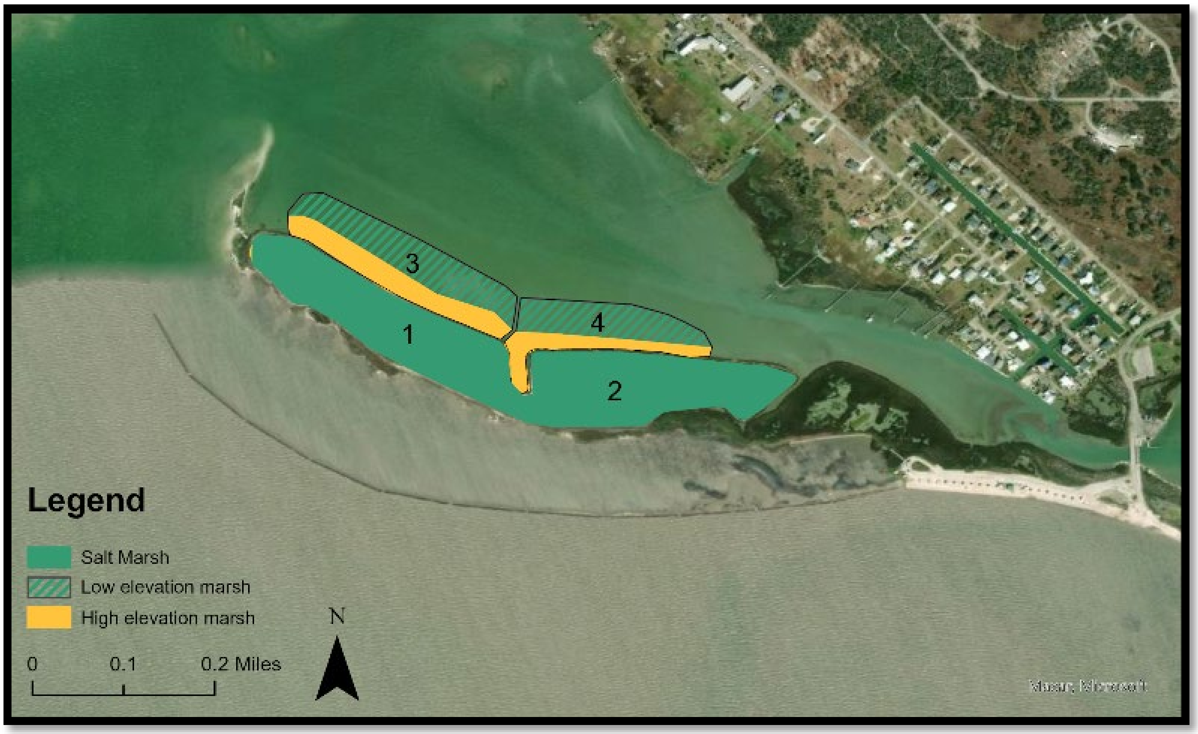

Figure 13: Alternative 3D constructs 32.8 acres of low elevation (0.6 to 0.8 ft NAVD88) and 6.2 acres of high elevation marsh (1.5 to 2.0 ft NAVD88) saline marsh

5. Comparison of Final Plans

The criteria used to compare alternatives in the Final Array consisted of environmental impacts, specifically on seagrass and oyster reefs in the area and the potential for maximizing dredge material use. Ecological lift of each alternative was estimated in Annual Average Habitat Units (AAHU) through ecological modeling (5.2 Ecological Lift). The focused array of alternatives at Goose Island State Park (Alternatives 3A-3D) vary primarily in scale to ensure that the proposed restoration would generate ecological benefits from BUDM of any increment of dredge material that is available for BU at the time of construction. The inclusion of living shoreline is a variation to explore whether ecological benefits can be increased as more BU is used.

Cost estimates were produced based on quantities and preliminary site assessments to include Operation, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R), monitoring and adaptive management, and real estate acquisition cost estimates. A 26% cost contingency was also included, estimated through an Abbreviated Risk Assessment (ARA) to reflect the project-specific cost uncertainty. Lastly, as this restoration is proposed as a BUDM effort, the costs were computed for Base Plan material placement that would occur in the absence of BU to assess the incremental cost over the Dredged Material Management Plan (DMMP) practices.

The cost effectiveness of the Final Array was evaluated with IWR Planning Suite, the required and certified model to characterize which alternatives are incrementally justified and which are Best Buy alternatives. Since the CE/ICA is deliberative, and not deterministic, the "Is It Worth It?" analysis considers and describes what benefits are produced that may not be captured within the CE/ICA results (5.5 "Is it Worth it?" Analysis). Additional details and information on the CE/ICA analysis can be found in the Economic Analysis Appendix E.

5.1 Planning Criteria

The criteria utilized in comparing the Final Array of alternatives includes Costs, Benefits, Objectives, Constraints, Completeness, Effectiveness, Efficiency, Acceptability, and Environmental Impacts (Table 12).

Table 12: Planning Criteria for Alternative Evaluation

	No Action	Alternative 3A	Alternative 3B	Alternative 3C	Alternative 3D
Completeness – Does the alternative provide and account for all required investments to meet planning objectives?	NO	YES	YES	YES	YES
Effectiveness – Does the alternative contribute to meeting the planning objectives?	NO	YES	YES	YES	YES
Efficiency – Is the alternative the most effective way of meeting the planning objectives?	NO	NO	NO	YES	YES

	No Action	Alternative 3A	Alternative 3B	Alternative 3C	Alternative 3D
Acceptability – Does the alternative meet all applicable laws, regulations, and public policies?	YES	YES	YES	YES	YES

5.1.1 Qualitative Comprehensive Benefits Analysis

In guidance provided on 5 January 2021, USACE PDT members were directed to identify and analyze benefits in total and equally across a full array of benefit categories and accounts during the planning process, which can be done qualitatively or quantitatively, and in varying degrees. The four accounts are national economic development (NED), regional economic development (RED), other social effects (OSE) and environmental quality (EQ). All alternatives, apart from the No Action Plan and Alternative 3E, are beneficial regarding all accounts (NED, RED, OSE, EQ; Table 13). The FWOP condition would have the dredged material placed in designated PAs, thus the opportunity to re-establish marsh habitat would be missed, and the vital habitat at the study area would have continued subsidence and erosion. Concerning NED benefits, economic benefits include the benefit to the Nation through beneficially using dredged material and avoiding the use of USACE approved dredged material placement sites. The RED account measures changes in the distribution of regional economic activity that would result from each alternative plan. For all alternatives apart from the No Action, beneficial use of dredged material would result in short-term increases in local spending, tax revenue, full-time employment positions, and overall economic output. The No Action alternative would have the least impact on RED as no funding would be expended to implement enhancements to the study area. Regarding OSE, the action alternatives would increase the marsh habitat and study area resiliency and improve recreational activity in the area. Because this project is an Ecosystem Restoration (ER) project, ER has been placed in association with the Environmental Quality account in Table 13. For more detailed information on the items under this account, please reference Section 7 Environmental Consequences of Alternatives.

5.1.2 Qualitative Evaluation of Alternative 3E

As mentioned in Section 4.10.1 Alternative 3E – Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells, and Living Shoreline of this report, Alternative 3E is considered impracticable for the following reasons:

- *Impacts to an existing ecosystem restoration site:* None of the other alternatives (3A-3D) would have direct adverse impacts to seagrasses. As mentioned above, Alternative 3E was developed prior to receiving input on environmental considerations from resource agencies. Updated information provided by resource agencies revealed that elements (6) and (4), shown in Figure 9, were inadvertently located within a seagrass restoration site at Goose Island State Park. Alternatives 3C and 3D represent two scenarios for full utilization of the surface area available for meaningful ecosystem restoration without adverse impact to seagrasses. Multiple resource agencies, including the Texas Parks and Wildlife Department (trust agency for Goose Island State Park) were in stark opposition to carrying Alternative 3E forward for further analysis.
- *The need for mitigation*. Alternative 3E is the only alternative presented that would require compensatory mitigation to offset adverse impacts to valuable fish and wildlife habitat, specifically seagrasses. The Planning Guidance Notebook (ER 1005-2-100 3-

5(b)(3)), states that, “Ecosystem restoration projects should be designed to avoid the need for fish and wildlife mitigation.” Since Alternatives 3C and 3D represent two scenarios that utilize all available surface area outside of the known seagrass restoration area and avoid direct adverse impacts to this resource. For these reasons, no further evaluation of Alternative 3E is warranted, and this alternative is removed from further consideration.

- *Adverse impacts to seagrasses are worth avoiding:* Seagrass beds are critical ecosystems in this region that have been severely depleted. At Goose Island State Park, the seagrass has become critical habitat for migratory ducks, commercially and recreationally important fish, and aquatic resources; thus, loss of this resource could have irreversible ecosystem damage. Therefore, the risk to this resource, in this instance, was determined too great to carry the Alternative 3E forward for further evaluation.
- *Risk of being incompliant with the MSFMA*. The NMFS raised concerns during resource agency meetings about the irreversible damage this Alternative 3E would have on EFH. Thus, this alternative runs the risk of not receiving concurrence from NMFS which would lead to being incompliant with the MSFMA.
- *Risk of being incompliant with EPA Section 404(b)(1) guidelines*. Section 404(b)(1) guidelines set “the precept that dredged material should not be discharged into the aquatic ecosystem, unless it can be demonstrated that such a discharge will not have an unacceptable adverse impact either individually or in combination with known and/or probable impacts…” (40 C.F.R. §230.1(c)). Submerged aquatic vegetation, in the form of seagrass, is present in the open water area between the existing containment dike and breakwater, which is classified as vegetated shallows (40 C.F.R. §230.43). The PDT determined the destruction of seagrass beds as a result of implementing Alternative 3E would have been at risk for incompliance with EPA Section 404(b)(1) guidelines which created too great a risk to carry this alternative forward.
- *Lack of habitat suitability*. As designed, the elevation proposed for cells 1 and 2 are too high to be a saline marsh, rather, this would create an upland habitat. The creation of upland habitat was removed from the management measures considered as it is not conducive or appropriate aquatic habitat for this site and does not meet the planning objective of creating suitable marsh.
- *Risk of being incompliant with Executive Orders 13112 and 13751*. The higher elevations proposed in this alternative elevate the risk of the spread and introduction of invasive species. Per E.O. 13112 and 13751 guidance, Federal agencies are required "to take steps to prevent the introduction and spread of invasive species…”. The upland habitat proposed in cells 1 and 2 is ideal for the spread of the invasive common reed (*Phragmites australis*), thus, should be avoided per this guidance.

Alternative 3E was presented in the Focused Array of alternatives to highlight the potential risks and to document the formulation process.

Table 13: Qualitative Comprehensive Benefits Analysis

	No Action	Alt 3A	Alt 3B	Alt 3C	Alt 3D
NER Plan Description	FWOP: Material placed between PAs 131-136	Saline Marsh in Existing Cells	Saline Marsh in Existing Cells + Living Shoreline	Saline Marsh in Existing Cells + Addition of New Low and High Emergent Marsh Cells	Saline Marsh in Existing Cells + Addition of New Low and High Emergent Marsh Cells (Variation of Alt C) **(Best Buy)**
Impact Assessment					
National Economic Development					
(1) Project Costs – FY22 first cost (2) Volume of dredged material placed somewhere other than the open-water PAs	(1) $0 (2) 0 cy	(1) $8,689,500 (2) 52,500 cy	(1) $12,034,800 (2) 82,500 cy	(1) $10,572,900 (2) 193,000 cy	(1) $10,656,000 (2) 196,500 cy
Regional Economic Development					
	No change	Beneficial use of dredged material would likely result in short-term increases in local spending, tax revenue, economic output, and full-time employment positions			
Other Social Effects					
Increase marsh habitat and the study area (shoreline) resiliency	No - The study area would have continued subsidence and erosion impacting vital habitat.	Yes	Yes	Yes	Yes

Improve recreational activity (e.g., Bird Watching)	No	Yes	Yes	Yes	Yes
Environmental Quality / Ecosystem Restoration					
(1) CE/ICA (2) Average Annual Habitat Units	Best Buy Plan (By definition) 0 AAHUs	Cost Effective 7.87 AAHUs	Non-Cost Effective 11.87 AAHUs	Cost Effective 16.52 AAHUs	Best Buy 17.27 AAHUs
Soils	Direct, long-term, localized, minor adverse impacts from sediment loss in the project area	Direct and indirect long-term, localized, moderate beneficial impacts to the project area			
Aquatic Resources	No effect	Beneficial effects by improving and enhancing marsh area/habitat			
Biological Communities	Long-term, moderate, adverse effects	Short-term, minor, adverse effects + Long-term, moderate, beneficial effects			
T&E Species	Moderate, adverse effects on migratory birds; Minor, long-term, adverse effects on essential fish habitat; Possible minor adverse effects on marine mammals – mitigation would occur to compensate	Moderate, long-term beneficial effects with Minor, short-term, adverse effects on migratory birds;	Moderate, long-term beneficial effects with Minor, short-term, adverse effects on essential fish habitat;	Minor, short-term, adverse effects on marine mammals	
Recreational	No adverse effects; Beneficial impacts, e.g., increased bird watching				
Cultural Resources	Low potential to affect historic properties; low probability for intact archeological deposits to occur				

Air Quality	Minor adverse impacts to ambient air quality from construction activities	Direct, short-term, localized, minor adverse impacts to ambient air quality from construction activities
Noise	Long-term, localized, minor, and adverse due to the loss of habitat at study area	Short-term, minor adverse effects + Long-term, minor, beneficial effects
HTRW	No increased risk of disturbance	
Climate	No construction activities are anticipated in the project area under the No Action Alternative, thus no emission of GHG's is expected	Short-term, minor, adverse effects during construction + Long-term, moderate, beneficial effects
Socioeconomics	No loss of revenue is expected	Short-term, minor, beneficial effects

5.2 Ecological Lift

A resource agency coordination meeting occurred on 29 July 2022 to discuss a variety of ecological models appropriate for estimating AAHUs for marsh habitat at Goose Island State Park. Through coordination it was determined the Wetland Value Assessment (WVA) Coastal Marsh Community Model (Version [v] 2.0) was the most suitable. The WVA Marsh models have been used for determining potential impacts and/or benefits under USACE civil works projects and for mitigation purposes. The models were developed to determine the suitability of marsh and open water habitats; thus, were designed to function at a community level and attempt to define an optimal combination of habitat conditions for all fish and wildlife species utilizing coastal marsh ecosystems. For this project, the saline coastal marsh model was used.

The period of analysis was 50 years, with target years (TY) 1, 5, 15, 35, and 50. All project-related direct (construction) impacts were assumed to occur in TY1. It was assumed by TY5 for FWP that a marsh would mature and reach optimum suitability. TY15 and TY35 coincided with years of projected RSLC from the National Oceanic and Atmospheric Administration's (NOAA's) Sea Level Rise (SLR) Viewer. NOAA's intermediate SLR curve was utilized for calculating ecological lift as it was comparable to the USACE intermediate SLR curve (3.18-feet vs. 2.28-feet, respectively) and would still afford observation of project benefits (i.e., AAHUs). NOAA's intermediate-low curve would not change the alternative selection, rather net AAHU's would be slightly higher as less dispersion from SLR would be expected under those conditions. Under the intermediate high and high SLR scenarios, the study area would be consistently inundated with water, thus the ecological lift would not be observed, but this would be scaled across all alternatives. Thus, the intermediate SLR curve was the most logical scenario to use for calculating ecological lift.

The marsh community model utilizes six variables, through a split model approach, to develop a habitat suitability index (HSI score) for open water and emergent marsh habitats. Subsequently, an AAHU value for each alternative is calculated from the combination of HSI scores for all variables.

As expected, net AAHU benefit increased with each alternative due, in part, to the increase in acreage (Table 14). Alternative 3C and 3D included the same acreage but placed a higher elevation marsh area in different locations, which offered a different level of protection to lower emergent marsh, contributing to the observed difference in net AAHU benefit.

Table 14: WVA Saline Marsh model net benefit AAHUs results. AAHU = average annualized habitat unit

Alternative	AAHUs	Acreage
FWOP	0	23
Alternative 3A	7.87	23
Alternative 3B	11.87	29.5
Alternative 3C	16.52	39
Alternative 3D	17.27	39

In general, the net AAHU benefits are small; however, this is attributed to the small acreage of all the alternatives (range 23 – 39 acres), because the final AAHU benefit is largely dependent on the total acreage. Overall, any alternative in the project would have a net benefit to the environment through restoration of critical saline marsh habitat. Additional detail of the WVA modelling can be found in Appendix C.

5.3 CE/ICA Results

To conduct the CE/ICA analysis, environmental restoration benefits (increase in with-project AAHUs) and annual costs were entered into IWR Planning Suite II. This resulted in three cost effective plans for each reach, shown in Table 15.

