Appendix E

Essential Fish Habitat Assessment

Note: The Section 508 amendment of the Rehabilitation Act of 1973 requires that the information in Federal documents be accessible to individuals with disabilities. The USACE has made every effort to ensure that the information in this appendix is accessible. However, this appendix is not fully compliant with Section 508, and readers with disabilities are encouraged to contact Mr. Jayson Hudson at the USACE at (409) 766-3108 or at SWG201900067@usace.army.mil if they would like access to the information.

Job No. PCA20166

APPENDIX E

FINAL
ESSENTIAL FISH HABITAT ASSESSMENT
FOR THE
PROPOSED CORPUS CHRISTI SHIP CHANNEL DEEPENING PROJECT

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Acronyms and Abbreviations

°F	degrees Fahrenheit
BU	beneficial use
CCSC	Corpus Christi Ship Channel
CDP	Channel Deepening Project
CFR	*Code of Federal Regulations*
CWA	Clean Water Act
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
GMFMC	Gulf of Mexico Fisheries Management Council
Gulf	Gulf of Mexico
mcy	million cubic yards
MLLW	mean lower low water
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
ODMDS	Ocean Dredged Material Disposal Sites
PA	placement area
PCCA or Applicant	Port of Corpus Christi Authority
ppt	parts per thousand
PRM	Permittee Responsible Mitigation
SAV	submerged aquatic vegetation
SPM	Single Point Mooring
TDSHS	Texas Department of State Health Services
TPWD	Texas Parks and Wildlife Department
USACE	U.S. Army Corps of Engineers
USFWS	U.S. Fish and Wildlife Service
VLCC	very large crude carriers

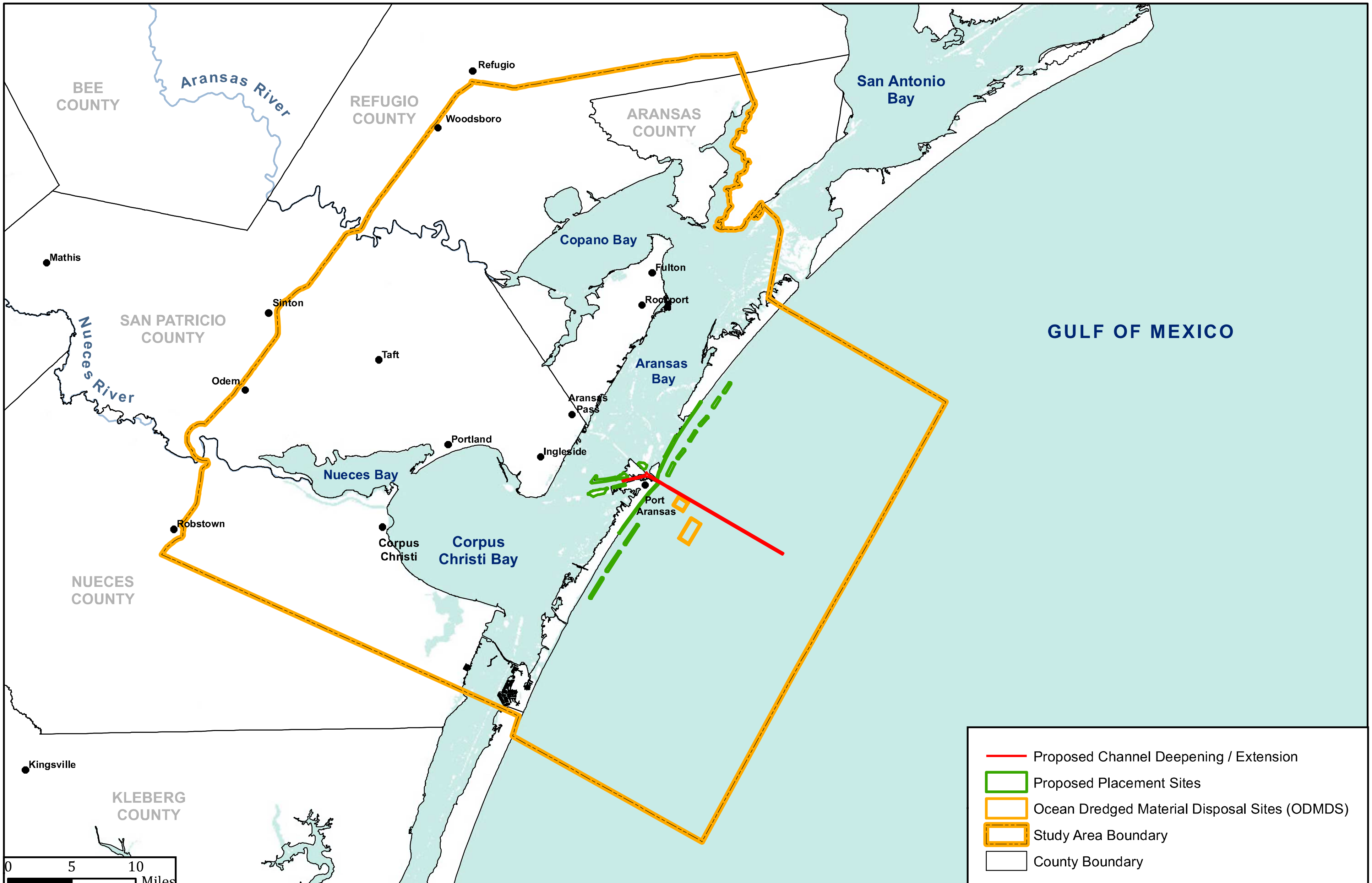
1.0 INTRODUCTION

The Port of Corpus Christi Authority (PCCA or Applicant) applied to the U.S. Army Corps of Engineers (USACE), Galveston District, for a Department of Army Permit, under Section 10 of the Rivers and Harbors Act of 1899, Section 404 of the Clean Water Act (CWA), and Section 103 of the Marine Protection, Research, and Sanctuaries Act (33 USA 1413) for activities related to the proposed channel improvements to the Corpus Christi Ship Channel. The proposed PCCA Channel Deepening Project (CDP) is located in Port Aransas, Nueces County, Texas within the existing channel bottom of the Corpus Christi Ship Channel (CCSC) near the southeast side of Harbor Island, and traversing easterly through Aransas Pass and extending an additional 5.5 miles beyond the existing terminus of the channel (Figure 1). The purpose of the proposed CDP is to accommodate transit of fully laden very large crude carriers (VLCCs) that draft approximately 68 feet. The deepening activities would be completed within the footprint of the authorized PCCA channel width.

Due to the potential impacts to Essential Fish Habitat (EFH), it was determined that preparation of an EFH Assessment pursuant to 50 *Code of Federal Regulations* (CFR) Section 600.920(i) would be required. This report presents an evaluation of potential EFH and fisheries within the project area. For this EFH, the project area is defined as the footprint of the construction area within the channel, 1-mile buffer, around the channel, and the proposed placement sites (Figure 2). The purpose of the investigation was to determine the location and extent of fisheries considered to occur within the project area and those protected under the 1996 Amendment to the Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), which mandated the identification of EFH for all Federally managed species. This EFH assessment is included as part of an Environmental Impact Statement (EIS).

1.1 ROLE OF NATIONAL MARINE FISHERIES SERVICE IN ESSENTIAL FISH HABITAT CONSULTATION

Congress enacted amendments to the MSFCMA (PL 94-265) in 1996 that established procedures for identifying EFH and required interagency coordination to further the conservation of Federally managed fisheries. Rules published by the National Marine Fisheries Service (NMFS) (50 CFR Sections 600.805–600.930) specify that any Federal agency that authorizes, funds, or undertakes, or proposes to authorize, fund, or undertake an activity that could adversely affect EFH is subject to the consultation provisions of the above-mentioned act and identifies consultation requirements. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity.” EFH is separated into estuarine and marine components. The estuarine component is defined as “all estuarine waters and substrates (mud, sand, shell, rock, and associated biological communities); subtidal vegetation (seagrasses and algae); and adjacent intertidal vegetation (marshes and mangroves).” The marine component is defined as “all marine waters and substrates (mud, sand, shell, rock, and associated biological communities) from the shoreline to the seaward limit of the Exclusive Economic Zone” (Gulf of Mexico Fisheries Management Council [GMFMC], 2004). Adverse effect to EFH is defined as, “any impact, which reduces quality and/or



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DATUM & COORDINATE SYSTEM
NAD83 State Plane (feet) Texas South Central

FILE NAME
Name: Fig_1_Study Area Boundary

PREPARED BY
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Port of Corpus Christi Authority
Corpus Christi Ship Channel Deepening Project