Cost effective plans are defined as the least expensive plan for a given set of benefits, or environmental output. In other words, no other plan would provide the same or more benefits for a lower cost.

Table 15: Annual Benefits and Annual Cost for Cost Effective Alternatives

Reach	Alternatives	AAHU	Annual Cost ($1s) October 2022 Prices
GIWW STA 1160 TO STA 1225	3A	7.87	$196,200
	3C	16.52	$253,800
	3D	17.27	$255,400

In Figure 14 below, the No Action Plan is by definition the point (0,0). Moving right along the AAHUs axis, the first red triangle represents Alternative 3A. Continuing right along the output axis, the blueish gray circle represents Alternative 3B (and it's apparent here that the costs are higher than for two plans that are cheaper with more AAHUs). Next is a red triangle representing Alternative 3C. Finally, the green square denotes Alternate 3C which is both a Cost Effective and a Best Buy Plan; "Best Buy" plans are discussed in further detail in the Economics Appendix E.

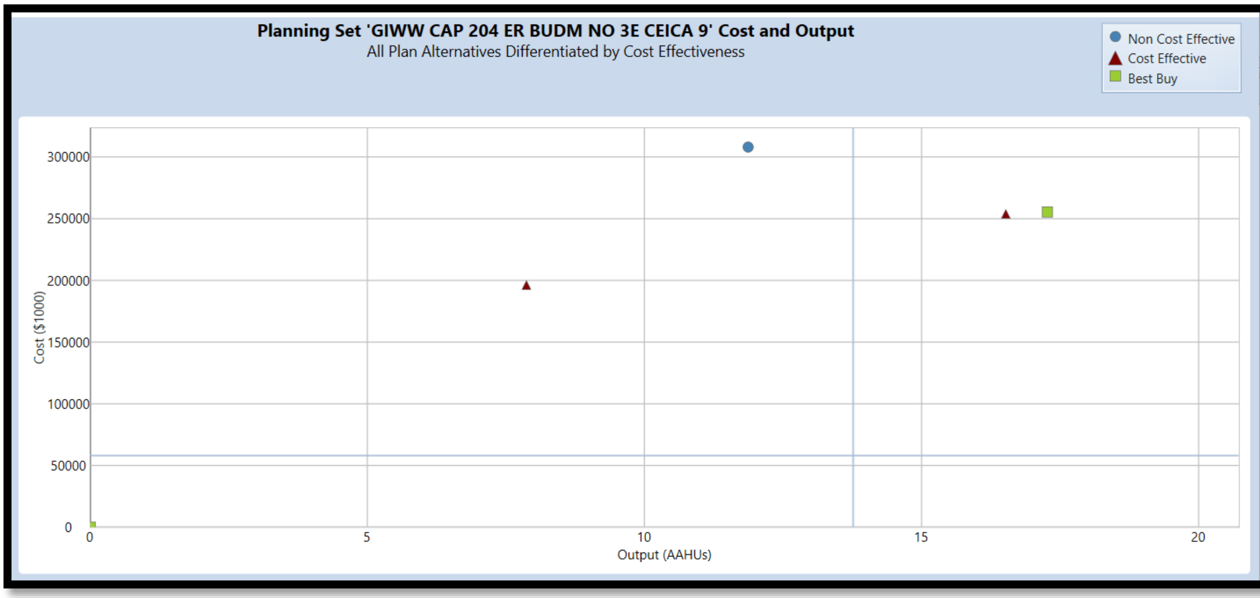

Figure 14: Cost Effective Results

5.3.1 Incremental Analysis and Best Buy Plans

The next step in the CE/ICA analysis is to perform an incremental cost analysis (ICA) on the cost-effective plans. ICA compares the incremental cost per incremental benefit (output or lift in environmental output) among the plans to identify plans that maximize the last dollar spent. Starting with the no action plan, the incremental cost per incremental benefit is calculated from the no action for each cost-effective plan. The plan with the least incremental cost per incremental output is identified as the first of the "with-project" best buy plans. Then starting with that plan, the incremental cost per incremental benefit is calculated between that plan and each remaining cost-effective plan, and the one with the least incremental cost per incremental benefit is identified as the next plan in the array of best buy plans. This process continues until there are there are no remaining plans. The last plan in the best buy array, is typically the "kitchen sink" plan, or the plan that contains all the management measures being analyzed (Table 16).

Table 16: Cost Effective Plans

Plan	Output (AAHU)	Total Annual Cost ($1s)	Avg Cost ($1s/AAHU)	Incremental Cost ($1s)	Incremental Output (AAHU)	Incremental Cost per Output	Plan First + Real Estate Inc. Costs
No Action Plan	0	$0	$0	$0	0	$0	$0
Alternative 3A	7.87	$196,200	$24,900	$196,200	7.87	$24,900	$5,600,000
Alternative 3C	16.52	$253,800	$15,400	$57,600	8.65	$6,700	$7,000,000
Alternative 3D (also Best Buy)	17.27	$255,400	$14,800	$1,600	0.75	$2,100	$7,000,000

From the cost-effective alternatives, two were identified as “Best Buy” plans (including the No Action plan). The result of the analysis is shown graphically in Figure 15: Incremental Cost Analysis Result. The alternative Best Buy plans are:

- **Alternative No Action Plan (by definition)**
- **Alternative 3D (Represented by the green rectangle in Figure 15, as the sole Best Buy Plan other than No Action, which is represented as the point (0,0))**

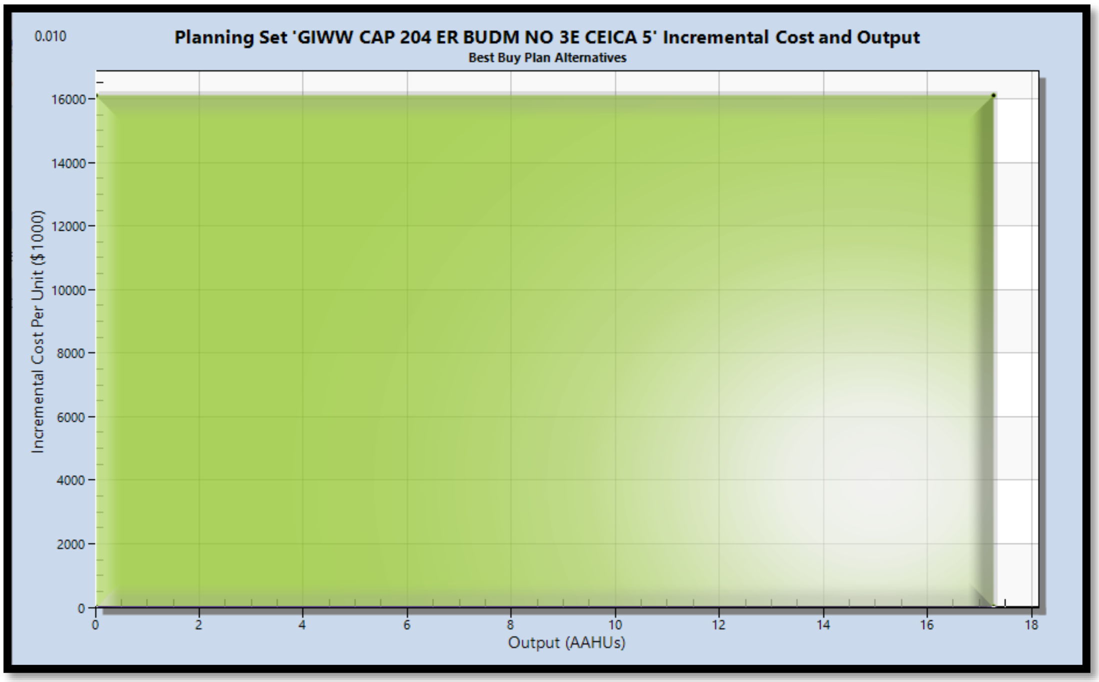

Figure 15: Incremental Cost Analysis Result

Table 17: Best Buy Plans

Plan	Output (AAHU)	Total Annual Cost ($1s)	Avg Cost ($1s/AAHU)	Incremental Cost ($1s)	Incremental Output (AAHU)	Incremental Cost per Output	Plan First + Real Estate Costs
No Action Plan	0	$0	0	0	0	0	$0
Alternative 3D	17.27	$255,400	$14,800	$255,400	17.27	$14,800	$7,000,000

5.4 Cost Estimates Pre-TSP

Alternatives cost estimates for the proposed work and base plan costs were developed using the Micro-Computer Aided Cost Estimating System (MCACES) computer application and the Cost Engineering Dredge Estimating Program (CEDEP). These estimates were prepared using the latest Unit Price Books and labor rates for fiscal year 2023 (October 2022) and in accordance with Engineering Regulation (ER) 1110-2-1302, dated June 30, 2016. This study focuses on BUDM for a Saline Marsh creation at Goose Island State Park, with four progressions of Alternative 3 under consideration (Table 18). Since the alternatives have different quantities, the base plan was developed to match the alternatives and have a more reasonable comparison between both costs. Markups for risk contingencies were obtained from the Abbreviated Risk Analysis (ARA). The ARA was developed with the participation of the PDT, and the results were used to develop the project contingencies. The ARA resulted in a 26% contingency, which applied to all costs except Real Estate. Costs include a Base Plan/FWOP alternative. For additional information, please reference the Cost Engineering Appendix F and the Economic Analysis Appendix E.

Table 18: Alternatives Cost Summary[2]

Alternatives		**Alt 3A**		**Alt 3B**		**Alt 3C**		**Alt 3D**
	Base Plan	**Alternative**	**Base Plan**	**Alternative**	**Base Plan**	**Alternative**	**Base Plan**	**Alternative**
01 Real Estate		$1,915,675.92		$4,383,264.94		$1,509,220.12		$1,508,140.16
06 Fish and Wildlife Facilities		$929,591.46		$1,123,719.66		$2,311,728.30		$2,311,728.30
12 Navigation, ports, & Harbors	$2,755,714.50	$4,601,958.48	$2,927,799.00	$4,800,219.48	$3,167,980.20	$5,218,224.48	$3,168,074.70	$5,258,166.48
30 Planning, Eng & design	$275,562.00	$731,934.00	$292,824.00	$1,001,448.00	$316,764.00	$893,844.00	$316,764.00	$897,750.00
31 Construction Mngt	$220,500.00	$585,522.00	$234,234.00	$801,234.00	$253,386.00	$715,050.00	$253,386.00	$718,200.00
Total Project Cost	$3,251,800.00	$8,764,700.00	$3,454,900.00	$12,109,900.00	$3,738,200.00	$10,648,100.00	$3,738,300.00	$10,694,000.00
Incremental Project Cost		$5,512,900.00		$8,655,000.00		$6,909,900.00		$6,955,700.00

Note: Costs include contingency and expressed in FY 23. Cost does not include escalation/inflation. WBS 01 assumes 35% per Real Estate Division. WBS 06 assumes 27% and WBS 12, 30, and 31 assume 26% per Abbreviated Risk Analysis.

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[2] This table has been updated per Walla Walla Cost Certification (Attached to Appendix F). Cost refinement did not change the selected plan. Reference Table 38 for the refined cost breakdown for the Recommended Plan.

Total project economic costs were annualized using the Annualizer tool in Institute for Water Resources (IWR) Planning Suite II. A period of analysis of 50 years was used, along with a Federal Discount rate of 2.5%. Prices are expressed in October 2022, FY23. Table 19 provides a summary of annual costs, including an initial estimate of annualized Operations, Maintenance, Repair, Replacement, and Rehabilitation (OMRR&R) for each alternative. Project first cost includes construction costs; planning, engineering, and design (PED); construction management; and contingency estimates. Real estate cost was estimated on a per-acre basis for each alternative and includes a contingency factor. Construction durations were estimated to be 9 to 11 months for all alternatives, used to calculate interest during construction (IDC). Construction and related first costs, real estate cost and IDC are summed to calculate the annual investment costs. The annual with-project OMRR&R is added to the annual investment cost to obtain the total annual costs. For more information, refer to the Economics Appendix E.

Table 19: TSP Annualized Cost Summary[3]

Reach	Project First Cost (PFC)	Real Estate	IDC	Economic Cost	Annual Investment Cost	Annual M&AM	Annual OMRRR	Total Annual Cost
1. GIWW STA 1160 to STA 1225	[redacted]							
ALT 3A	$3,597,200	$1,915,700	$51,400	$5,564,300	$196,200	Included PFC	$0	$196,200
ALT 3B	$4,271,700	$4,383,300	$80,600	$8,735,700	$308,000	Included PFC	$0	$308,000
ALT 3C	$5,400,700	$1,509,200	$78,800	$6,988,700	$246,400	Included PFC	$7,400	$253,800
ALT 3D	$5,447,600	$1,508,100	$79,300	$7,035,100	$248,000	Included PFC	$7,400	$255,400
	[redacted]							

*ER projects do not have OMRR&R costs since the restoration features are designed to be self-sustaining. Only engineered features are assigned O&M costs such as the new containment dikes constructed for sediment placement. Costs are expressed in FY 23.

5.5 “Is it Worth it?” Analysis

While the final array of alternatives each meet the study objectives, you will see that each alternative builds upon the previous, in order to determine which alternative best meets the study objectives. The CE/ICA analysis informs the selection process and shows that each of these meet the objectives of reinforcing the natural wetland building process at Goose Island, re-establishing the ecological integrity of the habitat, and restoring the marsh area while maximizing use of dredged material to the greatest extent achievable. However, alternative 3D ***best*** meets those objectives.

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[3] This table displays the Annualized Cost Summary prior to post TSP refinement. CE/ICA rerun was not conducted because the plan selection has not changed based on cost refinement.

5.5.1 No Action Alternative

Details: (0 AAHUs, $0 Ann Cost)

The No Action plan does not address any of the study objectives and would not restore coastal marsh habitats that would benefit migratory, breeding, and wintering waterfowl, waterbirds, and aquatic organisms. The No Action would also not demonstrate that BU can be effectively used to restore habitat, nor would it address existing or future problems related to degrade/degrading ecosystems or the dredging and placement challenges on the GIWW.

Pros:

- No surface disturbance or impacts to any natural resources or the human environment.

Cons:

- 0 acres of improved habitat leaving Goose Island in its existing condition.
- Would contribute to the significant national loss of wetland habitats occurring for fish and wildlife species and no efforts to offset this loss would be achieved for the study area.
- Ineffective to improve habitat for nationally significant migratory bird, threatened and endangered species, and aquatic wildlife populations within the study area.
- Material dredged from the GIWW would be placed in another location.

5.5.2 Alternative 3D

Details: 39-acre variable elevation marsh creation (17.27 AAHUs, $255,400 Ann Cost; $14,800 Incremental Cost per AAHU))

The additional federal investment of spending at least $14,800 (incremental cost/incremental output) to realize the last added habitat unit is worth pursuing over the No Action Plan because it addresses the study objectives and increases the availability of limited and degrading habitat in the study area. Alternative 3D is the only Best Buy Plan besides the No Action Plan (which by definition is a Best Buy Plan). It creates 39 acres of salt marsh and creates a more diverse habitat by incorporating low elevation and high elevation marsh cells but places the high elevation marsh cells in a better location, offering greater protection and extending sustainability. This plan is supported by the PDT, NFS, and resource agencies, and is the Recommended Plan for this project.

Pros:

- Demonstrates BU material can be used for ecosystem restoration and utilizes dredge material that would otherwise be placed in an open-water placement area.
- Creates and sustains 39 acres of emergent salt marsh for 50 years after construction with negligible degradation. No interior marsh, low or high elevation, would be anticipated to degrade; however, some degradation may occur to low elevation marsh in new cells north of the high elevation marsh area from RSLC and erosion due to wave action.
    - The higher elevation marsh and interior low elevation marsh is expected to withstand erosion and/or degradation. No loss is expected to occur to the interior marsh due to the added protection from the higher elevation marsh and extent of new marsh cells. However, some level of interspersion is likely to occur overtime from overtopping of the containment dike during extreme high tide events (Appendix C).
- Creates a crucial habitat for nationally significant migratory birds, threatened and endangered species, and aquatic wildlife populations within the study area.

- Contributes to offsetting the national loss of wetland habitats.
- Creates habitat diversity that has greater long-term sustainability for fish and wildlife organisms.
- Best buy plan

Cons:

- The newly created low elevation marsh north of the existing containment dike is likely to undergo some interspersion after 50 years, shifting the marsh to have a greater coverage of open water to emergent marsh.

5.6 Post TSP Cost Refinements

Table 18 Alternatives Cost Summary and Table 19 TSP Annualized Cost Summary were refined post TSP. The refinements did not change plan selection (Table 20). Reference Table 39 Project First Cost Summary in Section 12 for the cost breakdown for the Recommended Plan, Alternative 3D.

Table 20: Post TSP Costs Refinement

Alternatives		**Alt 3A**		**Alt 3B**		**Alt 3C**		**Alt 3D**
	Base Plan	**Alternative**	**Base Plan**	**Alternative**	**Base Plan**	**Alternative**	**Base Plan**	**Alternative**
01 Real Estate		$858,660.75		$1,737,328.50		$782,514.00		$781,434.00
06 Fish and Wildlife Facilities		$929,591.46		$1,123,719.66		$2,311,728.30		$2,344,553.35
12 Navigation, ports, & Harbors	$2,755,714.50	$4,601,958.48	$2,927,799.00	$4,800,219.48	$3,167,980.20	$5,218,224.48	$3,168,074.70	$5,268,872.70
30 Planning, Eng & design	$275,562.00	$633,276.00	$292,824.00	$754,488.00	$316,764.00	$826,056.00	$316,764.00	$1,039,104.23
31 Construction Mngt	$220,500.00	$506,646.00	$234,234.00	$603,666.00	$253,386.00	$660,870.00	$253,386.00	$607,320.00
Total Project Cost	$3,251,800.00	$7,530,200.00	$3,454,900.00	$9,019,500.00	$3,738,200.00	$9,799,400.00	$3,738,300.00	$10,041,300.00
Incremental Project Cost		$4,278,400.00		$5,564,600.00		$6,061,200.00		$6,303,000.00

5.6.1 Post TSP CE/ICA Results

To conduct the CE/ICA analysis, environmental restoration benefits (increase in with-project AAHUs) and annual costs were entered into IWR Planning Suite II. Table 21 displays the Post TSP total and annual Cost Summary. Table 22 displays the cost-effective alternatives post TSP cost refinements.

Cost effective plans are defined as the least expensive plan for a given set of benefits, or environmental output. In other words, no other plan would provide the same or more benefits for a lower cost.

Table 21: Total and Annual Cost Summary

Reach	Project First Cost (PFC)	Real Estate	IDC	Economic Cost	Annual Investment Cost	Annual M&AM	Annual OMRRR	Total Annual Cost
1. GIWW STA 1160 to STA 1225	[redacted]							
ALT 3A	$3,419,700	$858,700	$39,900	$4,318,200	$152,300	Included PFC	$0	$152,300
ALT 3B	$3,827,300	$1737300	$38,900	$5,603,500	$197,600	Included PFC	$0	$197,600
ALT 3C	$5,278,800	$782500	$63,400	$6,124,600	$215,900	Included PFC	$7,400	$223,300
ALT 3D								
	[redacted]							

*ER projects do not have OMRR&R costs since the restoration features are designed to be self-sustaining. Only engineered features are assigned O&M costs such as the new containment dikes constructed for sediment placement. Costs are expressed in FY 23.

Table 22: Annual Benefits and Annual Cost for Cost Effective Alternatives

Reach	Alternatives	AAHU	Annual Cost ($1s) October 2022 Prices
GIWW STA 1160 TO STA 1225	3A	7.87	$152,300
	3B	11.87	$197,600
	3C	16.52	$223,300
	3D	17.27	$224,900

In Figure 16 below, the No Action Plan is by definition the point (0,0). Moving right along the AAHUs axis, the first red triangle represents Alternative 3A followed by a second re triangle that Alternative 3B. Next is a red triangle representing Alternative 3C. Finally, the green square denotes Alternate 3D which is both a Cost Effective and a Best Buy Plan; “Best Buy” plans are discussed in further detail in the Economics Appendix E.

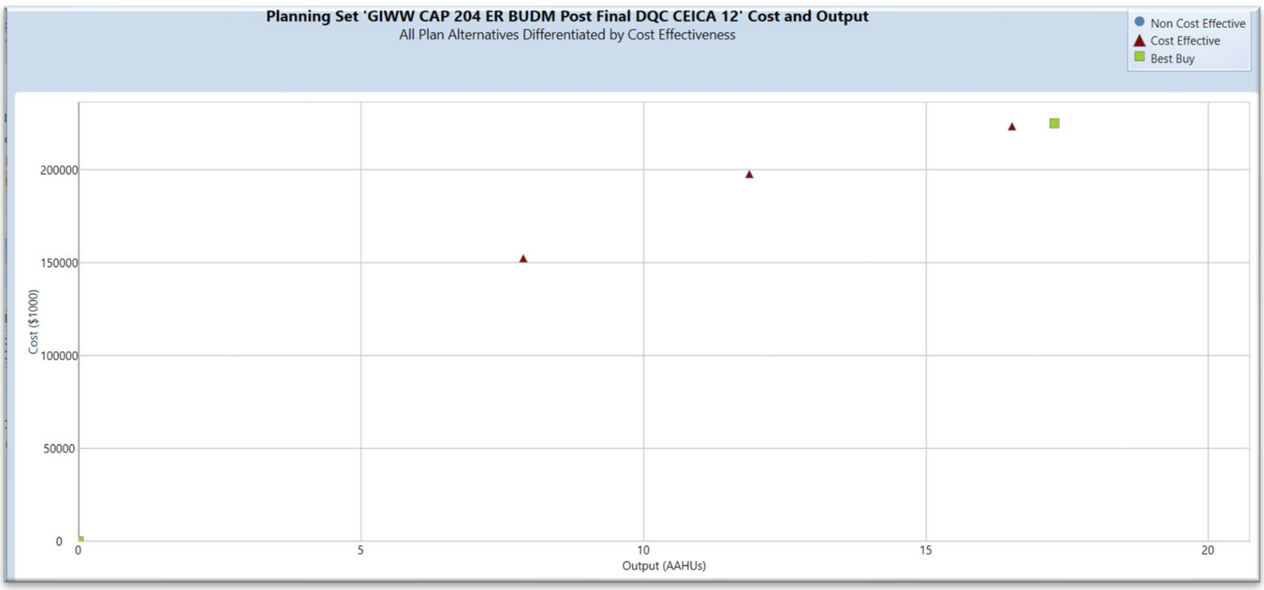

Figure 16: Post TSP - Cost Effective Results

5.6.2 Incremental Analysis and Best Buy Plans

The next step in the CE/ICA analysis is to perform an incremental cost analysis (ICA) on the cost-effective plans. ICA compares the incremental cost per incremental benefit (output or lift in environmental output) among the plans to identify plans that maximize the last dollar spent. Starting with the no action plan, the incremental cost per incremental benefit is calculated from the no action for each cost-effective plan. The plan with the least incremental cost per incremental output is identified as the first of the “with-project” best buy plans. Then starting with that plan, the incremental cost per incremental benefit is calculated between that plan and each remaining cost-effective plan, and the one with the least incremental cost per incremental benefit is identified as the next plan in the array of best buy plans. This process continues until there are there are no remaining plans. The last plan in the best buy array, is typically the “kitchen sink” plan, or the plan that contains all the management measures being analyzed.

Table 23: Post – TSP Cost Effective Plans

Plan	Output (AAHU)	Total Annual Cost ($1s)	Avg Cost ($1s/AAHU)	Incremental Cost ($1s)	Incremental Output (AAHU)	Incremental Cost per Output	Plan First + Real Estate Inc. Costs
No Action Plan	0	$0	$0	$0	0	$0	$0
Alternative 3A	7.87	$152,300	$19,400	$152,300	7.87	$19,400	$4,278,400
Alternative 3B	11.87	$197,600	$16,600	$45,300	4	$11,300	$5,564,600
Alternative 3C	16.52	$223,300	$13,500	$25,700	4.65	$5,500	$6,061,200
Alternative 3D (also Best Buy)	17.27	$224,900	$13,000	$1,600	0.75	$2,100	$6,303,000

From the cost-effective alternatives, two were identified as "Best Buy" plans (including the No Action plan). The result of the analysis is shown graphically in Figure 17. Note, these are the same best buys alternatives as before. The alternative Best Buy plans are:

- **Alternative No Action Plan (by definition)**
- **Alternative 3D (Represented by the green rectangle in** Figure 17**, as the sole Best Buy Plan other than No Action, which is represented as the point (0,0)).**

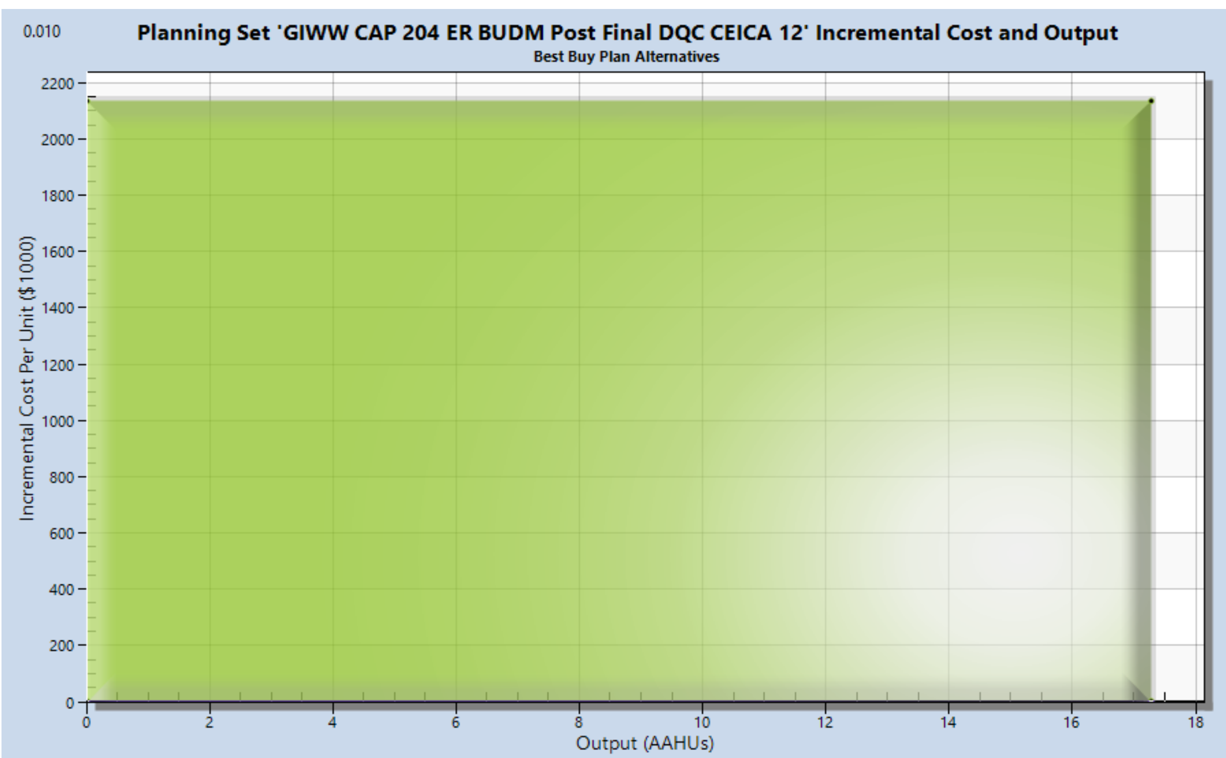

Figure 17: Post TSP - Cost Effective Results

Table 24: Post TSP - Best Buy Plans

Plan	Output (AAHU)	Total Annual Cost ($1s)	Avg Cost ($1s/AAHU)	Incremental Cost ($1s)	Incremental Output (AAHU)	Incremental Cost per Output	Plan First + Real Estate Costs
No Action Plan	0	$0	0	0	0	0	$0
Alternative 3D	17.27	$224,900	$13,000	$224,900	17.27	$13,000	$6,303,000

6. Future With Project Condition

Future with project conditions forecasts the most likely conditions expected during the period of analysis if the selected beneficial-use project, direct placement of sediment at Goose Island State Park is constructed. The FWP condition provides the basis from which benefits resulting from the construction project are calculated.

This study forecasts the conditions expected through a 50-year analysis if 196,500 cy of available material is placed at the study location, Goose Island, using design Alternative 3D, rather than in the placement area disposal area during the upcoming maintenance dredging of the GIWW. The analysis evaluated how the project would restore, sustain, and re-establish marsh ecosystems in the existing cells at Goose Island, with the creation of two additional cells.

6.1 Array of Alternative Plans Project Conditions

Table 25 includes the preliminary proposed candidate site locations with the last three as the screened focused array of locations. Goose Island was chosen as the most viable site location, and five progressions of Alternative 3 for Goose Island were developed, with one of the five eventually being screened from the final array of alternatives.

Table 25: Proposed Candidate Site Locations

Site	Location	Maximum Project Area (acres)	Maximum Dredged Material Volume Fill (cy)	Number of Containment Cells	Expected Dredged Material Source	Projected Cost of Construction
Lower Neches WMA Old River Unit	Orange County, Texas	224	393,000	6	SNWW	$5.6 million
Texas Point NWR	Jefferson County, Texas	623	1,600,000	3	SNWW	$11.4 million
McFaddin NWR Willow Lake Terraces	Jefferson County, Texas	218	466,000	1	GIWW or SNWW	$8.6 million

Site	Location	Maximum Project Area (acres)	Maximum Dredged Material Volume Fill (cy)	Number of Containment Cells	Expected Dredged Material Source	Projected Cost of Construction
Anahuac NWR Roberts Mueller Tract	Chambers County, Texas	552	639,000	4	GIWW	$16.4 million
San Bernard NWR Sargent Oil Field	Matagorda County, Texas	202	112,000	1	GIWW	$11 million
Schicke Point	Calhoun County, Texas	116	241,000	3	GIWW	$5.2 million
Guadalupe River Old Delta	Refugio County, Texas	1,085	1,910,000	4	Victoria Barge Canal	$19.6 million
Goose Island SP Cells	Aransas County, Texas	23	34,500	2	GIWW	$2.4 million
	Totals	3,043	5,395,500	24	N/A	$80.2 million

6.1.1 FWP Alternative 3D: Saline Marsh in Existing Cells, Addition of New Low and High Emergent Marsh Cells

In Alternative 3D, dredge material would be placed at Goose Island State Park for ecosystem restoration, in the existing cells, as well as new additional cells on the northern sides of the current ones. The material will also be used to create high elevation in the new cells and emergent marsh in the adjacent areas. The total habitat acreage would be 39 acres, and the AAHUs for this alternative would be 17.27. The ecological integrity of the marsh habitat will be re-established and the natural wetland building process at Goose Island will be reinforced. For additional details and information on the environmental impacts that correspond with alternative 3D and its benefits, please see sections 5.5.2 and 7.0, respectively.

7. Environmental Consequences of Alternatives

This chapter describes the scientific and analytic comparison of implementing the No Action Alternative/FWOP and the Action Alternative/FWP developed in Section 4. These potential impacts apply to the existing environmental conditions described in Section 2 Existing Conditions. This impact analysis includes a discussion of the potential cumulative impacts, any unavoidable adverse impacts, the relationship between short-term uses and long-term productivity, and the irreversible and irretrievable commitment of resources. All potential impacts, both beneficial and adverse, are described by their characteristics:

- type (direct, indirect, cumulative),
- duration (short-term, long-term, permanent),
- geographic extent (localized or beyond project boundaries), and
- magnitude/intensity (minor, moderate, major).

This chapter also includes effect determinations for impacts to protected species, habitats, and cultural resources (if any). Refer to Appendix C for additional details related to compliance with applicable laws and regulations.

7.1 Types of Potential Impacts

The following definitions of potential impacts were applied to this analysis, consistent with the Council on Environmental Quality's (CEQs) regulations at 40 C.F.R. § 1508.7 and § 1508.8 (1978). These categories are used to describe the nature, timing, and proximity of impacts on the affected resources:

- **Direct impact**: A known, or potential impact caused by the proposed action or project that occurs at the time and place of the action.
- **Indirect impact**: A known, or potential impact caused or induced by the proposed action or project that occurs later than the action or is removed in distance from it but is still reasonably expected to occur.
- **Cumulative impact**: A known or potential impact resulting from the incremental effect of the proposed action added to other past, present, or reasonably foreseeable future actions. The timeframe for the cumulative impact analysis is 50 years after project implementation to be consistent with other environmental analyses.

7.2 Duration of Potential Impacts

The duration of potential impacts is short-term, long-term, or permanent. This indicates the period during which the resource would be impacted. Duration considers the permanence of an impact and is defined as:

- **Short-term impact**: A known or potential impact of limited duration, relative to the proposed action and the environmental resource. For this analysis, short-term impacts may be instantaneous or last from minutes up to five years.
- **Long-term impact:** A known or potential impact of extended duration, relative to the proposed action and the environmental resource. For this analysis, long-term impacts are those lasting longer than five years.
- **Permanent impact:** A known or potential impact that is likely to remain unchanged indefinitely.