Study Area Boundary

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FIGURE 1

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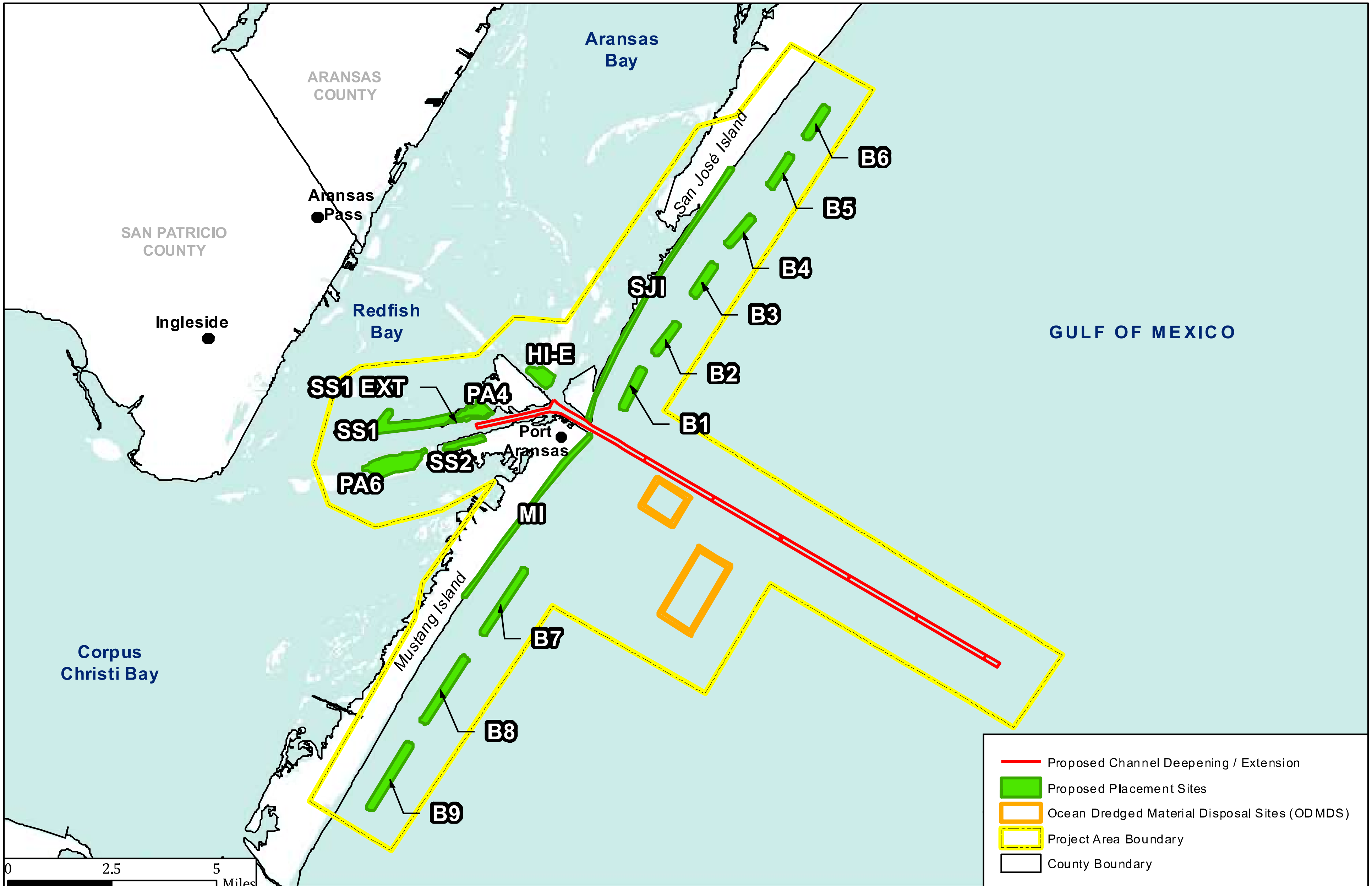

PROJECT NO. PCA20166

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Port of Corpus Christi Authority
Corpus Christi Ship Channel Deepening Project

Project Area Boundary

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FIGURE 2

Date Saved: 2/9/2024 11:45:21 AM Path: H:\ENVIRONMENTAL\Final_Exhibits\EFH Assessment Figures\Fig_2_Project Area Boundary.mxd quantity of EFH…" and may include direct, indirect, site specific or habitat impacts, including individual, cumulative, or synergistic consequences of actions.

1.2 PROJECT DESCRIPTION

The PCCA applied to the USACE, Galveston District, on January 3, 2019, for a Department of Army Permit, under Section 10 of the Rivers and Harbors Act, Section 404 of the CWA, and Section 103 of the Marine Protection, Research, and Sanctuaries Act for activities subject to the jurisdiction of the USACE that include filling discharge of dredged or fill material into waters of the United States, the construction of structures and/or work that may affect navigable waters, and ocean disposal of dredged material. The project proposed in the permit application was revised based on comments provided by the USACE on May 23, 2019. The Port submitted a revised application on June 4, 2019. Based on the Department of Army Permit application submitted by PCCA, the USACE determined that the permitting action for the proposed dredge and fill activities constitutes a major Federal action with potentially significant effects and/or substantial public interest. In accordance with the National Environmental Policy Act, this EFH Assessment is part of an EIS that has been prepared to analyze and disclose the potential impacts of the proposed project on EFH.

1.3 PROJECT AREA AND EXISTING CHANNEL

The CCSC provides deep water access from the Gulf of Mexico (Gulf) to the Port of Corpus Christi, via the Port Aransas Channel, through Redfish Bay and Corpus Christi Bay. The waterway extends from the jettied Port Aransas entrance 20.8 miles to the landlocked portion of the CCSC, known as the Inner Harbor. Access points to the CCSC include the La Quinta Channel, the Gulf Intracoastal Waterway, and the Rincon Canal. The La Quinta Channel extends from the CCSC near Ingleside, Texas, and runs parallel to the eastern shoreline of Corpus Christi Bay for 5.9 miles to the La Quinta Turning Basin. The Corpus Christ Ship Channel Improvement Project is presently underway. This project has deepened the offshore section outside of the jetties from –49 feet mean lower low water (MLLW) to –56 feet MLLW. The inshore sections will be deepened from –47 feet MLLW to –54 feet MLLW. This project will also widen the CCSC from 500 feet to 530 feet in the reach from Port Aransas to Ingleside and from 400 feet to 530 feet in the bay, with the addition of barge lanes. The USACE is responsible for the continued maintenance dredging of the CCSC.

1.4 PROPOSED ACTION AND ALTERNATIVES

The proposed CDP is located within the existing channel bottom of the CCSC starting near the southeast side of Harbor Island, traversing east through the Aransas Pass, and extending into the Gulf for an approximate distance of 13.8 miles. To address changing market needs, the proposed CDP would deepen this portion of the CCSC beyond the current authorized channel depths of –54 feet and –56 feet MLLW to maximum depths of –75 feet and –77 feet MLLW to accommodate transit of fully loaded VLCCs with vertical distances between the waterline and the bottom of the hull, or drafts, of approximately 68 feet. An estimated 46.3 million cubic yards (mcy) of new work dredged material would be generated from the channel deepening.

Additionally, the proposed CDP includes:

- Extending the existing terminus of the authorized channel, an additional 29,000 feet into the Gulf to reach –77 MLLW;
- Placement of the new work dredged material into Waters of the United States for beneficial use (BU) sites located in and around Corpus Christi and Redfish bays;
- Placement of dredged material on San José Island for beach restoration;
- Placement of dredged material in nearshore berms to indirectly nourish San José and Mustang islands; and
- Transport of new work dredged material to the New Work Ocean Dredged Material Disposal Site (ODMDS).

The proposed CDP does not include widening the channel; however, some minor incidental widening of the channel is expected to meet side slope requirements and to maintain the stability of the channel.

1.4.1 No-Action Alternative

The No-Action Alternative provides a means to evaluate the environmental impacts that would occur if the USACE were to deny the permit for the proposed channel improvements. The characterization of the No-Action Alternative provides a baseline for comparison of performance and impacts of the preferred alternative. Under the No-Action Alternative, the CCSC would not be deepened to –77 feet MLLW and would remain at –54 feet MLLW. VLCCs would continue to be partially loaded and reverse-lightered offshore. The No-Action Alternative does not meet the project purpose and need but is carried forward for detailed analysis in this EIS for comparison purposes.