7.3 Geographic Extent of Potential Impacts

The geographic extent of potential impacts is:

- **Localized:** Impacts that are site-specific and generally limited to the area within the project boundaries.
- **Beyond proposed boundaries:** Impacts that are unconfined or unrestricted to the project boundaries. These impacts may extend in the immediate vicinity of the project area or throughout the Texas coastal region.

7.4 Magnitude of Potential Impacts

The magnitude or intensity of the proposed action was qualitatively assessed by the degree to which each alternative would impact a particular resource. The qualitative assessment is based on a review of the available and relevant reference material and is based on professional judgement using standards that include consideration of permanence of an impact; potential for natural attenuation of the impact; uniqueness or irreplaceability of a resource; abundance or scarcity of the resource; geographic, ecological, or other context of the impact; and potential mitigation measures to offset the anticipated impact.

The magnitude of potential impacts was minor, moderate, or major, defined as:

- **Minor**: impacts to the structure or function of a resource might be perceptible but are typically not amenable to measurement. These are typically localized but may in certain circumstances extend beyond a project boundary. Generally, minor impacts are those that in their context and due to their low level of severity, do not have the potential to meet the considerations of ‘significance’ set forth in CEQ regulations (40 C.F.R. § 1508.27).
- **Moderate**: impacts to the structure or function of these resources are more perceptible and, typically, more amendable to quantification or measurement. These can be localized or may extend beyond a project boundary. Generally, moderate impacts are those that in their context and due to their low level of severity, do not have the potential to meet the considerations of ‘significance’ set forth in CEQ regulations (40 C.F.R. § 1508.27).
- **Major**: impacts to these resources are typically obvious, amendable to quantification or measurement, and result in substantial structural or functional changes to the resource. These can be localized or may extend beyond a project boundary. Generally, major impacts are those that in their context and due to their level of severity, have the potential to meet the considerations of ‘significance’ set forth in CEQ regulations (40 C.F.R. § 1508.27).

7.5 General Environmental Effects

The environmental effects associated with dredging activities are primarily short-term, localized, and minor as most affected resources would return to pre-construction conditions either immediately after dredging (e.g., aesthetic and noise resources, water quality) or within one- or two-years post-construction (e.g., benthic resources, marsh habitat). A table is provided at the end of each resource section discussion to describe the impact expected. The impacts are color coded following the legend in Table 26.

Table 26: Color coding legend for environmental impact analyses.

Beneficial Impact	Adverse Impact
Minor	Minor
Moderate	Moderate
Major	Major

In this case, the No Action Alternative means the dredged material would not be used for ecosystem restoration at Goose Island State Park. Federal O&M dredging of the GIWW would occur according to the Authorized Depth and material would be placed in an open water or upland disposal site (USACE 2000).

The Action Alternative is the Recommended Plan, which involves beneficially using dredged material to create approximately 39 acres of saline marsh, including 6.2 acres of higher elevation marsh to offer a diverse range of habitat at Goose Island State Park. This project assumes all sediment needs for implementing the Recommended Plan would be acquired from the Matagorda Bay to Corpus Christi Bay Reach of the GIWW. The sediment needs would be met with existing O&M dredging, thus, would not induce additional dredging beyond the Authorized Depth.

Unless indicated otherwise, environmental impacts of O&M dredging are considered identical under the No Action and Action alternatives. The anticipated impacts of the dredging activities are characterized in the NEPA documentation for the DMMP (USACE 2000) and thus, will not be discussed in this assessment. Rather, this EA focuses on the expected impacts of restoration activities and analyzed the transportation and placement of material to the Federal Standard location (No Action) or to Goose Island State Park (Action Alternative).

It is assumed, at minimum, that best management practices (BMPs) identified throughout this chapter would apply during project construction. The assumed BMPs are rooted in widely accepted industry, state, and federal standards for construction activities. Examples of common BMPs include, but are not limited to:

- Using of silt fencing to limit soil migration and water quality degradation.
- Refueling and maintenance of vehicles and equipment in designated areas to prevent accidental spills and potential contamination of water sources and the surrounding soils.
- Limiting idling vehicles and equipment to reduce emissions.
- Limiting ground disturbance necessary for staging areas, access routes, pipeline routes, etc. to the smallest footprint possible to safely operate during construction and restoring these areas and routes to avoid permanent loss.
- Minimizing project equipment and vehicles transiting between staging areas and the restoration site to the greatest extent practicable, including but not limited to using designated routes, confining vehicles to immediate project needs, and sequencing work to minimize the frequency and density of vehicular traffic.

If for any reason the BMPs are not implemented, the impacts of the Action Alternative would minimally increase from those described herein and would not trigger an impact to transition from insignificant to significant.

7.6 Air Quality

7.6.1 No Action Alternative

Under the No Action Alternative, air quality in the region is expected to continue attaining NAAQS even as standards become more stringent. The TCEQ state implementation maintenance plan, and state and local policies, require reducing emissions over the long-term, which should positively contribution to the area continuing to meet future NAAQS.

Under the Federal Standard, transport of dredged material to the offshore/upland disposal site would result in direct, short-term, localized, minor adverse impacts to ambient air quality from construction activities associated with dredging, transport, and placement of material. Dredged material would be transported by the dredge vessel approximately 5 miles. Dredging operations are not below *de minimus* and as a result have received a General Conformity Determination (USACE 2000).

7.6.2 Action Alternative

The Action Alternative would have direct, short-term, localized, minor adverse impacts to ambient air quality from construction activities like those described in the No Action Alternative. No long-term adverse or beneficial impacts from persistent operation and maintenance are expected from the project as no permanent structures with emissions are being built. Operation of heavy equipment, support vehicles, and other motorized machinery for construction at the restoration site would result in combustion of fossil fuels and the release of VOCs, NOx, CO, O_3, SO_2, and particulates. Additionally, fugitive dust (i.e., small dust particles suspended in air) suspended by heavy equipment and support vehicles traversing across unpaved, non-vegetated roadways or staging areas would be emitted to the atmosphere and could create a haze over the project area, increasing ambient concentrations of particulates. BMP's that can be implemented to reduce air quality impacts from fugitive dust include:

- Stabilize open storage piles and disturbed areas by covering and/or applying water or chemical/organic dust palliative where appropriate at active and inactive sites; and
- Install wind fencing and phase grading operations where appropriate and operate water trucks for stabilization of surfaces under windy conditions.

The following BMPs would be implemented for mobile and stationary source controls of construction activities to further reduce air quality impacts and would be incorporated when developing contract specifications:

- The use of heavy machinery should be fitted with approved muffling devices that reduce emissions;
- Plan construction scheduling to minimize vehicle trips;
- Limit idling of heavy equipment;
- Maintain and tune engineers per manufacture's specifications to perform at EPA certification levels, prevent tampering, and conduct inspections to ensure these measures are followed; and
- Consider alternative fuel and energy sources (e.g., natural gas, electricity) when and where appropriate.

Implementation of the Action Alternative is expected to have direct, short-term, localized, minor adverse impacts on air quality, but is not expected to impact or contribute to any areas not meeting NAAQS. Because the action would be implemented in an area currently in attainment for all NAAQS, the TCEQ is not required by the CAA and Texas Administrative Code to grant a general conformity determination. The Action Alternative complies with the CAA as it occurs in an attainment area.

Implementation of the project may have indirect, long-term, minor benefits for air quality locally and beyond the project boundaries. Wetland and marsh soils are important sinks for carbon sequestration. Reconstruction of marsh habitat and revegetation of newly deposited sediments will capture carbon and provide enduring environmental benefits.

Overall, it was determined that the **adverse** impacts on air quality from implementing the No Action or Action Alternative would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 27).

Table 27: Summary of environmental consequences of alternatives on the air quality in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Short-term	Localized	Minor	Adverse
Action	Direct	Short-term	Localized	Minor	Adverse
	Indirect	Long-term	Localized; Beyond project boundaries	Minor	Benefit

7.7 Climate

NEPA considers that climatic environmental effects can include both the potential effects of a proposed action on climate/climate change and the implications of climate change on the performance of the proposed action. Thus, climate is analyzed from these two perspectives when evaluating environmental consequences of the project.

NEPA does not specify significance thresholds that may be used to evaluate the effects of a proposed action on global climate, rather, the appropriate approach to evaluate a project's impact on global climate is still under development. However, the Forest Service developed guidance for climate considerations under NEPA, which focuses on 1) the effect of the project on climate change through greenhouse gas (GHG) emissions, and 2) the effect of climate change on the project (USFS, 2009). GHG emissions may include short-term impacts and alteration to the carbon cycle caused by fuels or extraction of fossil fuels and minerals. Climate change could affect the environment in such a way that it will impact the purpose and need of the project. For example, climate change could alter habitat suitability for target species or ecosystems in restoration efforts or increase flooding in a region that may render a project less successful. Finally, the implications of climate change for the environment with the proposed action should be considered with respect to other resources and/or actions that could lead to cumulative effects in the project area. For example, the potential for the project to lead to habitat fragmentation exacerbated by climate change that could lead to listing of a species under ESA (Brandt and Schultz, 2016).

On January 9, 2023, the CEQ released interim NEPA guidance for consideration of the effects of GHG emission and climate change under any Federal action. The 2023 guidance does not establish a quantity of GHG emissions as "significant" with respect to affecting the quality of the human environment, rather assists agencies to disclose and consider the effects of GHG emissions and climate change. The interim guidance recommends agencies quantify a proposed action's reasonably foreseeable GHG emissions and place them in an appropriate context to estimate impacts to climate change.

GHG's are regulated at the state level under the Nonattainment Prevention of Significant Deterioration (PSD) program when emissions exceed the thresholds set in 30 Texas Administrative Code 116.164(a)(1) or (a)(2). For new emission sources, such as those generated from implementation of the proposed action, the pollutants emitted, separate from GHGs, are considered in exceedance of the threshold if they surpass 75,000 tons per year (tpy) or more of carbon dioxide equivalent (CO_2e). GHG emissions require authorization only when the project's emission increases above this threshold.

In many natural habitats, GHG emissions can be combatted or reduced through the process of carbon sequestration – the practice of removing carbon from the atmosphere and storing it (USGS, n.d.). Biological carbon sequestration occurs in aquatic and vegetated habitats that have microbial communities which can break down carbon, plants to store carbon in their tissues, and carbon that can be dissolved in marine and aquatic water (USGS, n.d.). Blue carbon refers to atmospheric carbon that is captured by ocean and wetland habitats (USGS, n.d.). Saline marshes contribute 50% of carbon burial in marine sediments, making these habitats a critical component of CO_s sinks and reservoirs globally for GHG emissions (Duarte et al. 2013). Coastal wetlands efficiently preserve carbon through dense foliage and root networks that protect carbon deposited in the soil from erosion. Restoring salt marshes is a Blue Carbon initiative, proposed in 2009 (Nelleman et al. 2009), to help reduce GHG emissions through natural ecosystem enhancements (Duarte et al. 2013).

By identifying the level of GHG emissions and carbon sequestration, in relative terms, it can be determined or suggested whether an action would have a net gain, or loss, of benefits to climate change.

7.7.1 No Action Alternative

Under the No Action Alternative, O&M dredging activities would occur under a Federally authorized action. Thus, GHG emissions generated from dredging activities will not be considered in this analysis as it is the baseline for all alternatives (i.e., would not be a comparable difference between actions). No additional GHG emissions, beyond those produced during O&M dredging, are anticipated under the No Action Alternative.

At typical ocean temperatures and pressures, CO_2 exists as a gas above 500 m water depth (Chow, 2014); thus, the No Action Alternative is not anticipated to offer sequestration benefits from placing material in open water areas as they do not reach 500 m in depth. As such, the No Action Alternative would be a net emitter of GHG's.

7.7.2 Action Alternative

Under the Action Alternative, construction activities would generate GHG emissions because of combustion of fossil fuels while operating on- and off-road mobile sources, primarily CO_2, CH_4, and N_2O. Other GHGs (e.g., hydrofluorocarbons, perfluorocarbons, and sulfur hexafluoride) are typically associated with specific industrial sources and processes, thus would not be emitted during construction. Upon construction completion, all GHG emissions would cease, and the area would return to baseline conditions.

There are no apparent negative impacts to carbon sequestration (e.g., loss of wetlands) that would result from implementation of the Action Alternative; rather a net gain in carbon sequestration benefits is anticipated with the addition of marsh habitat.

As with the No Action Alternative, GHG emissions from O&M dredging activities are not captured in this analysis as those will be emitted in the absence of this project. CO_2 emissions are highly correlated to fuel use with approximately 99 percent of the carbon in diesel fuels being emitted in the form of CO_2 (EPA 2005). EPA published a CO_2 emission factor of 10.1 kilograms per gallon (kg/gal) to estimate the CO_2e for diesel use. To calculate gallons of fuel used to implement the Action Alternative, it was assumed eight percent (8%) of the BU incremental construction costs are associated with fuel consumption. Based on a 10-year average, the USACE Cost Center of Expertise estimated the cost of diesel to be $3.00 per gallon. The Action Alternative BU incremental construction costs are estimated to be $3,513,400.00. Under these assumptions, construction activities are expected to use 93,691 gallons of diesel over the construction period (12 months). With an emission factor of 10.1 kg/gal, the Action Alternative would emit 946,276 kg CO_2e or 946.28 metric tons CO_2e ($MTCO_2e$) over the course of a year. This is equivalent to GHG emissions from approximately 204 gas-powered passenger vehicles or 2,191 barrels of oil consumption (EPA 2022a). The emissions anticipated from construction activities are far below the thresholds regulated by the State and are not to the magnitude that could make any direct correlation with measurable impacts to climate change.

Salt marshes are reported to sequester carbon at a rate of 210 grams (g) of C per square meter per year (210 g $C/m^2/yr$; Charpentier et al. 2011). To estimate sequestration capabilities of the Action Alternative, it was assumed the baseline wetland sequestration rate for the restored marsh was 50% of the average rate (105 g $C/m^2/yr$). With the Action Alternative proposing to create 39 acres of salt marsh, it was estimated the FWP total sequestration would be 16,571,943.34 g C/yr. The ratio of the molecular weight of carbon dioxide to carbon (3.67) is used to convert the quantity of carbon to the equivalent quantity of carbon dioxide (EPA 2022). Thus, the Action Alternative would sequester 60,819,032.05 g CO_2e/yr, which equates to 60.88 $MTCO_2e$/yr. Assuming a project life of 50 years, the Action Alternative is estimated to sequester 3,044 $MTCO_2e$. Over the life of the project, the restored wetlands are estimated to sequester more CO_2e than emitted to construct the project. Given the project is expected to be a net capture of GHG emissions, it was determined the total direct and indirect impacts to climate would be localized, minor, and beneficial. Although the initial emission of GHG's to construct the project are not beneficial, the sequestration capabilities of the restored marsh offer benefits that supersede the negative impacts that would come from construction activities.

Because capture or emission of carbon is proportional to the size of the project, action alternatives would rank commensurate with acreage of wetland restoration in terms of GHG emissions or sequestration such that Alternative 3a (23 acres) < Alternative 3b (29.5 acres) < Alternative 3c/3d (39 acres).

Salt marshes offer other immeasurable benefits to combat stressors from climate change such as ameliorating the impacts of coastal flooding and storm surge (Duarte et al. 2013). Because of the compounding benefits marsh restoration has for Goose Island State Park (i.e., carbon sequestration, storm, and flooding buffer), the project is expected to have direct, long-term, moderate, beneficial impacts locally. In general, the Action Alternative is a Blue Carbon initiative that can contribute to climate change adaptation through ecosystem-based coastline protection.

Overall, it was determined that the **adverse** and **beneficial** impacts on climate from implementing the Action Alternative would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 28).

Table 28: Summary of environmental consequences on climate in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct; Indirect	Short-term	Localized	Minor	Beneficial
	Direct	Long-term	Localized	Moderate	Beneficial

7.7.2.1 Social Cost of Carbon

Executive order 13990 *Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis* directs Federal agencies to capture the full costs of GHG emissions, including by taking potential global damages into account. The social cost of carbon (SCC) is a monetary estimate of damages associated with incremental increases in GHG emissions. The EPA uses an interim SCC of $51 per ton (EPA 2022b). Assuming an average discount rate of 3% (EPA 2022b) and the year of emissions occurring in 2024, the SCC for the Action Alternative was estimated at $50,841 (costofcarbon.org/calculator). Using the same assumptions, carbon sequestration of the Action Alternative is estimated to have a SCC of $163,593. As the SCC benefits outweigh the cost, the project is justified from a SCC standpoint.

7.8 Physical Oceanography

7.8.1Tides, Currents, Circulation

7.8.1.1 No Action Alternative

Under the No Action Alternative, water currents and circulation would not be expected to change. As shoreline loss continues, the open water habitat would likely breach the current containment dikes and expose more marsh to tidal surges and waves from the adjacent bays.

7.8.1.2 Action Alternative

During marsh restoration, existing shallow open water areas would be restored to marsh habitat. Earthen containment/exclusion dikes would prevent local flows from coming into and over the marsh restoration site during construction activities and protect the interior marsh once construction is completed. The temporary change in water circulation through the restoration area would not be expected to modify water levels in adjacent areas or permanently alter flows or water levels. Post-construction, marsh platforms would be elevated from their existing condition to aid in the resiliency and sustainability under future conditions. The higher elevations may slightly reduce and modify local current patterns and flows of water over the footprint immediately following construction, until the area compacts, and sea levels rise. However, original current patterns and circulation would be similar to that which existed prior to the erosion, degradation, and loss under the existing condition. Marsh elevation increases would also reduce the amount of ponding and allow water to circulate throughout the area and drain to adjacent estuaries and bays. Marsh restoration would be expected to have direct, long-term, localized, minor, beneficial impacts to oceanographic conditions in the project area.

Overall, it was determined that the **beneficial** impacts to the tides, currents, and circulation from implementing the Action Alternative would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 29).

Table 29: Summary of environmental consequences on tides, currents, and circulation in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct	Long-term	Localized	Minor	Beneficial

7.8.2 Depth of Closure

7.8.2.1 No Action Alternative

The depth of closure (DOC) is intended to define the seaward limit of the active profile, which is the theoretical cross-shore extent of sediment movement, beyond which elevation changes are thought to be negligible.

The only channel nearby is a small non-Federal channel for the local residents. Because these vessels are not commercial vessels AIS data is limited to nonexistent. Therefore, it is assumed the maximum ship induced wave at high tide with a breaking criterion of 0.78 would be the design wave. The result of that maximum possible ship induced wave is 1.8 feet.

7.8.2.2 Action Alternative

Because a GIS layer for the survey was unable to be provided it was assumed that each of the contour's edges were vertical. While this is unrealistic the differences in quantities will not be drastically different since the contours range between 0.3ft and 1.2ft in depth. It was assumed that the maximum wave height that the containment berm would see would be depth limited since there was not available AIS data for the vessels that utilize the channel adjacent to Goose Island.

7.8.3 Relative Sea Level Change

7.8.3.1 No Action Alternative

RLSC is likely to amplify the loss of habitat in the project area under the No Action Alternative (NOAA 2022b). Under current conditions, the site would be almost completely inundated with saltwater with +2 feet mean higher high water (MHHW), which would be expected to occur within 40 years in the absence of restoration efforts (NOAA 2022b). This would be expected to have direct, long-term, moderate impacts locally and beyond the project boundaries due to an increase in shoreline exposed to erosive forces and loss of habitat.

7.8.3.2 Action Alternative

RSLC is accounted for in the targeted marsh elevation, which includes contributions from erosion, end loss, and overfill. The higher elevation of marsh platforms may help to reduce immediate impacts of RSLC; however, any beneficial impacts of restoring the marsh to combat sea level rise is not likely to be realized because of the short duration of the project analysis.

Overall, it was determined that the **adverse** impacts from RSLC would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 30).

Table 30: Summary of environmental consequences of RSLC in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct	Long-term	Localized	Minor	Beneficial

7.9 Geomorphology

7.9.1 No Action Alternative

No changes to geology or soil are anticipated with the No Action Alternative.

7.9.2 Action Alternative

The Action Alternative would reintroduce sediments to the system through placement of dredged material during marsh restoration. The restoration activities are expected to have direct, long-term, localized, moderate beneficial impacts to geomorphology. Introduction of the dredged materials would change the topography and bathymetry of the restoration area. Marsh would be increased +0.6 to 0.8 feet NAVD88 for low-elevation areas and up to +2 feet NAVD88 for higher elevated zones. The existing elevations are at or below +0.0 mean sea level (MSL), which does not benefit the system. With the increase in elevation and change in topography, the estuary system will be able to function naturally and create a more resilience and sustainable system under RSLC conditions.

Overall, it was determined that the **beneficial** impacts on the geomorphological resources from implementing the Action Alternative would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 31).

Table 31: Summary of the environmental consequences of alternatives on the geomorphology of the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct	Long-term	Localized	Moderate	Beneficial

7.10 Sediments

7.10.1 No Action Alternative

Under the No Action Alternative, current sediment deficits would likely continue to increase resulting in shoreline loss similar to that experienced over the last several decades. Sediments dredged from the GIWW would be placed in an offshore location beyond the depth of closure, and thus, would result in approximately 196,500 cy of sediment being removed from the sediment budget in the estuary system. This would result in direct, long-term, localized, minor adverse impacts from sediment loss in the project area.

7.10.2 Action Alternative

The Action Alternative would reintroduce sediments to the system through placement of dredged material during marsh restoration. Approximately 196,500 cy would be placed in the project area and create approximately 39 acres of marsh that may otherwise remain open water habitat over the 50-year period of analysis. This increase in sediment is expected to have direct, long-term, localized, moderate beneficial impacts to the project area by increasing the amount of sediment in the system and creating stability and restoring function. The added sediment is expected to increase productivity, support wetland building functions, and reintroduce and distribute sediment and nutrients throughout the ecosystem beyond the project area. This is expected to result in indirect, long-term, moderate beneficial impacts beyond the project area.

During construction, hydric soils would be minimally compacted from heavy equipment moving and placing dredged material within the restoration area. Compaction would be temporary and would be expected to have a compaction rate similar to other marsh areas near the restoration site until shortly after construction ceases and the marsh is under normal surface flow influence. Placed material would be a similar quality as the existing soil in the area, which would reduce any compositional or structural changes associated with placing an outside sediment source into the marsh. Construction activities are expected to have direct, short-term, localized, minor adverse impacts to the restoration area due to compaction from heavy equipment.

Overall, it was determined that the **beneficial** and **adverse** impacts on the sediment resources from implementing the No Action or Action Alternatives would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 32).

Table 32: Summary of the environmental consequences of alternatives on the sediments of the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized	Minor	Adverse
Action	Direct	Long-term	Localized	Moderate	Beneficial
	Indirect	Long-term	Beyond project boundaries	Moderate	Beneficial
	Direct	Short-term	Localized	Minor	Adverse

7.11 Shoreline Erosion

7.11.1 No Action Alternative

Under the No Action Alternative, shoreline loss is anticipated to continue eroding, albeit slower than historical rates because of the protection from the breakwater and containment dikes. However, the containment dikes are already eroding, and unexpected breaches have occurred. As a result, erosion is expected to completely breach the containment dikes or begin eroding the dikes over the next 50 years and eventually remove the limited amount of accreted marsh habitat currently present. Unprotected erosion is expected to have direct, long-term, moderate adverse impacts locally and beyond the project boundaries, as loss of the habitat would impact resident and migratory bird species.

7.11.2 Action Alternative

With the restoration of marsh habitat, shoreline loss would be reduced, and the extent of marsh would more closely align with historical coverages. Accretion of sediment is expected to occur behind the existing breakwater and in front of the containment dikes as a more robust habitat is built within the dikes. This will result in accretion of shoreline and growth of additional marsh habitat, which is expected to have direct, long-term, moderate benefits locally and beyond the project boundaries, as additional habitat would be created for resident and migratory bird species and threatened and endangered species.

Overall, it was determined that the **beneficial** and **adverse** impacts on shoreline erosion from implementing the No Action or Action Alternatives would be **less than significant** due to the low level of intensity of expected impacts (Table 33).

Table 33: Summary of the environmental consequences of alternatives on water quality in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized; Beyond project boundaries	Moderate	Adverse
Action	Indirect	Long-term	Localized; Beyond project boundaries	Moderate	Beneficial

7.12 Water Quality

7.12.1 No Action Alternative

The project area is susceptible to erosion which results in excessive amount of sediment input and thereby increases turbidity. Increased turbidity can have an adverse effect on aquatic life and fisheries, restrict light penetration necessary for photosynthetic plants, and reduce aesthetic quality important for recreation. Turbidity levels are not expected to change under the No Action Alternative because it is related to the current wave activity and erosion. As water temperatures increase with climate change, dissolved oxygen levels in the open water habitat would be reduced which could result in algal blooms or create toxic conditions for aquatic species. Droughts may amplify these effects, while periods of high rainfall could degrade water quality through increased sedimentation, erosion, turbidity, and nutrient loading (Coffey et al. 2018). Under the No Action Alternative, the impacts are expected to be direct, long-term, localized, minor, and adverse. Short-term adverse impacts from turbidity are expected to occur at the borrow site but are discussed in the DMMP (USACE 2000).

7.12.2 Action Alternative

Construction activities, hydraulic dredging, and material placement could result in temporary, localized, adverse impacts to water quality including reduced water clarity; change in color; increased acidity of receiving waters (i.e., reduce pH); emission of reduced sulphur compounds including hydrogen sulfide; and release of organic material (e.g., ammonia, nitrogen, phosphorus) that could stimulate algae and aquatic plant growth. The factors responsible for degradation of water quality include increased turbidity and suspended sediments, organic enrichment, chemical leaching, reduced dissolved oxygen, and elevated carbon dioxide levels. Tidal currents present in the project area would serve to disperse and thereby dilute localized changes to water quality. Any such impacts would be minimized and controlled by using the best available practical techniques and BMPs.

Areas where dredged material would be placed for wetland restoration would be isolated from surrounding waters by containment dikes with to minimize the discharge of turbid water. These impacts would be localized to the project area and would be temporary in nature. The fill material would eventually settle in the placement area, and the turbidity due to project activities would no longer occur. Measures to control turbidity would be in place to ensure water quality standards are met and affects to sensitive resources are minimized. These measures may include appropriate water control structures to decant water, as well as the installation of silt fences or curtains, hay bales, filter-fabric, and/or temporary dikes to control sediments and avoid negative impacts associated with the fill placement.

The Action Alternative would not have long-term, significant adverse impacts to water chemistry. During marsh restoration, effluent from the dredge discharge pip would be directed to adjacent fragmented marsh or shoreline for nourishment. Dredged material is expected to be free of contaminants and would be suitable for placement in the marine habitat in accordance with the CWA Section 404(b)(1). It is not expected to result in adverse effects to aquatic organisms. Dredging would occur during regularly scheduled maintenance events; therefore, water quality and salinity impacts would be the same as those described in the DMMP (USACE 2000). The adverse impacts to water quality from construction and dredging activities is expected to be direct, short-term, localized, and minor.

Indirect water quality improvements because of marsh restoration are expected to be long-term, localized, moderate, and beneficial. Restored areas would increase the surface area in which sediment and excess nutrients can be trapped. In turn, this can reduce total suspended solids, phosphorus, and nitrogen levels in the water column. Congruently, this would increase dissolved oxygen levels, in which all these conditions improve and maintain local water quality.

Overall, it was determined that the **beneficial** and **adverse** impacts on water quality from implementing the No Action or Action Alternatives would be **less than significant** due to the low level of intensity of expected impacts (Table 34).

Table 34: Summary of the environmental consequences of alternatives on water quality in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized	Minor	Adverse
Action	Indirect	Long-term	Beyond project boundaries	Moderate	Beneficial
	Direct	Short-term	Localized	Minor	Adverse

7.13 Biological Communities

7.13.1 No Action Alternative

Under the No Action Alternative, the conditions of the open water habitat would likely exacerbate over the period of analysis. Some accretion of marsh vegetation has occurred since installation of the containment dikes in 2008 and previous application of dredged material; however, the dikes have eroded significantly over the last decade as a function of tidal movement and wave energy. The previously pumped material has settled substantially, and it is assumed that some material has been lost through openings in the containment dike from sediment movement over time. Prior to construction of the breakwater and containment dikes (2005 and 2008, respectively), the project area was comprised of an unconsolidated shoreline that was severely depleted by erosion.

The project area experiences shallow coastal flooding and according to NOAA's Sea Level Rise Viewer, has medium vulnerability for impacts of RSLC (NOAA 2022b). As such, if no action occurs, it is likely the containment dikes will continue to erode and expose what minimal marsh vegetation is currently present. Over the period of analysis, this erosion would likely result in loss of the marsh habitat and expansion of open water habitat. This would have direct, long-term, localized, minor adverse impacts to the project area due to habitat loss. Additionally, the loss of this habitat would expose the adjacent shoreline, communities, and infrastructure north of the project area to erosive forces it currently abates.

RLSC is likely to amplify the loss of habitat in the project area under the No Action Alternative (NOAA 2022b). Under current conditions, the site would be almost completely inundated with saltwater with +2 feet mean higher high water (MHHW), which would be expected to occur within 40 years in the absence of restoration efforts (NOAA 2022b). This would be expected to have direct, long-term, moderate impacts locally and beyond the project boundaries due to an increase in shoreline exposed to erosive forces and loss of habitat.

7.13.2 Action Alternative

During construction activities, it is anticipated there would be a temporary decrease in habitat quality due to increased sedimentation from work activities occurring in and near open water. Under the Action Alternative, there would be an immediate loss of shallow open water and gain of land. In the marsh areas, placement and reworking of dredged material by construction equipment would cover and trample the limited marsh vegetation present in the construction footprint. Minimal emergent vegetation would be present immediately after construction as most of the project area would be unvegetated dredged material. This is expected to result in direct, short-term, localized, minor adverse impacts to the restoration area.

Existing marsh areas would likely revegetate more rapidly than large, open water areas that were filled. Marsh vegetation nourished with 6 to 12 inches of material has been shown to respond favorably and revegetate quickly in previous restoration projects. Large, open-water areas filled with dredged material would likely revegetate at a slower rate than existing marsh. Areas of significant concern for erosion or formation of monoculture communities would be planted post-construction. Areas that are not planted would be expected to fully vegetate to densities, heights, and compositions similar to adjacent marshes within 1 to 2 years post-construction. It is anticipated the material placement would have direct, long-term, localized, moderate beneficial impacts to the restoration area.

Earthen retention dikes would be constructed with existing material sourced onsite. Impacts from the construction of retention dikes would be direct, short-term, localized, minor, and adverse and are expected to be mitigated by natural or induced recruitment of native vegetation.

Post-construction, marsh restoration activities would restore shallow open water habitat to saline marsh. Using the WVA saline marsh model, the net increase in average annual habitat units (AAHUs) was calculated for the Action Alternative (Table 35). Placement of dredged material into marshes would increase marsh elevations to compensate for ongoing erosion and future RSLC.

Table 35: Net change in saline marsh with implementation of the Action Alternative.

Alternative	FWOP	FWP	Net Change	Acres Restored
Alternative 3D	0	17.27	+17.27	39

Construction-related activities are anticipated to impact fish and wildlife, if they occur as a resident, migrant, or incidental, within or near the project area. Impacts include habitat removal and/or fragmentation during construction activities and habitat avoidance because of increased noise, dust generation, vibrations, and overall lower quality habitat. Losses of slow moving and less mobile species (e.g., small mammals, aquatic invertebrates, benthic species, mussels, nekton, and herpetofauna) are anticipated along the access roads and within the construction footprint, particularly during placement of dredged material due to burial of individuals and/or increased turbidity. More motile species are expected to be capable of avoiding injury or death while crossing access roads and by avoiding the construction area. In general, most fish, wildlife, and benthic species would become habituated to the work and adapt to the habitat changes; however, species with low tolerance to are anticipated to be displaced for the duration of activities. The level and duration of the impacts is dependent on the final design of the restoration, type of equipment used, and duration of construction activities. Once construction is complete, it is anticipated that construction-related impacts to organisms would cease.

Benthic, plankton, suspension/filter-feeding species, visual predators, and other fishery/aquatic organisms are expected to have direct, short-term, localized, minor adverse impacts caused by increased turbidity, total suspended sediments, and water temperatures, as well as lower dissolved oxygen levels from dredging and construction. Benthic organisms would be smothered which would result in death. Suspension/filter feeding organisms could be impacted due to clogging of gills and feed mechanisms, which would cause death or reduce growth and reproduction. Visual predators would have a reduced success rate at catching prey due to lower visibility levels. Following dredging and construction activities, turbidity and suspended sediment levels, water temperature, and dissolved oxygen levels are expected to return to pre-construction conditions. These adverse impacts would be minimized and controlled by implementing the best available practical techniques and BMPs during construction.

Implementation of the Action Alternative would result in improved habitat conditions and an expansion of available habitat for all wetland-dependent species. This restored habitat would allow for improved diversity and an increase in abundance of plant and animals species. Emergent and submerged vegetative species would have more surface area to colonize, which then establishes a more sufficient food supply to support primary (i.e., herbivores) and secondary (i.e., carnivores) consumers. Intertidal marsh and marsh edge would provide increased foraging opportunities for shorebirds and wading birds using the shoreline habitats. Nesting habitat would be improved as the restored marsh would provide more desirable nesting habitat in an area that would otherwise be inhabitable for nesting under FWOP conditions. The increase in vegetative structure would also provide shelter for prey species to evade predators. The Action Alternative is expected to have direct and indirect, long-term, moderate beneficial impacts locally and beyond the project boundaries because of the creation of marsh habitat that would be utilized for several life stages of numerable species of wildlife.