1.4.2 Alternative 1: Channel Deepening (Applicant's Preferred Alternative)

Alternative 1 consists of deepening the CCSC to –77 feet and –75 feet MLLW from the Gulf to station 110+00 near Harbor Island, including the approximate 10 mile-extension to the Entrance Channel necessary to reach sufficiently deep waters. As a result of one-way transit assumed for VLCCs, the planned widths for the –54-foot currently authorized project are nominally sufficient. Therefore, no widening other than the minor incidental widening to keep these bottom widths and existing channel slopes at the proposed deeper depths would occur. Deepening would take place largely within the footprint of the currently authorized –54-foot channel. Under this alternative, only berths at Axis Midstream and Harbor Island terminals would be capable of fully loading VLCCs. However, partially loaded outbound VLCCs at Ingleside could top off at Harbor Island and potentially reduce or eliminate reverse lightering.

Dredging 46.3 mcy would be required with inshore and Gulf placement of the material. Placement would occur in a mix of placement areas (PAs), BU sites, and/or the New Work ODMDS. PCCA selected these potential PAs through a process that included agency input and consideration of State and Federal coastal restoration plans.

The Applicant's Preferred Alternative consists of the following elements (see Figure 2):

- Deepening from the authorized –54 feet MLLW to approximately –75 feet MLLW, with 2 feet of advanced maintenance and 2 feet of allowable overdredge, from Station 110+00 into the Gulf of Mexico to Station –72+50 (3.5 miles).
- Deepening from the authorized –56 feet MLLW to approximately –77 feet MLLW, with 2 feet of advanced maintenance and 2 feet of allowable overdredge, from Station –72+50 to Station 620+00 in the Gulf of Mexico (10.4 miles).
- Placement of new work dredged material at the following BU and PA sites (Table 1, and see Figure 2):
  - SS1: Restoring eroded shorelines
  - SS2: Restore eroded shoreline along Port Aransas Nature Preserve/Charlie's Pasture
  - PA4: Reestablish eroded shoreline and land loss in front of PA4 (SS1 Extension), and upland placement within PA4
  - HI-E: Bluff and shoreline restoration with site fill
  - PA6: Raise levee 5-foot and fill with new work material
  - SJI: Beach nourishment at San José Island
  - B1–B9: Nearshore berms offshore of San José Island and Mustang Island
  - MI: Beach nourishment for Gulf side of Mustang Island
  - ODMDS: Place within New Work ODMDS
- Incremental future maintenance material may be placed at the following PA sites as material suitability allows:
  - Existing Maintenance ODMDS in the vicinity of the CCSC
  - Proposed nearshore berms B1 through B9

1.4.3 Alternative 2: Offshore Single Point Mooring

Under Alternative 2, the CCSC would not be deepened to –77 feet MLLW and would remain at –54 feet MLLW. The Offshore Single Point Mooring (SPM) Alternative is a multi-buoy, single-point mooring system consisting of multiple sets in an array of SPM buoys (also known as Single Buoy Moorings). It would be in the Gulf approximately 15 miles from the Gulf-side shoreline. To meet the project purpose, eight individual SPM buoys or four sets in an array would be required. Vessels would be loaded entirely offshore, eliminating the need to traverse the CCSC. This alternative would also eliminate dredging of the channel and the impacts associated with dredged material placement.

Table 1
Description of Placement Sites

Placement Site	Description	Total Volume (cubic yards [cy])	Features Being Built		
			Purpose	From Dredged Material	Others (Armoring etc.)
SS1	Restoring eroded shorelines and creating low marsh, high marsh, and marsh-upland fringe habitat	2,793,000	Restore eroded shoreline landmass and provide protection to Harbor Island seagrass area. Mitigation for unavoidable impacts to wetlands and submerged aquatic vegetation (SAV).	Dikes, landmass backfill	Slope armoring/riprap
SS2	Restoring two shoreline breaches and landmass along Port Aransas Nature Preserve resulting from Hurricane Harvey. Would add land mass behind Federal Emergency Management Agency shoreline bulkhead project. Low marsh habitat creation.	374,000	Restore shoreline washed out by Hurricane Harvey to protect Piping Plover sand flat Critical Habitat. Mitigation for unavoidable impacts to wetlands.	Interior dikes, landmass backfill	Bulkhead
PA4	Reestablish eroded shoreline and land loss in front of PA4 (SS1 Extension), and upland placement within PA4.	4,537,000	Restore eroded shoreline and land loss; provide protection to Harbor Island seagrass by extending SS1 berm in front of PA4. Raise levees for placement of new work material unsuitable for BU	Exterior containment dike, landmass backfill, raise interior levee, PA interior fill	Slope armoring/riprap
HI-E	Bluff and shoreline land mass restoration with site fill on eastern Harbor Island	1,825,000	Restore eroded bluff and shoreline to historic profiles. Mitigation for unavoidable impacts to oysters.	Containment levees, landmass backfill	Slope armoring/riprap
PA6	Raise PA dike 5 feet and fill with 4 feet of new work material	1,796,400	No environmental benefit, material unsuitable for BU	Raise levee, PA interior fill	
SJI	Beach nourishment at San José Island	2,000,000	Restores several miles of beach profile that was washed away during Hurricane Harvey	Beach	

Placement Site	Description	Total Volume (cubic yards [cy])	Features Being Built		
			Purpose	From Dredged Material	Others (Armoring etc.)
B1–B9	Nearshore berms offshore of San José Island and Mustang Island	8,660,000	Nearshore berms within transport zone to indirectly nourish barrier islands	Nearshore berms	
MI	Beach nourishment for Gulf side of Mustang Island	2,000,000	Mustang Island beach nourishment to enhance shoreline	Beach	
New Work ODMDS	Place material in existing New Work ODMDS	22,531,200	No environmental benefit, material suitable for ocean placement	Placement mound	

1.4.4 Alternative 3: Inshore/Offshore Combination

Under Alternative 3, the CCSC would not be deepened to –77 feet MLLW and would remain at –54 feet MLLW. Like Alternative 2, the Inshore/Offshore Combination Alternative is a SPM buoy located in the Gulf approximately 15 miles from the Gulf-side shoreline. Each set consists of two SPMs that would be serviced by either one or two pipelines from shore originating in Ingleside or Harbor Island facilities. Vessels are partially loaded inshore then traverse the CCSC offshore to the SPM to fully load. This alternative would also eliminate dredging of the channel and the impacts associated with dredged material placement.

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2.0 EXISTING ENVIRONMENT

For the discussion of the existing environment, habitat types are described within the study area (see Figure 1), while the evaluation of potential EFH and fisheries resources focuses on the project area footprints (see Figure 2). It should be noted that the study and project areas are similar in habitat and community types.

2.1 HABITAT/COMMUNITY TYPES

Ecoregions are typically considered large geographic areas that are easily distinguished from adjacent regions by differing biotic and environmental factors or ecological processes. Fundamental differences among ecoregions often include changes in climate, physical geography, soils, and large-scale vegetative structure and composition. The study area is located entirely within the Western Gulf coastal plain (U.S. Environmental Protection Agency [EPA] level III ecoregion), which is a low-elevation area adjacent to the Gulf (Griffith et al. 2004; EPA, 2013). Due to its nutrient-rich soils and abundance of rain, much of the land has been converted to cropland and pastures for livestock. About a third of the State's population resides within 100 miles of the coast along with a large part of the State's industry. The large expanses of intact wetlands and coastal marshes along the coast are also important rest stops and wintering habitats for waterfowl and migrating birds. The warm Gulf waters are home to a variety of fish and shellfish, while the marshes and wetlands provide an abundance of habitat for birds and migrating waterfowl (Griffith et al., 2007).

The Western Gulf coastal plain can be further categorized into nine distinct EPA level IV ecoregions (Griffith et al., 2004, 2007). These level IV ecoregions are divided based on similarities of soils, vegetation, climate, geology, wildlife, and human factors. The following sections describe the four level IV ecoregions found within the study area.

Mid Coast Barrier Islands and Coastal Marshes: Stretching from Galveston Bay to Corpus Christi Bay, this ecoregion generally receives less annual precipitation than the Texas-Louisiana marshes. This region is characterized by barrier islands, tidal marshes, dunes, and salt/brackish/freshwater marshes. Cordgrass (*Spartina* spp.), saltgrass (*Distichlis* sp.), and sedges (*Cyperaceae* spp.) are typically found in the marsh habitats, while seacoast bluestem (*Schizachyrium scoparium*) and sea oats (*Uniola paniculata*) are found on sandy barrier islands. During the fall, endangered Whooping Cranes (*Grus americana*) migrate to the brackish marshes of Aransas National Wildlife Refuge to feed on blue crabs (*Callinectes sapidus*) (Griffith et al., 2007). This is the most dominant coastal ecoregion within the study area, including the entire barrier island strip from Packery Channel to Matagorda Island.