Marsh restoration would result in the loss of approximately 23 acres of open water in the containment dikes and an additional 16 acres north; however, the wildlife species currently using this habitat are not expected to be significantly adversely affected. The wildlife species using the open water habitat are mobile and can relocate into adjacent open water habitat south of the containment dikes outside of the proposed restoration site. The conversion of open water to marsh habitat is generally accepted as a benefit to aquatic species.

Overall, it was determined that the **beneficial** and **adverse** impacts to the biological communities from implementing the No Action or Action Alternatives would be **less than significant** due to the low level of intensity of expected impacts in the context of the proposed project (Table 36).

Table 36: Summary of the environmental consequences of alternatives on the sediments of the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized; Beyond project boundaries	Moderate	Adverse
	Direct	Long-term	Localized	Minor	Adverse
Action	Direct	Short-term	Localized	Minor	Adverse
	Direct	Long-term	Localized	Moderate	Beneficial
	Indirect	Long-term	Beyond project boundaries	Moderate	Beneficial

7.14 Threatened and Endangered Species

The impacts described in Section 7.13 Biological Communities would also apply to ESA-listed species under the No Action (Section 7.13.1 No Action Alternative) and Action Alternatives (Section 7.13.2 Action Alternative).

A Biological Assessment (BA) was prepared to document the impacts of implementing the Recommended Plan on listed species (Appendix C). Based upon the findings of the BA, USACE has made the following effects determinations for species that were identified as occurring or potentially occurring in the action area.

Attwater's Greater Prairie chicken: No restoration work would be completed in suitable habitat for Attwater's Greater Prairie chicken. Populations are only found in two Texas counties – Colorado and Goliad, as well as the Aransas NWR, located approximately two miles east of the project area. It is highly unlikely that individuals would be affected by restoration actions due to the distance between the restoration site and known population distributions. No suitable habitat is present in the proposed restoration area for Attwater's Greater Prairie chicken; thus, implementation of the Action Alternative would have ***no effect*** on this species.

Piping plover and Rufa red knot: Restoration work would be completed near suitable foraging and roosting habitats for these species, and both have been observed in the vicinity of the project area. It is highly unlikely that individuals would be affected by restoration actions due to the lack of suitable habitat in the direct restoration site; however, there is the potential to have temporary effects from construction activities (e.g., noise) that could result in displacement to adjacent areas. Therefore, implementation of the Action Alternative ***may affect, but is not likely to adversely affect (NLAA)*** piping plover or red knot.

Eastern black rail: Marsh restoration and construction would occur in degraded open water habitat but would be near or within 50 feet of suitable habitat for Eastern black rails. However, presence of this species is highly unlikely in the project area because of the very low occupancy probability of the rails present in the broader region, generally. Long-term, the restoration of the coastal marsh will be beneficial for the species because it proposes building preferable habitat of Eastern black rail demonstrating higher elevation marsh areas, dense vegetation, most soils, and shallow flood depths. Implementation of the Action Alternative is ***NLAA*** Eastern black rail because conservation measures have been incorporated into the plan to reduce the potential impacts to the individuals that may be in nearby suitable habitat, and overall, a net benefit is anticipated for this species that far exceeds any temporary negative effects.

Whooping crane: Restoration work could potentially disrupt individual birds during foraging activities. Implementation of the Action Alternative is ***NLAA*** whooping cranes. Conservation measures have been incorporated into the plan to reduce the potential impacts to the species, which include a seasonal restriction on construction in marshes (October 1 – April 15). If the operating windows cannot be achieved, a biological monitor would be required on site to stop work if a bird is spotted within 1,000 feet of the active site and would require tall equipment (> 15 feet) be laid down at night.

Northern aplomado falcon: No restoration work would be completed in or near known habitat for Northern aplomado falcons, as these birds require open grassland or savannah with scattered trees or shrubs. No suitable habitat is present in or near the proposed restoration area for this species; thus, implementation of the Action Alternative would have ***no effect***.

West Indian manatee: Due to the rarity of the manatee in the action area and the conservation measures that would be implemented, implementation of the action is ***NLAA*** the West Indian manatee.

Sperm whale: Restoration activity would occur outside of the known ranges for this species and lacks suitable habitat as Sperm whales occupy deep oceanic waters; therefore, implementation of the Action Alternative would have ***no effect*** on this species.

Rice's whale: Restoration activity would occur outside of the known ranges for this species as Rice's whales are restricted to a very narrow depth corridor along the shelf break in the northeastern Gulf of Mexico; therefore, implementation of the Action Alternative would have ***no effect*** on this species.

Sea turtles: The leatherback sea turtle prefers deep marine water habitat, which is not available in the project area, and the project area is outside the species known nesting range. Therefore, implementation of the Action Alternative would have ***no effect*** on leatherback sea turtles.

Dredging operations have been analyzed for the remaining four sea turtle species and was issued a Biological Opinion (BO) for the action (Consultation No: F/SER/2000/01287). In the BO, NMFS determined that the proposed action of the project was ***likely to adversely affect***

but were not likely to jeopardize the continued existence of hawksbill, loggerhead, Kemp's ridley, or green sea turtles. The BO determined the action would have ***no effect*** on leatherback sea turtles due to lack of suitable habitat or regular occurrence within the action area. Conservation measures and an incidental take statement were issued for the four turtle species with the BO. Any dredging operations that would occur for ecosystem restoration would be subject to the conservation measures identified in the BO for regular maintenance dredging.

Implementation of the Action Alternative would have no effect on nesting loggerhead, green, hawksbill, and Kemp's ridley sea turtles because no work is proposed along the Gulf of Mexico shoreline. However, in-water construction activities could result in habitat avoidance, noise and visual disturbance, entrapment, and/or collision with any of the four species of sea turtles; thus, implementation of the Action Alternative is ***NLAA*** loggerhead, green, hawksbill, and Kemp's ridley sea turtles.

<u>Monarch butterfly</u>: Restoration work could potentially disrupt individual butterflies during pollinating or migrating activities. Implementation of the Action Alternative is ***NLAA*** monarch butterflies.

<u>Oceanic whitetip shark:</u> No restoration work would be completed in or near suitable habitat for Oceanic whitetip shark because they prefer deeper water on the outer continental shelf; thus, the Action Alternative would have ***no effect*** on this species.

<u>Giant manta ray</u>: The Giant manta ray can occupy estuarine waters, particularly along productive coastlines, with the ability to transit, forage, or seek refuge in the same areas as sea turtles. Although it is highly unlikely giant manta ray would be in the project area, it cannot be definitively ruled out. In-water construction activities could result in habitat avoidance, noise and visual disturbance, entrapment, and/or collision with giant manta ray, though these impacts would be expected to be discountable. Implementation of the Action Alternative is ***NLAA*** giant manta ray.

7.14.1 Texas State Listed Species

The impacts described in Section 7.13 Biological Communities would also apply to state-listed species under the No Action (Section 7.13.1 No Action Alternative) and Action Alternatives (Section 7.13.2 Action Alternative). In general, all species identified as occurring or potentially occurring in the action area are mobile and have the ability to avoid construction related impacts. Two species, green sea turtle and West Indian manatee, are slower moving but have a large home range. Conservation measures would be implemented (Environmental Appendix C) to avoid and minimize impacts to both species. The most detrimental impacts would be vessel strikes or entrapment in open water; though this is expected to be unlikely given the conservation measures to be implemented. For all species, the benefits of ecosystem restoration greatly outweigh any adverse impacts associated with construction. The proposed restoration would increase resource availability (i.e., habitat, food, shelter) and, subsequently, overall health and biodiversity of state-listed species.

7.14.2 Migratory Birds

7.14.2.1 No Action Alternative

Migratory birds are sensitive to environmental changes, such as increasing temperatures, vegetation change, habitat loss, and extreme weather conditions, that can lead to significant changes in preferred habitats of these birds. Species responses to environmental changes differ, in which shorter-distance migrators can often adapt to changes more easily, while longdistance migrators struggle with adjustments. The loss of critical stopover sites and breeding/wintering habitat can significantly alter annual migrations and overall survival of some migratory bird species through population declines, reduction in distribution, or potential extinction.

Under the No Action Alternative, the project area is expected to lose more habitat in response to RSLC and continued erosion, which would contribute to a region-wide loss of critical wetland habitat that are important for breeding, wintering, and stop overs of migratory birds. This loss of habitat is expected to have direct, long-term, moderately adverse impacts locally and beyond the project boundaries due to the nature of migratory bird behavior.

7.14.2.2 Action Alternative

Many important habitats in the study area provide migratory birds shelter, nesting, foraging, and roosting habitats. All adverse impacts to migratory birds would occur during construction activities and are expected to be direct, short-term, localized, and minor, as they are expected to cease post-construction. Restoration of marsh would result in an overall net increase in functional value and ultimately support larger populations of species of migratory birds, with the potential to also increase species diversity. This is expected to have direct, long-term, localized, moderate beneficial impacts locally and beyond the project boundaries.

During construction, there is the potential for harm and/or harassment of nesting migratory birds. Attempts would be made to conduct all restoration activities outside of the nesting season; however, this may not be possible due to the timing of dredge availability and the extended nesting season for some species. If construction occurs during nesting season, nest surveys should be completed prior to commencing work activities. If nests are identified, all construction activities should observe a 1,000-foot buffer of any colonial-nesting waterbird colonies (e.g., egrets, herons, ibis); a 1,300-foot buffer for any shorebird nesting colonies (e.g., terns, gulls, plovers); and a 2,000-foot buffer for any brown pelican nesting colonies near the restoration location. Coordination with the USFWS should be completed prior to construction if nesting has been identified and USFWS guidelines should be followed to avoid adverse impacts to these species. By implementing these conservation measures there should be no adverse effects to migratory birds.

The Action Alternative is subject to comply with the Migratory Bird Treaty Act and Executive Order 13186, *Responsibility of Federal Agencies to Protect Migratory Birds*.

Overall, it was determined that the **beneficial** and **adverse** impacts to migratory birds from implementing the No Action or Action Alternatives would be **less than significant** (Table 37).

Table 37: Summary of the environmental consequences of alternatives on migratory birds in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Beyond project boundaries	Moderate	Adverse
Action	Direct	Long-term	Localized; Beyond project boundaries	Moderate	Beneficial
	Direct	Short-term	Localized	Minor	Adverse

7.14.3 Essential Fish Habitat

7.14.3.1 No Action Alternative

Impact to EFH and Federally managed species would be similar to those described in Section 6.13.1 No Action Alternative. Under the No Action Alternative, continued breach, and degradation of the containment dikes, exacerbated with rising sea levels, would introduce new and widen existing pathways for Federally managed species to use the open water within the project area. However, most of this habitat will convert to less productive mud bottom and essentially extend the surface area of open water in the M-A estuary system. With these conditions, the adverse effects are anticipated to be direct, long-term, localized, and minor.

7.14.3.2 Action Alternative

The Action Alternative would convert open water to estuarine marsh (marsh edge, submerged aquatic vegetation [SAV], marsh ponds, and inner marsh EFH). Construction activities using earthen material to create marsh would bury existing EFH substrates and temporarily change environmental conditions, including increased turbidity, total suspended sediments, and water temperatures, as well as lower dissolved oxygen levels in the water column. These effects are expected to be direct, short-term, localized, minor, and adverse as the area would be expected to return to baseline conditions following completion of dredging and construction activities. However, this does not apply to the marsh restoration area because a different type of EFH would be formed.

Estuarine emergent wetland would be the primary EFH that would significantly increase under the Action Alternative. This habitat would be created in shallow-open water areas, creating 39 acres of emergent marsh habitat. SAV is also expected to increase in parts of the restoration area; however, this would be limited by depth and turbidity. Increase in SAV would benefit post-larval/juvenile and subadult brown shrimp; post-larval/juvenile and subadult white shrimp; post-larval/juvenile and adult red drum; and adult gray snapper.

The creation of estuarine emergent wetlands would result in the loss of mud bottoms and estuarine water column as emergent marsh would replace those habitat types. Loss of mud bottom EFH could result in negative impacts to subadult brown shrimp; juvenile and sub-adult pink shrimp; juvenile, sub-adult, and adult white shrimp; larval red drum; and juvenile lane snapper. Although adverse impacts would occur to some types of EFH, these are expected to be direct, short-term, localized, and minor. The benefits of creating more productive EFH is expected to be direct, long-term, localized, and moderate, and would likely supersede any adverse impacts of reducing open-water EFH.

As part of the MSFMA, any Federal agency that authorizes, funds, or undertakes, or proposes to authorize, fund, or undertake any activity which could adversely affect EFH is subject to the consultation provisions of the Act and identifies consultation requirements (50 CFR Sections 600.805-600.930). This DDPR/EA was prepared to serve as the EFH assessment.

Overall, it was determined that the **beneficial** and **adverse** impacts to EFH from implementing the No Action or Action Alternatives would be **less than significant** (Table 38).

Table 38: Summary of the environmental consequences of alternatives on EFH in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized	Minor	Adverse
Action	Direct	Long-term	Localized	Moderate	Beneficial
	Direct	Short-term	Localized	Minor	Adverse

7.14.4 Marine Mammals

7.14.4.1 No Action Alternative

Under changing future climatic conditions, a shift in the distribution of common bottlenose dolphins is possible as temperatures and habitats change, accompanied by a shift in the distribution and abundance of prey species. There are also likely to be changes in the distribution of pathogens, so naïve populations may be exposed to new diseases. The impacts of climate change on common bottlenose dolphin populations will depend on their ability to adapt to change and on the continued availability of suitable resources and habitat available for the dolphins and their prey. It is assumed that any future dredging or in-water work would comply with the MMPA, which prohibits take of marine mammals and if adverse impacts are possible, mitigation would occur to minimize or compensate for the impacts.

7.3.1.2 Action Alternative

Impacts to marine mammals from implementation of the Action Alternative could occur during in-water activities such as construction/deconstruction of dredged material transport pipes, operations of watercraft and heavy equipment, etc. These impacts could include habitat avoidance, exposure to underwater sound, and visual disturbances, which would cease after construction is completed. The most extreme impact could include entrapment and/or collision with pipes, silt barriers, pumps, placement equipment, or other construction equipment. Although this is unlikely due to the relatively low occurrence rate of bottlenose dolphins and extremely rare occurrence of West Indian manatee in the project area, additional measures would be incorporated into the plan to avoid potential incidental harassment and take of marine mammals.

- Qualified biologists would monitor the presence of marine mammals during phases which involve open water areas capable of supporting marine mammals.
- Prior to activities occurring in open water, a 50-foot radius of the work area should be delineated. If any marine mammal is observed within this radius, the biological monitor shall halt construction activities, including shutting down any running equipment until the animal has moved beyond said radius, either through sighting or in the absence of sighting, by waiting approximately 15 minutes.
- If silt barriers are used, they will be made of material that cannot entangle marine mammals, should be properly secured, and regularly monitored to avoid mammal entrapment.

Implementation of the Action Alternative could result in direct, short-term, localized, minor, adverse impacts on marine mammals, but impacts are not anticipated to result in takes. The Action Alternative would not result in long-term adverse or beneficial impacts to marine mammals. The action is not expected to reduce the food base, block, or limit passage to or from biologically important areas, or permanently destroy habitat of marine mammals. The anticipated impacts are not expected to be significant or result in the need for NOAA to issue an Incidental Take Authorization, especially with the incorporation of the mitigation measures listed above. Typical actions which require permits from NOAA include those that involve military sonar and training; oil and gas development, exploration, and production; geophysical surveys for renewable energy and scientific research; and pile driving associated with construction projects. None of these activities are proposed in the Action Alternative.

Overall, it was determined that the **adverse** impacts to marine mammals from implementing the Action Alternative would be **less than significant** (Table 39).

Table 39: Summary of the environmental consequences of the Action Alternative on marine mammals in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct	Short-term	Localized	Minor	Adverse

7.15 Cultural Resources Impacts

The Recommended Plan includes the use of dredged material from the GIWW to fill two existing marsh cells at Goose Island State Park to a low elevation marsh. Two new cells would be constructed to the north of the existing cells and include a fill material for a new containment berm and low elevation marsh.