Floodplains and Low Terraces: This ecoregion consists of Holocene floodplains and alluvial deposits. Bottomland forests are the dominant vegetation type in this region. Large swaths of these floodplain woodlands have been converted to cropland, pastures, and forests. Freshwater flows through these historic floodplains have also been redirected for municipal, industrial, and agricultural uses. Combined with recent droughts in Texas and the Southwest, flows in the Nueces River have greatly diminished, which affect the salinity and productivity of downstream estuaries and bays (Griffith et al., 2007). Only a small portion of the study area contains this ecoregion type, occurring in the uppermost reaches of the Nueces River delta.

Southern Subhumid Gulf Coastal Prairies: Generally drier than the northern humid Gulf Coastal Prairie, this region only receives about 26 to 37 inches of rain annually. The regional soil temperature is hyperthermic meaning it stays above 71.6 degrees Fahrenheit (°F). Decades of fire suppression, overgrazing, and other landscape alterations have led to an increased abundance of woody and thorny-scrub plants such as honey mesquite (*Prosopis glandulosa*), huisache (*Acacia farnesiana*), and blackbrush (*Vachellia rigidula*). Prairie grassland species such as seacoast bluestem, Gulf muhly (*Muhlenbergia capillaris*), and switchgrass (*Panicum virgatum*) can still be found but in less abundance than described in historical records (Griffith et al., 2007).

Southern Subhumid Gulf Coastal Prairies: This ecoregion is categorized by tidal mud flats, barrier island, seagrass meadows, and hypersaline lagoons. Seagrass meadows grow in the shallow, clear waters along the Laguna Madre. The seagrass beds serve as a productive nursery habitat for Red Drum (*Sciaenops ocellatus*) and grazing for sea turtles and Redhead Ducks (*Aythya americana*). Seacoast bluestem, sea oats, and other grassy vegetation can be found along the 113-mile-long island, the longest barrier island in the world. Ponds and marshes are populated with cordgrass, cattails (*Typha* spp.), and bulrush (*Seirpus* spp.). Sea turtles including the Leatherback (*Dermochelys coriacea*), Green (*Chelonia mydas*), Atlantic Hawksbill (*Eretmochelys imbricata*), and Kemp's Ridley (*Lepidochelys kempii*) are dependent on the sandy barrier islands for nesting habitat (Griffith et al., 2007). The study area includes the northern-most reaches of this ecoregion along the Texas coast.

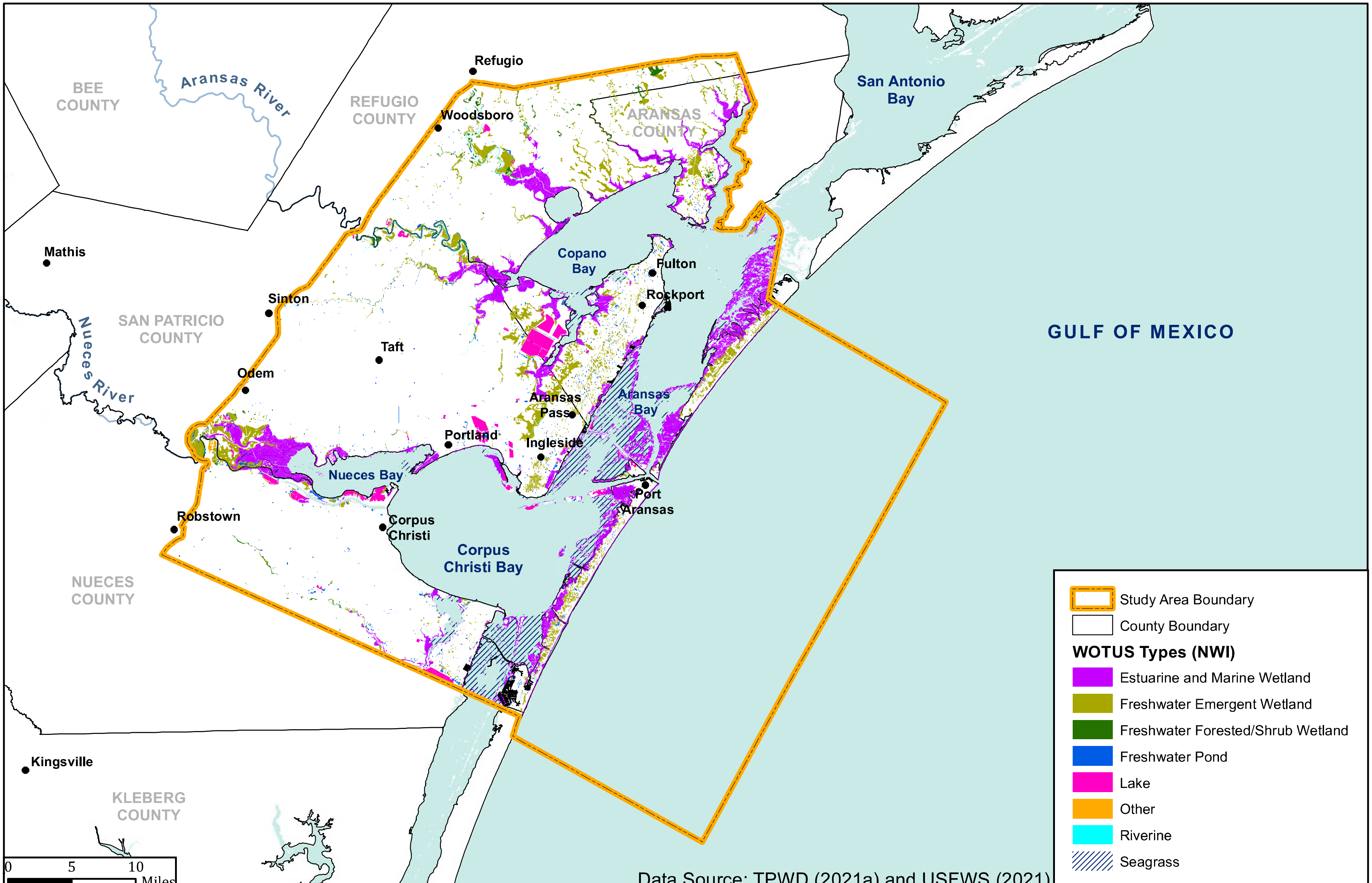
Non-tidal Wetlands: Non-tidal wetlands within the study area include depressional wetlands located inland of the tidal zone and palustrine fringe wetlands associated with the upper reaches of river systems in the study area, including the Nueces, Mission, and Aransas rivers. Depressional wetlands are regionally known as prairie potholes and are generally low topography divots within the prairie mosaic landscape. Rainfall and groundwater sources contribute to depressional wetland hydrology, along with poorly drained soils that increase water holding times and result in a hydrophytic vegetation community (Cowardin et al., 1979). These wetland types are also converted for agricultural uses, often in the form of upland cattle stock tanks (Moulton et al., 1997). Included within the depressional category are PAs with earthen levees and poor drainage, and the U.S. Fish and Wildlife Service (USFWS) National Wetlands Inventory geospatial maps identify several placement actions targeting BU that are mapped as wetlands (USFWS, 2021). Depressional wetlands are often dominated by herbaceous vegetation, and common wetland plant species include: spike rush (*Eleocharis* spp.), smartweed (*Polygonum hydropiperoides*), various sedges (*Carex* spp.), soft rush (*Juncus effusus*), and cattail (*Typha latifolia*). Some woody species can also be found in depressional wetlands, such as: black willow (*Salix nigra*), rattlebush (*Sesbania drummondii*), eastern baccharis (*Baccharis halimifolia*), and the non-native Chinese tallow (*Triadica sebifera*).

Palustrine fringe and riverine wetlands are also common within the study area and are located within the alluvial floodplains of the larger river systems and above the influence of tides. Like depressional wetlands, the plant communities are primarily herbaceous in nature, although later successional scrub-shrub and forested types are found in smaller amounts within the study area (USFWS, 2021). These wetlands include low-lying areas within floodplains and areas adjacent or abutting riverbanks. Wetland hydrology is often provided through a direct hydrologic nexus to riverine features or by seasonal and temporary flooding. While the sources of hydrology differ, there are often great similarities between wetlands lying adjacent to lakes or rivers and isolated wetlands of the same class in the same region (Cowardin et al., 1979).

Tidal Wetlands: Tidal wetlands include features that are in the brackish transition between freshwater and tidally influenced saltwater marshes all the way to the subtidal unconsolidated bottom of bay systems, known as deepwater habitats. Not including persistently inundated bay bottoms or the marine environment, estuarine emergent wetlands are the most prevalent within the study area, followed by intertidal unvegetated mud or sand flats and estuarine shrubs (USFWS, 2021). Common herbaceous species that occur in estuarine wetlands include glasswort (*Salicornia depressa*), salt marsh bulrush (*Scirpus maritimus*), smooth cordgrass (*Spartina alterniflora*), saltgrass (*Distichlis spicata*), and sea-oxeye (*Borrichia frutescens*). Black mangrove (*Avicennia germinans*) is the primary estuarine shrub species. Coastal estuarine wetlands of the bay systems within the study area play an important part in sustaining the health and abundance of life within the ecosystem. They are extremely important natural resources that provide essential habitat for fish, shellfish, and other wildlife (Rozas and Minello, 1998; Sather and Smith, 1984; Turner, 1977). Coastal wetlands also serve to filter and process agricultural and urban runoff and buffer coastal areas against storm and wave damage. Geospatial data from the National Wetlands Inventory was used to map existing estuarine and coastal wetland features in the study area (Figure 3).

Seagrass: Submerged aquatic vegetation (SAV) includes the true seagrasses such as shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), and clover grass (*Halophila engelmannii*), but also includes widgeon grass (*Ruppia maritima*) which is not considered a true seagrass because it also grows in freshwater environments. Seagrasses typically occur in water shallower than 4 feet mean low tide. In the study area, they occur primarily in Redfish Bay and the Upper Laguna Madre in large, contiguous tracts, and along the bay side of Mustang Island and San José Island inlets and shallow, relatively low energy areas (Texas Parks and Wildlife Department [TPWD], 2021a). Seagrass communities generate high primary productivity and provide refuge for numerous species including shrimp, fish, crabs, and their prey. Animal abundances in seagrass beds can be two to 25 times greater than in adjacent unvegetated areas (TPWD, 1999). All five taxa are found within the study area, with shoal grass being the most abundant seagrass species across the bay systems (Congdon and Dunton, 2019).

There are approximately 41,583 acres of seagrass within the study area boundary (TPWD, 2021a). The net acreage of seagrass within the combined estuarine systems has remained relatively stable since 1958, although there has been fragmentation of this habitat and some local losses in Redfish Bay/Harbor Island. Seagrass beds dominated by turtle grass in southern Redfish Bay decreased in 2017 following Hurricane Harvey and coverage remained low following Winter Storm Uri in 2021 (Congdon and Dunton, 2019; Capistrant-Fossa, 2023). However, in 2022 seagrass canopy cover increased suggesting that seagrass has begun to recover from both storms (Capistrant-Fossa, 2023). It remains to be seen whether the loss of slow



PROJECT NO.	PCA20166
DATE CREATED	Date: 3/11/2024
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FILE NAME	Name: Fig_3_Wetlands
PREPARED BY	KLC

Port of Corpus Christi Authority
Corpus Christi Ship Channel Deepening Project

Wetlands and other Waters of the U.S.

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FIGURE 3

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Path:H:\ENVIRONMENTAL\Final_Exhibits\EFH Assessment Figures\Fig_3_Wetlands.mxd slow growing turtle grass would lead to colonization by more opportunistic species like shoal grass and manatee grass (Congdon and Dunton, 2019). Seagrass beds in Nueces Bay are limited to the shoal grass and widgeon grass (Pulich et al., 1997).

The most currently available geospatial data for seagrass mapping was downloaded from the National Oceanic and Atmospheric Administration (NOAA) and TPWD Geographic Information System data sites and combined to provide mapping of seagrass (TPWD, 2021a). Figure 3 shows the seagrass mapped in the study area. Within the proposed project footprint, the depth of the existing channel, side slopes and regular maintenance are not conducive to supporting seagrasses. Therefore, the proposed project location is currently devoid of seagrass, and there are some small seagrass areas mapped adjacent to the channel in the shallow margins of dredge spoil islands near Ingleside, Texas (TPWD, 2021a).

Aquatic Communities: The open bay community is composed of plankton and nekton. Phytoplankton (microscopic algae) are the major primary producers (plant life) in the open bay, taking up carbon through photosynthesis and nutrients for growth. Phytoplankton are fed upon by zooplankton (small crustaceans), fish, and benthic consumers. Nekton (organisms that swim freely in the water column) consist mainly of secondary consumers, which feed on zooplankton and smaller nekton (Armstrong et al., 1987; Britton and Morton, 1989). Diverse and abundant plankton and nekton communities occur throughout the entire study area. Phytoplankton assemblages in Aransas Bay are comprised primarily of *Coscinodiscus* spp. in the winter and *Rhizosolenia alata* in the summer. Blue-green and green algae dominate the upper portions of the Mission-Aransas Estuary, whereas diatoms dominate the lower estuary. Diatoms (*Thalassionema nitzschioides*, *Thalassiothrix frauenfeldii*, and *Chaetoceros* spp.) make up over 70 percent of the phytoplankton community in Corpus Christi Bay. In Nueces Bay and the Upper Laguna Madre, the same diatoms dominate abundance, especially during the winter months, followed by the dinoflagellate *Ceratium furca* (Tunnell et al., 1996; Hildebrand and King, 1977). Salinity appears to be the controlling factor of phytoplankton abundance, with low salinities corresponding with high phytoplankton numbers and high salinities (greater than 60 parts per thousand [ppt]) corresponding with low to nonexistent numbers, as occurs in some areas of the Upper Laguna Madre (Armstrong et al., 1987; Hildebrand and King, 1977).

Armstrong et al. (1987) and Tunnel et al. (1996) describe the dominant zooplankton in Copano and Aransas bays as calanoid copepod *Acartia tonsa* with maximum abundances occurring in the winter and spring. Barnacle nauplii and *Acartia tonsa* dominated zooplankton assemblages in Corpus Christ and Nueces bays during every season except late winter and early spring when the dinoflagellate *Noctiluca scintillans* dominated. Calanoid copepods, especially *Acartia tonsa,* were the dominant species in Oso Bay and the Upper Laguna Madre with peak abundance occurring in the spring (Armstrong et al., 1987; Tunnell et al., 1996).

Texas bay systems support a diverse nekton population including fish, shrimp, and crabs. Some of these are resident species, spending their entire life in the bay, whereas others are migrant species spending only a portion of their life cycle in the estuary (Armstrong et al., 1987; Tunnell et al., 1996; Buskey, 2018). Many of these species are estuarine-dependent, migrating through passes of the Gulf to use the different habitats in the bay including SAV, marsh, and oyster reefs as nursery habitat (Tunnell and Judd, 2002; Buskey, 2018). With respect to the Upper Laguna Madre, the hypersaline waters can affect fish osmotic balance and decrease dissolved oxygen; however, fish occupying these areas are euryhaline (able to tolerate a wide range of salinities) and better able to cope with the harsh conditions (Gunter, 1967).

Dominant nekton inhabiting the study area include blue crab, white shrimp (*Litopenaeus setiferus*), brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), Atlantic Croaker (*Micropogonias undulatus*), Bay Anchovy (*Anchoa mitchilli*), Code Goby (*Gobiosoma robustum*), Black Drum (*Pogonias cromis*), Gulf Menhaden (*Brevoortia patronus*), Hardhead Catfish (*Arius felis*), Pinfish (*Lagodon rhomboides*), Sheepshead (*Archosargus probatocephalus*), silversides (*Menidia* sp.), Southern Flounder (*Paralichthys lethostigma*), Spot (*Leiostomus xanthurus*), Spotted Seatrout (*Cynoscion nebulosus*), and Red Drum (Nelson et al., 1992; Tunnell et al., 1996; Pattillo et al., 1997; EPA, 2020). These species are ubiquitous along the Texas coast and are unaffected by salinity changes. Differences in abundance occur seasonally, with the fall usually the lowest in biomass and number. Newly spawned fish and shellfish begin migrating into the bays in winter and early spring with the maximum biomass during the summer (Pattillo et al., 1997; Buskey, 2018).

Open-bay Bottom: The open-bay bottoms in the study area include all unvegetated subtidal areas with various sediment types. These are open systems that greatly interact with the overlying waters and adjacent habitats (Armstrong et al., 1987; Tunnell and Judd, 2002). Benthic organisms are divided into two groups: epifauna, such as crabs and smaller crustaceans that live on the surface of substrate, and infauna, such as mollusks and polychaetes that burrow into the substrate (Green et al., 1992). Mollusks and other infaunal organisms are filter feeders that strain suspended particles from the water column. Other infauna, such as polychaetes, feed by ingesting sediments and extracting nutrients. Many of the epifauna and infauna feed on plankton, which are fed upon by numerous fish and birds (Armstrong et al., 1987; Lester and Gonzales, 2011).