There is a potential for the recommended plan to impact historic properties. The proposed construction activities will be the use of dredged material to improve and construct marsh cells to the north of Goose Island State Park. These effects consist of direct impacts from dredged material placement, specifically disturbance of the bay bottom. Dredged material for these activities will come from existing USACE Operations and Maintenance of the GIWW. Due to the uncertainty of the location of the shipwreck *Lizzie Baron* and potential for other submerged archeological resources to occur, it is recommended that a marine archeological investigation be conducted for the new construction areas (marsh cells 3 and 4). These investigations will be conducted prior to construction during the U.S. Army Corps of Engineers PED phase. The scope of these investigations will be determined in consultation with the Texas State Historic Preservation Officer, Tribal Nations, and the Texas Parks and Wildlife Department and in accordance with the Programmatic Agreement for this project.

7.16 Socioeconomics/Economics

Socioeconomic impacts are assessed in terms of direct effects on the local economy and populations, and related indirect effects on other socioeconomic resources within the study area or adjacent to the study area. Socioeconomic impacts would be considered significant if the alternative resulted in a substantial shift in population trends or notably affected regional employment, earnings, or community resources such as schools.

7.16.1 No Action Alternative

No loss in revenue is expected under the No Action Alternative.

7.16.2 Action Alternative

Construction activities would be expected to beneficially affect the local economy directly by temporarily (short-term) increasing economic activity in the construction sector. Temporary increases in employment, income, business activity, and local tax revenues would be anticipated in years in which construction would occur. No permanent change in population or demand on local public services would be expected because of implementing the Action Alternative.

Many local communities value recreation and depend on recreation activities as a source of income. No negative impacts associated with reduced recreation, in particular fishing, kayaking, boating, and hiking opportunities, are anticipated as public access to Goose Island State Park would be maintained.

Because children may suffer disproportionately from environmental health and safety risks, Executive Order 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, was issued on April 21, 1997, to help ensure that federal agencies' policies, programs, activities, and standards address environmental health and safety risks to children. Implementing the Action Alternative is not expected to disproportionally affect children due to the remoteness of the project areas relative to the nearest schools and residences (22 miles away) and the overall benefit of ecosystem restoration to the environment and the communities nearby.

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, addresses concerns over disproportionate environmental and human health impacts on minority and low-income populations. The impetus behind environmental justice is to ensure that all communities, including minority, low-income, or federally recognized tribes, live in a safe and healthful environment and that no group of people including racial, ethnic, or socioeconomic, should bear a disproportionate share of the negative consequences resulting from the execution of federal, state, local, and tribal programs, and policies. The goal of fair treatment is not to shift risks among populations, but to identify potential disproportionately high and adverse effects and identify alternatives that may mitigate these effects.

No populations or communities in the study area or at the county level meet the criteria for identification of minority or low-income populations under the CEQ Environmental Justice Guidance; however, a small portion of the population in the census tract meet the criteria for low-income. The Action Alternative proposes ecosystem restoration of the local state park which has an important beneficial impact on socioeconomic characteristics of a region. Because of the overall benefits of ecosystem restoration to the environment and nearby communities, implementation of the Action Alternative is not expected to result in a disproportionately high or adverse impact on minority or low-income populations.

Overall, it was determined that the **beneficial** impacts to socioeconomics/economics from implementing the Action Alternative would be **less than significant** (Table 40).

Table 40: Summary of environmental consequences of the Action Alternative on socioeconomics/economics in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
Action	Direct	Short-term	Localized	Minor	Beneficial

7.17 Noise, Aesthetics and Recreation

7.17.1 No Action Alternative

Under the No Action Alternative, erosion would result in the loss of the limited available marsh habitat currently present in the project area. The loss of habitat may be visually unappealing for recreationalists who often expect to view coastal wetlands at the state park. The impact to noise, aesthetics, and recreation under this alternative is expected to be direct, long-term, localized, minor, and adverse due to the loss of habitat.

7.17.2 Action Alternative

Impacts associated with dredging and construction activities include visibility of construction disturbances, constructed structures, and temporary roads. Vegetation clearing and/or placement of dredged material over existing vegetation would present an obvious contrast in color with the surrounding area.

Direct, short-term, localized, minor, adverse impacts on the aesthetic and recreational value of the area from construction and ground disturbance is certain; however, the level of impact, by nature, is subjective and difficult to quantify. Short-term impacts may occur where construction-related equipment, activities, and dust could be visible to observers. Impacts would be anticipated in years in which construction is implemented and would realize only temporary aesthetic degradation until the disturbed area blends in with the surrounding environment, at which time, the aesthetic value of the area would be improved over the existing condition.

For marsh restoration, obvious aesthetic changes from the surrounding environment would remain until vegetation has established and the system has begun to function as designed. Temporary placement of training berms, staging areas, and access roads would be visually obvious until use of these areas is discontinued, and the area is restored, or the structure is removed. Natural restoration would be expected to occur over a period of a couple of years as compared to areas that are assisted with restoration which could take as few as a couple of months. As restoration proceeds, aesthetic degradation would decrease as the disturbed surface begins to blend in color, form, and texture. In general, restoration measures would be direct, long-term, localized, and minorly beneficial to the aesthetic value of the area and pleasing to observers.

During the period of construction, recreationists at Goose Island State Park or adjacent waters may experience an increase in noise from operation of equipment that could impact their ability to seek solitude or may reduce the success of wildlife-dependent recreation activities. Additionally, as a public safety measure, boating would be prohibited near the operating construction equipment and sediment placement locations. Recreational access and opportunities would return to preconstruction conditions following completion of the project and not result in any long-term beneficial or adverse impacts.

Overall, it was determined that the **beneficial** and **adverse** impacts to noise, aesthetics, and recreation from implementing the No Action and Action Alternatives would be **less than significant** (Table 41).

Table 41: Summary of the environmental consequences of the alternatives on noise, aesthetics, and recreation in the project area.

Alternative	Type of impact	Duration of impact	Geographic extent	Magnitude/intensity	Quality
No Action	Direct	Long-term	Localized	Minor	Adverse
Action	Direct	Short-term	Localized	Minor	Adverse
	Direct	Long-term	Localized	Minor	Beneficial

7.18 Hazardous, Toxic, and Radioactive Waste

7.18.1 No Action Alternative

A records review evaluating records, maps, and other documents that provide environmental information was conducted to investigate and identify current environmental conditions for the project site. The results are summarized as follows:

Federal NPL and Delisted NPL – The records search did not reveal any NPL nor delisted NPL sites in the project footprint or adjacent areas. This is based on a search of the EPA Superfund NPL list within a 1-mile radius of the site.

Federal SEMS – formerly called the Comprehensive Environmental Response, Compensation, and Liability Information System (CERCLIS), the SEMS database tracks hazardous waste sites where remedial action has occurred under the EPA's Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This list also includes sites that are in the screening and assessment phase for possible inclusion on the NPL. The records search of EPA's listed SEMS sites did not reveal any sites in the project footprints or adjacent areas within a 0.5-mile radius of the site.

Federal SEMS archive – The SEMS archive, formerly known as the No Further Remedial Action Planned (NFRAP) List, tracks sites where no further remedial action is planned, based on available assessments and information. The list also represents sites that were not chosen for the NPL. Further EPA assessment could possibly be ongoing, and hazardous environmental conditions may still exist; however, in the absence of remedial action and assessment data, no determination about environmental hazards can be made. The records search did not reveal any NFRAP sites within the project footprint or adjacent areas. This is based on a search of the EPA SEMS archive within a 0.5-mile radius of the site.

Federal RCRA Corrective Action facilities list – The records search of EPA's Cleanups in My Community did not reveal any sites within one mile of the project search area. This is based on a search of the EPA Cleanups in My Community website within a 1-mile radius of the site.

Federal RCRA TSD facilities list – The records search of EPA's RCRA Info website did not reveal any sites within 0.5 mile of the project search area.

Federal RCRA generators list – The records search of EPA's RCRA Info website did not reveal any sites at the project site nor at the properties adjacent to the project site.

Federal institutional control/engineering control registries – The records search of EPA's Cleanups in My Community did not reveal any sites within one mile of the project search area. This is based on a search of the EPA Cleanups in My Community website within a 1-mile radius of the site.

State Superfund Sites (equivalent CERCLA and NPL) – This search is to check for any state CERCLA sites in the project vicinity. The records search of state CERCLA cleanup sites did not show any sites of concern in the project or adjacent areas. This search is based on a search of the TCEQ Superfund Sites database within a 0.5-mile radius.

State and Tribal Solid Waste Facilities/Landfill Sites – This search is designed to check any state or tribal databases for solid waste handling facilities or landfills in the project vicinity. The records search did not find any solid waste facilities or landfill sites in the area of this project or adjacent areas. This is based on a search of the TCEQ Municipal Solid Waste Viewer. No sites were found within 0.5-mile of the subject property area.

State and Tribal UST and Leaking UST – This list is a combination of the State of Texas registered UST database and the US EPA UST database, representing sites with storage tanks registered with the State of Texas. No registered storage tanks are registered for the subject property nor the immediately adjoining properties. No USTs were identified within 0.5-mile of the TCEQ Petroleum Storage Tank Viewer.

State and Tribal Voluntary Cleanup Sites – The TCEQ Voluntary Cleanup Program (VCP) database identifies sites where the responsible party chooses to clean up the site themselves with TCEQ oversight. No sites were identified within 0.5 mile of the project based on a search of the TCEQ Voluntary Cleanup Program using the Central Registry (CR) Query within 0.5-mile of the subject property area.

State and Tribal Brownfields List – A brownfield is a property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. There are no brownfield sites within 0.5 mile of the project site. These results are based on a search for Brownfields sites within 0.5-mile of the subject property area using the EPA Cleanups in My Community search engine.

Texas RRC GIS Viewer for Oil and Gas Wells – A search of the oil and gas wells in the area using the RRC website identified multiple sites including oil wells, plugged oil wells, and injection/disposal sites within the surrounding area. Although not classified as HTRW under USACE regulations, pipelines, and oil wells play an important role in the HTRW existing conditions near the potential project area. This is because the well and/or pipeline contents could potentially leak or spill into the surrounding environment or affect the proposed project features. The RRC website was used to map these findings. Two dry holes were drilled within the site footprint and one plugged gas well was found northwest of the site footprint, as well as natural gas and crude oil pipelines in the area shown in Figure 2 of the HTRW Appendix B. The location of pipeline infrastructure to the north of the site, in particular those labeled as natural gas and horizontal lines, should be coordinated with the selected alternative as the project moves to a design phase. Additional details and information can be found in the Hazardous, Toxic and Radioactive Waste Appendix B.

7.18.2 Action Alternative

In an HTRW analysis, there were no recognized environmental issues found that would cause concern with the site and the recommended action alternative. For situation awareness, several oil/gas pipelines were identified that should be noted to avoid during construction. This was determined by searching numerous databases for various environmental events such as oil spills, regulated storage tanks, and former landfills.

8. Project Risks

8.1 Cost Risks

Cost risks are reflected through the Cost Contingency, which is determined for each project based upon the specific likelihood of cost increases before construction. The PDT completed an ARA which estimated 26% contingency for this effort. Although the ARA captures cost uncertainty, the current inflationary climate and high fuel cost, the construction risk for BUDM is somewhat compounded by its dependence upon O&M dredging, which always requires prioritization of O&M needs in excess of the available O&M budget. Recent BUDM challenges have arisen due to its dependence upon O&M constraints such as contractual demands, available dredge equipment and changing District and agency priorities. For additional information please reference the Cost Engineering Appendix F.

8.2 Physical Condition Risks

Project success will be dependent upon physical conditions in the study area before, during, and after construction. An adaptive management plan and monitoring will be provided to anticipate and mitigate potential risks to restoration success.

8.3 Sensitive Resources Risks

Special aquatic sites are protected under EPA's 404(b)(1) regulations and include vegetated shallows, communities that supported rooted aquatic vegetation, such as seagrasses (40 C.F.R. §230.43). Seagrass presence was confirmed during a field visit conducted August 2022 located between the existing containment dikes and breakwater. Local experts from resource agencies are uncertain of the quantity or extent of seagrass around and near that area. The most recent seagrass surveys were conducted by TPWD in 2003 prior to the construction of the breakwater. During preconstruction engineering and design (PED), seagrass surveys would need to be completed to avoid smothering or destruction of these sensitive resources.

Oyster reefs are important habitat for a variety of species such as forage fish, invertebrates, and other shellfish, and provide nursery habitat for commercially valuable species such as blue crab (*Callinectes sapidus*), Southern flounder (*Paralichthys lethostigma*), Penaeid shrimp, and Spanish mackerel (*Scomberomorus maculatus*). Oysters are vital to regulating ecosystem health through their water filtering capabilities (NOAA 2022a). Additionally, oysters can reduce risks from storms, tidal fluctuations, and prevent erosion of productive estuaries. Oyster reefs are present near Goose Island State Park and should be avoided during restoration activities. Oyster surveys would need to be completed during PED to avoid smothering or impacting these sensitive resources.

There are no previously recorded cultural resources within the proposed alternatives. However, all alternatives have a potential to affect historic properties within the proposed project footprint. There is a moderate probability for terrestrial and/or marine archeological resources to occur. The need for a pedestrian and marine archeological survey will be determined in consultation with the Texas SHPO and Tribal Nations in compliance with the National Historic Preservation Act of 1966, as amended (54 U.S.C. § 306108) (NHPA). For additional information, please reference the Cultural Resources Analysis in the Environmental Appendix C.

8.4 Implementation Risks

Project implementation risks include:

- Active or abandoned pipelines have not been identified.
- Active or abandoned buried cables have not been identified.

9. Recommended Plan

The plan formulation process developed a progression of Alternative 3 to include: marsh restoration alone (Alternatives 3A), marsh restoration with living shoreline (Alternatives 3B), creation of marsh with variable elevations (Alternatives 3C and 3D), and a combination of all techniques (Alternative 3E).

Alternative 3D was recommended as the TSP after evaluation of the alternatives' ability to meet the objectives of the project and the comparative performance of the plan in terms of ecological lift, sustainability of the measure over time, and cost effectiveness.

Alternative 3D is the Recommended Plan which proposes beneficially using dredged material to restore saline marsh habitats and create resiliency against RSLC. It is assumed all sediment needs for implementation would come from material dredged from the GIWW. The sediment needs would be met using existing O&M dredging and would not induce additional dredging beyond the Authorized Depth Alternative 3D was identified as the best buy plan in the CE/ICA.

Evaluation of smaller increments of marsh restoration (Alternatives 3A and 3C) were found to be viable refinements should the dredge volume be lower than the volumes needed for the Recommended Plan. Alternatives 3A and 3C were determined cost effective during the CE/ICA. Alternative 3B was the only non-cost-effective plan in the CE/ICA. Therefore, after consideration of the ecological lift, the sustainability of the effort, and the navigational opportunity to create an opportunity for placement of dredge material in proximity of the channel, the screening analysis confirmed that Alternative 3D most effectively achieves the study objectives. The GLO and DU have identified Goose Island as a priority for marsh restoration in a regional effort to combat land loss, build coastal resiliency, and restore natural ecosystems of the Texas coast, and are in support of Alternative 3D as the Recommended Plan. Alternative 3D is consistent with proven best practices of the USACE and conservation agency efforts and satisfies the objectives of CAP Section 204.

10. Environmental Operating Principles

The Recommended Plan, Alternative 3D, supports the USACE Environmental Operating Principles. These principles are consistent with the NEPA, the WRDA, and other environmental statutes that govern USACE projects and activities. All disciplines of the project team, including Non-Federal stakeholders, complied with policy and statutory law in formulating the Recommended Plan. Science was employed to formulate economic, social, and environmentally sustainable solutions while using risk management considerations for the project life cycle. The Recommended Plan and its selection process will be provided to the public for review.

The environmental operating principles employed in this project include, but are not limited to:

- Foster sustainability as a way of life throughout the organization.

- Proactively consider environmental consequences of all USACE activities and act accordingly.
- Create mutually supporting economic and environmentally sustainable solutions.
- Continue to meet our corporate responsibility and accountability under the law for activities undertaken by the USACE, which may impact human and natural environments.
- Consider the environment in employing a risk management and systems approach throughout the life cycles of projects and programs.
- Leverage scientific, economic, and social knowledge to understand the environmental context and effects of USACE actions in a collaborative manner.
- Employ an open, transparent process that respects views of individuals and groups interested in USACE activities.