The distribution of benthic macroinvertebrates is primarily influenced by bathymetry and sediment type (Calnan et al., 1989). Mud (silt and clay) is the dominant sediment type throughout this bay-estuary-lagoon system; however, sandier sediments occur along bay margins and are more common in the Laguna Madre and Redfish Bay. Benthic macroinvertebrates found in these sediments are primarily polychaetes (including *Polydora caulleryi*, *Tharyx setigera*, and *Mediomastus ambiseta*), bivalves, crustaceans (including *Listriella clymenellae*), and gastropods (White et al., 1983; Montagna and Froeschke, 2009).

Benthic samples were also collected in the study area as part of the EPA National Coastal Assessment Program (EPA, 2020). These samples were dominated primarily by polychaetes, amphipods, and gastropods, same as were observed by White et al. (1983) and Montagna and Froeschke (2009). Polychaetes dominated the samples, including *Paleanotus heteroseta*, *Aricidea fragilis*, *Capitella capitata*, *Mediomastus* sp., *Tharyx annulosus*, *Paraonides lyra*, and *Asychis elongata* (EPA, 2020).

Oyster Reef: Most oyster reefs are subtidal or intertidal and found near passes and cuts, and along the edges of marshes. Within the study area Eastern oyster (*Crassostrea virginica*) are found within Copano Bay (142 acres total), Aransas Bay (91 acres total), Mesquite Bay (199 acres total), and Redfish Bay/Harbor Island (113 acres total), growing perpendicular to the shoreline, with some small patch reefs scattered in Nueces (25 acres total) and Corpus Christi (1.14 acres total) bays. Most oyster reefs in Corpus Christi Bay are dead; but living oyster reefs were found in Nueces Bay and the intertidal zone (Pulich, et al., 1997; Tunnell et al., 1996).

Oyster reefs are formed where a hard substrate and adequate currents are plentiful, and they are ecologically important. Currents carry nutrients to the oysters. They filter sediment and waste from the water. Oysters can filter water 1,500 times the volume of their body per hour, which, in turn, influences water clarity and phytoplankton abundance (Lester and Gonzalez, 2011; Powell et al., 1992). Due to their lack of mobility and their tendency to bioaccumulate pollutants, oysters are an important indicator species for determining contamination (Lester and Gonzalez, 2011).

While oysters can survive in salinities ranging from 5 to 40+ ppt, they thrive within a range of 10 to 25 ppt where pathogens and predators are limited. The low-salinity end of the range is critical for osmotic balance. Oysters can survive brief periods of salinities less than 5 ppt by remaining tightly closed. Oysters will remain closed until normal salinities are reestablished or until they deplete their internal reserves and perish. In contrast, predators, such as oyster drills, welks, and crabs reduce oyster populations during long periods of high salinities (Cake, 1983). *Perkinsus marinus* (Dermo) is the most common and deadly oyster pathogen in the bays bordering the Gulf. It is a primary factor affecting habitat suitability.

Many organisms, including mollusks, barnacles, crabs, gastropods, amphipods, polychaetes, and isopods, are found living on oyster reefs, forming a very diverse community (Sheridan et al., 1989). Oyster reef communities are dependent upon food resources from the open bay and marshes. Many organisms feed on oysters, including fish such as black drum, crab, and gastropods, such as the oyster drill (*Thais haemastoma*) (Lester and Gonzales, 2011; Sheridan et al., 1989). When oyster reefs are exposed during low tides, shore birds will use the reef areas for resting (Armstrong et al., 1987).

Currently some commercial harvesting of oysters occurs in Aransas Bay, but none in Corpus Christi Bay or the Upper Laguna Madre (Pers. Comm., D. Topping [TPWD], 2016). In Texas, all molluscan shellfish must be harvested from areas that have been approved or conditionally approved as designated by the Texas Department of State Health Services (Texas Department of State Health Services [TDSHS], 2021). This status is subject to change to prohibited or restricted by the TDSHS at any time due to extreme weather conditions, oil spills, and red tides. Currently, oysters are approved for harvesting from much of Corpus Christi, Aransas, and Copano bays (TDSHS, 2021).

Jetty Communities: Jetty communities occurring within the study area include the Aransas Pass and Packery Channel jetties. Found along the mouth of inlets, these granite jetties serve to stabilize channels by extending into the Gulf beyond sandbars and breaking waves (Fikes and Lehman, 2010). These man-made jetties exhibit a diverse rocky shore community that can effectively transport larva into and out of these passes (Britton and Morton, 1989).

Jetty communities are comprised of stone crab (*Menippe adina*), porcelain crab (*Petrolisthes armatus*), hermit crab (*Clibanarius vittatus*), tree oysters (*Isogonom bicolor*), horse oyster (*Ostrea equestris*), fragile barnacle (*Chthamalus fragilis*), striped barnacle (*Balanus amphitrite*), ivory barnacle (*Balanus eburneus*), lined periwinkle (*Nodilittorina lineolata*), Atlantic Needlefish (*Strongylura marina*), Sergent Major (*Abudefduf saxatilis*), common octopus (*Octopus vulgaris*), false limpet (*Siphonaria pectinata*), sea lettuce (*Ulva fasciata*, *Gelidium crinale*, *Pandina vickersiae*), red sea urchin (*Arbacia punctulata*), anemones (*Bunodosoma cavernata*, *Anthopleura krebsi*, *Aiptasiomorpha texaensis*), common hydroids (*Bougainvilla inaequalis*, *Obelia adichotoma*, *Gonothyraea gracilis*), (Britton and Morton, 1989). Numerous macroalgae inhabit this rocky intertidal habitat including *Gelidium pusillum*, *Gracilaria tikvahiae*, *Grateloupia filicina*, and *Hypnea musciformis* (Fikes and Lehman, 2010). Gorgonian (soft) corals, known to be successful in jetty environments, can also be found including *Leptogorgia virgulate*, *Leptogorgia setacea*, and *Leptogorgia hebes* (Williamson et al., 2011).

Offshore Bottom Communities: There are few seagrasses or attached algae found in the offshore sands due to the strong currents and unstable sediments. Most of the bottom surface is populated with macroinfauna such as an occasional hermit crab (Paguroidea), portunid crab (Portunidae), or ray (Batoidea). Even though there is little life on the sand surface, the overlying waters are highly productive. Phytoplankton are abundant, including microscopic diatoms, dinoflagellates, and other algae (Britton and Morton, 1989).

Much of the faunal diversity lies buried in the sand and relies on phytoplankton for food. Bivalves found in offshore sands include the blood ark (*Anadara ovalis*), incongruous ark (*Anadara brasiliana*), southern quahog (*Mercenaria campechiensis*), giant cockle (*Dinocardium robustum*), disk dosini (*Dosinia discus*), pen shells (*Atrina serrata*), common egg cockle (*Laevicardium laevigatum*), crossbarred venus (*Chione cancellata*), tellins (*Tellina* spp.), and the tusk shell (*Dentalium texasianum*). One of the most common species occurring in the shallow offshore sands is the sand dollar (*Mellit quinquiesperforata*), followed by several species of brittle stars (*Hemipholis elongata*, *Ophiolepis elegans*, and *Ophiothrix angulata*). Many gastropods are common, including the moon snail (*Polinices duplicatus*), ear snail (*Sinum perspectivum*), Atlantic auger (*Terebra dislocata*), Salle's auger (*Terebra salleano*), scotch bonnet (*Phalium granulatum*), distorted triton (*Distrosio clathrata*), wentletraps (*Epitonium* sp.), and whelks (*Busycon* spp.). Crustaceans inhabit these waters, including white and brown shrimp (both commercially harvested species), rock shrimp (*Sicyonia brevirostris*), blue crabs, mole crabs (*Albunea* spp.), speckled crab (*Arenaeus cribrarius*), box crab (*Calappa sulcata*), calico crab (*Hepatus epheliticus*), and pea crab (*Pinotheres maculatus*). The most abundant infaunal organisms with respect to the number of individuals are polychaetes (Capitellidae, Orbiniidae, Magelonidae, and Paraonidae) (Britton and Morton, 1989).

Artificial Reefs: In the Gulf, two types of artificial reefs exist: those structures placed to serve as oil and gas production platforms and those intentionally placed to serve as artificial reefs (GMFMC, 2004). The more than 4,500 oil and gas structures in the Gulf form unique reef ecosystems that extend throughout the water column, providing a large volume and surface area, dynamic water-flow characteristics, and a strong profile (Ditton and Falk, 1981; Dokken, 1997; Stanley and Wilson, 1990; Vitale and Dokken, 2000). Fish are attracted to oil platforms because these structures provide food, shelter from predators and ocean currents, and a visual reference, which aids in navigation for migrating fishes (Bohnsack, 1989; Duedall and Champ, 1991; Meier, 1989; Vitale and Dokken, 2000). The size and shape of the structure affect community characteristics of pelagic, demersal, and benthic fishes (Stanley and Wilson, 1990). Many scientists believe that the presence of oil platform structures allows fish populations to grow, which increases fishery potential (Scarborough-Bull and Kendall, 1994).

Artificial reefs are colonized by a diverse array of microorganisms, algae, and sessile invertebrates, including shelled forms (barnacles, oysters, and mussels), as well as soft corals (bryozoans, hydroids, sponges, and octocorals) and hard corals (encrusting, colonial forms). These organisms (referred to as the biofouling community) provide habitat and food for many motile invertebrates and fishes (GMFMC, 2004).

Species associated with the platforms that are not dependent on the biofouling community for food or cover include the Red Snapper (*Lutjanus campechanus*), Atlantic Spadefish (*Chaetodipterus faber*), Lookdown (*Selene vomer*), Atlantic Moonfish (*Selene setapinnis*), Creole-fish (*Paranthias furcifer*), Whitespotted Soapfish (*Rypticus maculatus*), Gray Triggerfish (*Balistes capriscus*), and Lane Snapper (*Lutjanus synagris*), all transients (move from platform to platform) and resident species (always found on the platforms), including Red Snapper, Large Tomtate (*Haemulon aurolineatum*), and some large groupers. Other resident species that are dependent upon the biofouling community for food or cover include numerous blennies, Sheepshead, and small grazers (butterflyfishes, Chaetodontidae). Highly transient, large predators associated with these structures include Barracuda (*Sphyraena barracuda*), Almaco Jack (*Seriola rivoliana*), Hammerhead Sharks (*Sphyrna* spp.), Cobia (*Rachycentron canadum*), mackerels (Scombridae), other jacks (*Caranx* spp.), and the Little Tunny (*Euthynnus alletteratus*) (GMFMC, 2004).

A total of 15 active oil and gas platforms occur within the study area, far fewer than are found in the northern Gulf (U.S. Energy Information Administration, 2021). In addition, the TPWD operates the Texas Artificial Reef Program that insures the continued enrichment of the Texas Gulf fishery and fishing opportunities (Stephan et al., 1990). There are three TPWD artificial reef sites that occur within the study area: Boatmen's Reef, located 4.7 miles from Aransas Pass; Lonestar Reef, located 8.8 miles from Mustang Island; and Mustang Island-775 Reef, located 10.6 miles from Mustang Island. These reefs are each 40 acres in size and are at depths from 60 to 73 feet. The materials of these nearshore reefs consist of barges and/or boats, well heads, concrete culverts, and reef pyramids. The Mustang Island Liberty Ship Reef site is located 18.1 miles from Mustang Island, just outside the study area. This artificial reef site consists of two Liberty Ships including: the Charles A. Dana (bow and stern) and the Conrad Weiser, Rachael Jackson. Water depth at this site ranges from 108 to 111 feet (TPWD, 2021b).

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3.0 ESSENTIAL FISH HABITAT

Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 United States Code 1802(10)). EFH is found in the tidally influenced or estuarine emergent wetland communities and brackish or marine open-water communities within the proposed project areas (see Figure 1). These communities play an important role in the cycling of nutrients and food energy through coastal ecosystems. Communities, such as wetlands, produce detritus that is transferred to food energy for higher trophic levels via zooplankton, bivalves, crustaceans, and small fish. Some organisms that serve as intermediate stages of the food web utilize benthic, epibenthic, and nearshore Gulf habitats. Dominant motile benthic species likely to occur in the shallow fringes of these communities include serpulid worms (polychaetes), gastropods, such as the oyster drill, and crustaceans, such as the hermit crab (*Clibanarius vittatus*) and mud crabs (*Rhithropanopeus harrisii*, *Neopanope texana*, and *Panopeus herbstii*). Other common invertebrates that may occur within the study and project areas are bivalves, such as the common rangia (*Rangia cuneata*) and Eastern oyster. Sessile macroepifauna, such as the sea pansy (*Renilla mulleri*) and acorn barnacles (*Balanus* sp.), are found throughout the nearshore Gulf and are likely to occur within the study area on hard surfaces, such as pilings, rock jetties, and other structures (Hoese and Moore, 1998). Many of these species are dominant food items in the diet of fish species, including drums and flounder, as well as large marine fishes such as grouper and snapper.

Estuaries such as Corpus Christi Bay often contribute to the shellfish resources of the Gulf. Shellfish species range from those located only in brackish wetlands to those found mainly in saline marsh and inshore coastal waters. Multiple species of penaeid shrimp are expected to occur in the vicinity of the proposed CDP; however, brown shrimp and white shrimp are the most numerous (Nelson et al., 1992). At least eight species of portunid (swimming) crabs are common residents of the coastal and estuarine waters of the northern Gulf. Brown shrimp, white shrimp, and blue crabs are the primary shellfish located throughout the study area that comprise a substantial fishery (Pattillo et al., 1997; Byrnes et al., 2017).

Life histories of many Gulf fish can be characterized as estuarine dependent. These species typically spawn in the Gulf, and their larvae are carried inshore by currents. Juvenile fish generally remain in these estuarine nurseries for about a year, taking advantage of the greater availability of food and protection that estuarine habitats afford. Upon reaching maturity, estuarine-dependent fishes migrate to sea to spawn (returning to the estuary on a seasonal basis) or migrate from the shallow estuaries to spend the rest of their lives in deeper, offshore waters (Pattillo et al., 1997).

Estuary-dependent species potentially occurring within the study area include menhaden, shrimps, crabs, and sciaenids. Common species occurring in the study area include Striped Mullet (*Mugil cephalus*), Red Drum, Atlantic Croaker, Spot, Sand Seatrout (*Cynoscion arenarius*), and Spotted Seatrout. Resident estuarine fishes, which inhabit estuaries throughout their entire life cycle, likely to occur within the study area include killifishes (*Fundulus* spp.), Sheepshead Minnow (*Cyprinodon variegatus*), and silversides (Nelson et al., 1992; Pattillo et al., 1997).

Non-estuarine-dependent fishes, including coastal pelagic marine fishes, are also likely to occur in the vicinity of the proposed CDP. The common coastal pelagic families occurring in the region are Carcharhinidae (requiem sharks), Elopidae (ladyfish), Engraulidae (anchovies), Clupeidae (herrings), Scombridae (mackerels and tunas), Carangidae (jacks and scads), Mugilidae (mullets), Pomatomidae (bluefish), and Rachycentridae (Cobia). Coastal pelagic species traverse shelf waters of the region throughout the year. Some species form large schools (e.g., Spanish Mackerel [*Scomberomorus maculatus*]), while others travel singly or in smaller groups (e.g., Cobia).

Table 2 provides a list of representative commercial and game fish species known to occur in the study area.

3.1 FISHERIES OF SPECIAL CONCERN

Fish and macroinvertebrate species of special concern (including those of economic importance) that occur in the vicinity of the project area include those with designated EFH and those of commercial and recreational value. In 1996, the MSFCMA mandated the identification of EFH for all Federally managed species. For a list of commercial and recreational fisheries species within and adjacent to the project areas, refer to Table 2. The categories of EFH that occur within the project area include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, seagrasses, and mangroves. Additionally, portions of the project area are in marine waters and include the marine water column and unconsolidated marine water bottoms.

3.2 RECREATIONAL AND COMMERCIAL FISHERIES

Table 2 provides a list of representative commercial and recreational fish and shellfish known to occur in the study area. The main commercial species in Aransas Bay, Corpus Christi Bay, and the Upper Laguna Madre are Black Drum, Southern Flounder, Sheepshead, mullet (*Mugil* sp.), blue crab, brown shrimp, white shrimp, and pink shrimp. Of the bay systems included in the study area, the Upper Laguna Madre had the highest commercial finfish harvest of all bays on the Texas coast, with 43.8 percent of the total finfish landings, followed by Corpus Christi Bay with the fourth-highest (9.3 percent) and Aransas Bay with the sixth-highest (3.0 percent) (pers. comm. D. Topping [TPWD], 2021).

In the Gulf portion of the study area, commercially harvested species include Black Drum, flounder, mullet, Cobia, grouper, snapper, and other. Snapper make up most of the commercial harvest, followed by grouper (Serranidae), Cobia, and mullet (pers. comm. D. Topping [TPWD], 2021). Shrimp and blue crab are also commercially harvested from this area of the Gulf, with brown shrimp comprising the majority, followed by white and pink shrimp (NOAA, 2021a).