11. Key Social and Environmental Factors and Mitigation Actions

11.1 Stakeholder Perspectives and Differences

In accordance with NEPA, 42 U.S.C. 4321 et seq., the draft DPR/EA was published January 2023 for a 30-day public comment period. The USACE accepted written public comments from January 19 to February 19, 2023. During the comment period, the USACE received one comment from TPWD. The comment read as follows:

> *There is concern for direct impacts to fish and aquatic life during dredged material placement activities. Since openings have been cut into the existing containment berms, fish and aquatic life have likely used these openings for ingress and egress. Similar activities in 2008 resulted in impacts to fishery resources including recreationally important species such as southern flounder (Paralichthys lethostigma), sheepshead (Archosargus probatocephalus), black drum (Pogonias cromis), and red drum (Sciaenops ocellatus). The draft EA states that adverse impacts would be minimized and controlled by implementing the best available practical techniques and BMPs during construction. However, the draft EA does not identify specific best available practical techniques and BMPs that will be implemented to help minimize these impacts. If mortalities are deemed excessive by TPWD Coastal Fisheries Division, contractors may be required to pay restitution for those mortalities. TPWD recommends that USACE and/or the contractors coordinate with the TPWD Kills and Spills Team to develop the practical techniques and BMPs necessary to minimize impacts.*
>
> *The draft EA states that habitat surveys will be done prior to construction. Because there is potential for special aquatic sites to establish between now and then, TPWD recommends that the final design include some built-in contingency plans and/or adaptive management strategies which aim to retain the proposed acreage of the BU project to the extent practicable.*
>
> *We look forward to continued coordination on this proposed project.*

In response, the USACE will commit to working with TPWD during PED to design the project in such a way as to avoid injury and loss of aquatic resources as much as possible. The USACE held a meeting with TPWD Kills and Spills on April 13, 2023, to discuss potential BMP's and considerations for dredged material placement during PED. TPWD expressed support for employing techniques that could remove aquatic resources, particularly fish, from the project site prior to dredge material placement and construction of new containment dikes. This could include, but is not limited to, hazing fish (e.g., net deployment, silt boons) to remove them from the area and/or removing fish access to the cells prior to construction. It is likely a combination of techniques could be used to effectively reduce impacts to aquatic resources during construction. The USACE will coordinate with resource agencies, including the TPWD Kills and Spills Team, during PED to select the best options before construction.

11.2 Agency Consultation and Coordination

The USACE consulted with other federal and state agencies and non-profit organizations to gather input on the proposed project and to inform development of the alternatives described in this report. These consultations helped ensure environmental compliance and maximized information input and collaboration when developing the criteria and measures for evaluating the action alternatives. The agencies consulted for this project included NMFS, USFWS, TCEQ, TWDB, TPWD, GLO, and DU.

Virtual meetings were held to formulate alternatives, address environmental concerns, maximize resource benefits, and discuss ecological modelling results. A meeting with representatives from the USACE, NMFS, USFWS, TPWD, and DU was held on September 7, 2022, to examine the values of the variables in the ecological model for the existing conditions, FWOP, and FWP conditions.

A collaborative discussion was undertaken for each variable including the FWOP and FWP conditions. Concurrence by all representatives were required before model outputs were accepted. The model assumptions are described in Appendix C-1 of the Environmental Appendix and were shared during the meeting to determine variable scores. These data helped inform decisions during modelling efforts.

The GLO will require a lease for use of state-owned submerged lands for construction of the containment dikes and marsh cells. In addition, the GLO will require that a Coastal Boundary Survey be completed prior to issuance of the lease.

Based on recommendations from USFWS's PAL, the USACE will provide final design documents during PED that outline the staging areas, pipeline, and access routes in addition to any natural resource surveys implemented during that phase. If oyster shell or seagrasses are identified during those surveys, the USFWS will provide additional guidance and recommendations to address protection of these resources. Additionally, the USACE commits to following the recommendations as outlined in the PAL to ensure adequate protection and reduction of impacts to important aquatic resources during construction of this project. Additional recommendations can be found in the PAL in Appendix C.

11.3 Environmental Compliance

Compliance with the NHPA requires the consideration of effects of the undertaking on all historic properties in the project area and development of mitigation measures for those adversely affected properties in consultation with the SHPO and Tribal Nations. It has been determined that there is a potential for new construction, improvements to existing facilities, and maintenance of existing facilities to cause effects to historic properties. The Texas SHPO has responded that there is a potential to affect historic properties and are requiring a marine survey of submerged portions of the project area. The USACE is in the process of executing a Programmatic Agreement between the Texas SHPO and possibly TPWD.

Compliance with NEPA requires the consideration of effects of the proposed action on environmental resources in the project area prior to making decisions. Under the NEPA process, the environmental and related social and economic effects of the proposed action must be evaluated, in which, an opportunity for public review and comment is provided. As such, an environmental assessment will describe the expected outcomes of the proposed action on environmental resources, including their level of significance, magnitude, and expected duration. The environmental assessment is integrated into the project report and released for public review.

It was determined the proposed action may affect threatened and endangered species potentially occurring in the action area, thus a biological assessment was prepared. Informal consultation with the USFWS and NMFS was initiated on January 23, 2023. The USACE received notification from NMFS on February 27, 2023, to resubmit the consultation request in their expedited format, which was completed on March 7, 2023. The USFWS provided their concurrence letter to the effects determinations described in the BA on April 5, 2023, and is included in the Environmental Appendix C. The NMFS concurred with the USACE's effects determinations in a letter provided on July 11, 2023.

Additionally, the project must meet water quality standards; thus, TCEQ was notified of the project following the TSP meeting and later requested for certification of the project. The TCEQ provided a letter certifying there is reasonable assurance that the proposed action would be conducted in a way that would not violate water quality standards.

The proposed action must comply with the Coastal Zone Management Act, as such a consistency determination was submitted to the GLO. The USACE received a response letter from the GLO on March 24, 2023, stating "at this phase, the proposed measures are generally consistent with the Texas Coastal Management Program". However, detailed information about the project design and construction is set to be determined during PED, thus, the GLO evaluated the consistency determination under the provisions of NOAA's federal consistency regulations for phased consistencies per 15 CFR 930.36(d). The USACE commits to continue working with the GLO as more details are made available about specific measures during PED to reach full consistency with the CZMA prior to construction. For the purpose of this report, compliance for CZMA was met with the understanding the future coordination with the GLO is necessary during PED.

Table 42 summarizes the Environmental Compliance for this study. For additional information, please reference the Environmental Appendix C.

Table 42: Environmental Compliance

Policies	Compliance Status	Notes
Public Laws		
Abandoned Shipwreck Act of 1988, as amended	Not Applicable	
Archeological and Historic Preservation Act of 1974, as amended	Not Applicable	
Bald and Golden Eagle Protection Act of 1940, as amended	Compliant	Section [Alt 3D Migratory Birds], Appendix C
Clean Air Act of 1970, as amended	Compliant	Section [Alt 3D Air Quality],
Clean Water Act of 1972, as amended	Compliant	Appendix C
Coastal Barrier Resources Act of 1982, as amended	Not Applicable	
Coastal Zone Management Act of 1972, as amended	Compliant	Appendix C
Endangered Species Act of 1973, as amended	Compliant	Section [Alt 3D T&E], Appendix C
Farmland Protection Policy Act of 1981	Not Applicable	
Fish and Wildlife Coordination Act of 1934, as amended	Compliant	Appendix C
Magnuson-Stevens Fisheries Conservation and Management Act of 1976, as amended	Compliant	Section [Alt 3D EFH], Appendix C
Marine Mammal Protection Act of 1972, as amended	Compliant	Section [Alt 3D Marine Mammals]
Marine Protection, Research, and Sanctuaries Act of 1972, as amended	Not Applicable	
Migratory Bird Treaty Act of 1918, as amended	Compliant	Section [Alt 3D Migratory Birds]
National Environmental Policy Act of 1969, as amended	Compliant	Appendix C
National Historic Preservation Act of 1966, as amended	Compliant	Section [Alt 3D Cultural], Appendix C
Native American Graves Protection and Repatriation Act of 1990	Not Applicable	

Policies	Compliance Status	Notes
Rivers and Harbors Act of 1899, as amended	Compliant	Section [Federal Navigation Project]
Wild and Scenic Rivers Act, as amended	Not Applicable	
Executive Orders		
Environmental Justice (E.O. 12898)	Compliant	Section [Alt 3D Socioeconomics]
Flood Plain Management (E.O. 11988)	Compliant	Section [Alt 3D Hydro]
Protection of Wetlands (E.O. 11990)	Compliant	Section [Alt 3D Habitats]
Protection of Children from Environmental Health Risks (E.O. 13045)	Compliant	Section [Alt 3D Socio]
Invasive Species (E.O. 13751)	Compliant	Section [Alt 3D Wildlife/Fisheries]
Migratory Birds (E.O. 13186)	Compliant	Section [Alt 3D Migratory Birds]

11.3.1 Feasibility Level Evaluation of Dredged Sediment

In order to complete a feasibility level evaluation of dredged sediment quality for the GIWW BUDM project, data of the sediment proposed for placement at the selected site is needed to determine suitability and compliance with EPA and TCEQ regulations. Data for sediment that may be used for this project was identified but is older than 5 years and is beyond the limit imposed by the US Environmental Protection Agency (US EPA) Region 6 and USACE Galveston and New Orleans District Regional Implementation Agreement of July 2003. It is recommended that a sampling plan be developed that would provide chemical analysis of sediment that could be used to determine the sediment quality of the dredged material and elutriate data. Dredging operations agitate sediment that can contain contaminants and cause the release these contaminants to the water (dissolved) and re-suspension of fine sediment that may contain absorbed contaminants at both the dredge location and the placement area. Thus, a sampling plan would also provide elutriate data that would ensure that the placement aspect of the dredging operation is compliant with federal (e.g., Clean Water Act or CWA) and state regulations (Environmental Appendix C).

12. Cost and Cost Sharing

12.1 Project Costs

Under Section 204 authority, each project is limited to a Federal cost of not more than $10 million, which refers to the incremental cost over the Base Plan. Funding was prepared in accordance with the scope for required tasks to complete the report. It focuses on the critical determinations and disciplines to determine existing conditions and formulation of potential solutions to meet customer needs and deliver in an expedite fashion.

A Total Project Cost Summary was prepared for the Recommended Plan (Cost Engineering Appendix F). The summary consists of estimated cost, project first cost and total project cost and includes contingency and escalation/inflation for the project. The total project first cost for Alternative 3D is $10,219,000. The feasibility study cost is approximately $552,000. Project costs were originally certified by the Walla Walla Cost MCX on 2023 March 3. Project costs were updated to current FY24 Price Levels. The project cost estimate summaries and additional details are provided in Appendix F – Cost Engineering.

Alternative 3D was selected as the TSP and is the Recommended Plan. Table 43 contains the costs of Alternative 3D including the base plan/Federal Standard. Base plan cost varies per alternative, because base plan dredge quantities match dredge quantities needed per alternative. Each alternative requires a different quantity of dredged material. A summary comparing all the alternatives and their costs can be found in Appendix F.

Table 43: Project First Cost Summary

Account	Construction Item	Cost
01	Lands and Damages	$805*
06	Fish and Wildlife Facilities	$2,425
12	Navigation, Ports & Harbors	$5,272
30	Planning, Eng. & Design	$1,082
31	Construction Management	$634
Project First Cost		$10,219
	Base Plan, FWOP	*-$3,761*
Incremental Project First Cost		$6,458

October 2023 Price Levels, Price in $1,000s, 26% Contingency
*Due to a change in the NFS on 25 September 2023, the costs for Lands and Damages are expected to be reduced and will be finalized at the PPA. Please see and Appendix D Real Estate Plan for further details.

12.2 Project Cost Sharing

Based upon the Project First Costs shown in Table 44, the Non-Federal share is approximately $2,259,000 and the Federal share is $7,958,000 ($4,197,000 for beneficial use placement and $3,761,000 for base plan dredging). The cost of the feasibility phase was $552,000 which was paid entirely by USACE. The grand total for real estate costs are currently shown to be $844,000 for Alternative 3D (Real Estate Appendix D). These are expected to be reduced to about $180,000 due to a change in the NFS to The State of Texas: Aransas County. The revised real estate costs are expected to be all administrative in nature and no acquisitions are anticipated. More details are found in the Real Estate Plan, Appendix D.

Table 44: Cost Share of Project First Costs

Item		Project First Costs			
		Base Plan	Federal Cost	Non-Federal Cost	Account Total
01	Lands and Damages	*$0.0*	$0.0	$805	**$805**
02	Relocations	*$0.0*	$0.0	$0.0	**$0.0**
06	Fish and Wildlife Facilities	*$0.0*	$2,099.6	$325.4	**$2,425**
12	Navigation Ports and Harbors	*-$3,170*	$1,366.3	$735.7	**$5,272**
30	Planning, Engineering, and Design	*-$328*	$490.1	$263.9	**$1,082**
31	Construction Management	*-$264*	$241	$129	**$634**
PROJECT FIRST COST TOTAL: $10,219		$3,761	$4,197	$2,259	**$10,219**

October 2023 Price Levels, Price in $1,000s, Slight Rounding in Total Approximations
Base Plan costs subtracted from Account Total prior to Cost Share 65/35 split calculations resulting in the Federal and Non-Federal costs.

13. Real Estate Requirement

This Real Estate Plan (REP) is prepared based on specific data from the USACE, Galveston District PDT for the GIWW BUDM CAP 204 Study. However, this plan is tentative in nature and intended for planning purposes only. Some modifications to the recommended plan could occur and change the determinations of real property lines, estimates of values, and rights required for the project, etc. as outlined in this plan, even after final report approval. The level of detail provided in this REP is understood to be equivalent to the other PDT disciplines. A detailed Real Estate Summary is provided within Appendix D, the Real Estate Plan. Additional information regarding the NFS change and associated Real Estate updates can be found in Appendix D as well.

14. Project Implementation

Upon approval of the final report, the NFS will enter into a Project Partnership Agreement (PPA) with The Department of The Army. The State of Texas: Aransas County, and the Texas General

Land Office (GLO) are fully supportive of the recommended plan and have actively participated in the feasibility study.

Construction of the recommended plan requires no additional Congressional authorization. Public Law 115-123 provides, “that a project that is studied using Supplemental investigations funds is eligible for implementation using Construction funds provided in that Act if the Secretary determines that the project is technically feasible, economically, justified, and environmentally acceptable”. Implementation of the project depends on approval of this report and Project Partnership Agreement executed between the U.S. Army Corps of Engineers and the NFS.

A Project schedule has been developed based upon the assumption that this Supplemental Report will be approved by or before September 26, 2024. The Project schedule sequences design and construction activities to allow immediate execution of the plan beginning in FY2026. The development of this schedule assumes Federal funding is available in the years required and that the real estate actions are completed on schedule.

The recommended schedule reflects the information currently available and the current departmental policies governing execution of projects. It does not reflect program and budgeting priorities inherent in either the formulation of a national civil works construction program or the perspective of higher review levels within the Executive Branch. Consequently, the schedule recommended may be modified before it is transmitted to higher authority for implementation funding. Assuming funding availability, construction completion is planned for FY2026.

15. Recommendation

I recommend that the Aquatic Ecosystem Restoration plan as generally described in this Detailed Project Report and Integrated Environmental Assessment, be implemented under the Authority of Section 204 of the Water Resources Development Act of 1992, as amended, Regional Sediment Management (Beneficial Use of Dredged Material), with such modifications as within the discretion of the appropriate authority may be deemed advisable.

Alternative 3D is the Recommended Plan for this study. This alternative best achieves the study objectives while reasonably maximizing AAHUs and BUDM. With this plan and design, marsh ecosystems will be restored and the ecological integrity of marsh ecosystems in the project area of Goose Island will be re-established. Additionally, alternative 3D has been demonstrated to be cost effective and the Best Buy Plan. Implementation is proposed for 2026 in accordance with the dredging schedule and the Authorized Depth of dredging of the GIWW. The project first cost is estimated to be $10,219,000.

The Aquatic Ecosystem Restoration for GIWW BUDM project is an example of an opportunity to beneficially use dredge material produced through O&M dredging for ecological purposes. This effort included a partnership with the NFS of this study, the State of Texas: Aransas County, and an interagency agreement with the GLO in order to restore the self-sustaining capabilities and ecological integrity of emergent marsh ecosystems.

The recommendations contained herein reflect the information available at the time and current departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels within the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to higher authority as proposals for authorization and implementation funding. However, prior to transmittal to higher authority, the sponsor, the states, interested federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

09 August 2024

Date

RHETT A. BLACKMON, P.E.
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16. Report Preparers

The PDT and their technical specialties are displayed below (Table 41). Everyone was primarily responsible for the feasibility level study tasks and report preparation.

Table 45: Report Preparers

NAME	DISCIPLINE
Katrina White	Project Management
Hana Schlang	Plan Formulation
Caroline McCabe	Plan Formulation
Arden Sansom	Economics
Dr. Raven Blakeway	Environmental Resources
Dr. Himangshu Das	Hydrology and Hydraulic Engineering
John Campbell	Cultural Resources
Ismael De La Paz-Bonilla	Geotechnical Engineering
Dr. Konstantinos Kostarelos	HTRW
Brenda Hayden	Civil Engineering
Martin Regner	Cost Engineering
Britney Nealon	Real Estate
Seth Jones	Operations

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