Table 2
Representative Recreational and Commercial Fish and Shellfish Species Known to Occur in the Study Area

Common Name	Scientific Name[1]
Brown shrimp	*Farfantepenaeus aztecus*
Pink shrimp	*F. duorarum*
White shrimp	*Litopenaeus setiferus*
Blue crab	*Callinectes sapidus*
Bull Shark	*Carcharhinus leucas*
Blacktip Shark	*C. limbatus*
Atlantic Sharpnose Shark	*Rhizoprionodon terraenovae*
Gulf Menhaden	*Brevoortia patronus*
Striped Mullet	*Mugil cephalus*
Cobia	*Rachycentron canadum*
Greater Amberjack	*Seriola dumerili*
Lesser Amberjack	*S. fasciata*
Red Snapper	*Lutjanus campechanus*
Lane Snapper	*Lutjanus synagris*
Sheepshead	*Archosargus probatocephalus*
Sand Seatrout	*Cynoscion arenarius*
Spotted Seatrout	*Cynoscion nebulosus*
Atlantic Croaker	*Micropogonias undulatus*
Black Drum	*Pogonias cromis*
Red Drum	*Sciaenops ocellatus*
Little Tunny	*Euthynnus alletteratus*
King Mackerel	*Scomberomorus cavalla*
Spanish Mackerel	*S. maculatus*
Southern Flounder	*Paralichthys lethostigma*

Source: Nelson et al. (1992); Pattillo et al. (1997); NOAA (2021a); Personal communication with Darin Topping (September 2021) from the TPWD, Rockport Marine Lab, Rockport, Texas.
[1] Fish species according to Page et al. (2013).

During 2014 to 2020, recreational bay fishing represented 12.1 percent of the Upper Laguna Madre catch, 10.8 percent of the Aransas Bay catch, and 7.6 percent of the Corpus Christi Bay catch. The main recreational species include Spotted Seatrout (*Cynoscion nebulosus*), Black Drum, Red Snapper, and King Mackerel (*Scomberomorus cavalla*) (pers. comm. M. Fisher [TPWD], 2021).

3.2.1 Life History Characteristics

A description of life history characteristics, habitat preferences, and distribution of commercially and recreationally important species, except for those described in Section 3.4, is provided in the following sections. These estuarine-dependent species serve as prey for other fisheries managed under the GMFMC.

Blue Crab (*Callinectes sapidus*)

Blue crabs are harvested commercially and recreationally throughout the coastal waters of the Gulf. These fisheries have become increasingly important in the Gulf, with reported landings exceeding 3.4 million pounds in 2020 (NOAA, 2021a). Blue crabs occupy a variety of habitats, including the upper, middle, and lower estuaries, as well as associated marine environments, depending on their life history stage. Larvae occupy the lower estuary and marine water with salinities greater than 20 ppt. Blue crabs first enter the estuary during the megalopae life stage where they begin a benthic existence. Spawning occurs during the spring, summer, and fall (Pattillo et al., 1997).

Factors that affect the distribution and survival of blue crabs are substrate, food availability, water temperature, and salinity. Blue crabs are opportunistic omnivores and feed on fish, detritus, crustaceans, mollusks, and other blue crabs. They are also prey for higher trophic levels, including diving ducks, herons, and predatory fish, including commercial and recreational species (Perry and McIlwain, 1986).

Blue crabs may be found throughout the tidally influenced emergent wetlands and open water areas of the study area. All life stages of blue crab are common to highly abundant year-round in the study area (Nelson et al., 1992; Pattillo et al., 1997).

Gulf Menhaden (*Brevoortia patronus*)

Gulf Menhaden occur throughout the northern Gulf from the Caloosahatchee River, Florida, to the Yucatan, Mexico (Hoese and Moore, 1998). Juvenile menhaden prefer low salinity, open-water habitats adjacent to emergent marsh. Adults often occur offshore. This species makes up a majority of the commercial "pogy" purse-seine fishery. As filter feeders, they feed on phytoplankton, zooplankton, and organic detritus. Spawning season usually occurs from October through March but may begin in August and last as late as May. Spawning may occur multiple times during a single spawning season (Lassuy, 1983a; Pattillo et al., 1997). In the study area, juvenile Gulf Menhaden are common to abundant year-round, adults are common and juveniles abundant July through November, and larvae are common to abundant September through November (Nelson et al., 1992).

Striped Mullet (*Mugil cephalus*)

Striped Mullet spawn offshore near the surface from October to March. Eggs and sperm are released into the water column for fertilization. Once they reach the pre-juvenile stage, they enter the bays and estuaries to mature. Sexual maturity is reached at 3 years of age, and adults remain near shore throughout their life. Striped mullet feed mainly on microalgae, detritus, and sediment particles (Pattillo et al., 1997). Adult and juvenile Striped Mullet are common to abundant year-round in the study area, while larval Striped Mullet are found October through May the Laguna Madre (Nelson et al., 1992).

Sheepshead (*Archosargus probatocephalus*)

Sheepshead is an estuarine-dependent species that inhabits much of the Atlantic and Gulf coasts of the United States. Spawning occurs offshore from February through April, with the peak in March and April. Eggs typically are laid over the inner continental shelf (Pattillo et al., 1997). Larvae are pelagic, but move into estuaries, seeking refuge in seagrass (Lee et al., 1980; Pattillo et al., 1997). Juveniles begin leaving seagrass in late summer, congregating with adults around nearshore reefs as they mature (Jennings, 1985; Pattillo et al., 1997). Adults also use oyster reefs, shallow muddy bottoms, marshes, piers and rocks, and bare sands of the surf zone. Larval and juvenile Sheepshead consume primarily zooplankton, whereas larger juveniles and adults prey on blue crab, oysters, clams, and small fish (Pattillo et al., 1997).

All life stages of Sheepshead are common to highly abundant year-round in the study area (Nelson et al., 1992; Pattillo et al., 1997). Since juveniles are typically associated with vegetation (Pattillo et al., 1997), they may occur in the tidally influenced brackish marshes in the study area. Adults may occur in open-water habitat and probably would not occur in brackish marsh habitats in the study area.

Sand Seatrout (*Cynoscion arenarius*)

Sand Seatrout is an estuarine species that occurs throughout the Gulf coast in nearshore habitats (Pattillo et al., 1997). Spawning occurs primarily in shallow, higher salinity habitats from February through October (Pattillo et al., 1997; Sutter and McIlwain, 1987). Typical habitats preferred by juvenile sand seatrout are flooded marshes and seagrass meadows with soft organic substrates. Adults are found in open water over most substrates. Sand Seatrout migrate to the Gulf in late fall or winter to spawn. Eggs and sperm are released into the water column for fertilization. Larvae are carried into the estuary by the currents and migrate to the upper areas of the estuary, preferring channels, small bayous, and shallow marshes to develop. Adult Sand Seatrout reach sexual maturity at 12 months (Pattillo et al., 1997). They feed mainly on fish and shrimp (Overstreet and Heard, 1982).

Juveniles and adults are common to abundant almost year-round in the project areas, while larvae are common January through March in Corpus Christi Bay (Nelson et al., 1992). There is a high probability of juvenile and adult Sand Seatrout occurring in the study area, especially in tidally influenced emergent wetlands and open-water habitats.

Spotted Seatrout (*Cynoscion nebulosus*)

Spotted Seatrout are estuarine residents, spending their entire life cycle in estuarine waters (Lassuy, 1983b). Spawning typically occurs from March to October, with a peak between April and August. Spawning takes place in passes and in shallow, grassy habitats in bays with moderate salinities. Adults and juveniles prefer seagrass meadows and sandy to muddy substrates. Larval Spotted Seatrout feed on zooplankton while juveniles feed on larger invertebrates and small fish. As adults their diet consists primarily of fish (Pattillo et al., 1997).

Juvenile Spotted Seatrout are common year-round occurring in tidally influenced emergent wetlands in the study area; adults are common and may be found throughout the study area all year. Larvae are common during March through October throughout the study area (Nelson et al., 1992).

Atlantic Croaker (*Micropogonias undulatus*)

Atlantic Croaker spawn near passes in the Gulf from September through May. Eggs and sperm are randomly released into the water column for fertilization. Early larval stages are usually offshore and are carried by currents inshore to estuarine habitats. Juvenile Atlantic Croaker move into tributaries where they spend 6 to 8 months before migrating offshore starting in March and lasting until November (Lassuy, 1983c; Pattillo et al., 1997). Adults have seasonal migrations moving into estuarine waters typically in the summer and then into marine waters typically in the fall (Pattillo et al., 1997).

Adult Atlantic Croaker are common to abundant year-round within the study area (Nelson et al., 1992; Pattillo et al., 1997). Juveniles are highly abundant in the study area through the spring before migrating to the Gulf in April or early summer (Lassuy, 1983c; Nelson et al., 1992). There is a high probability of juvenile and adult Atlantic Croaker occurring in the study area, especially in fresh-intermediate marshes and open-water habitats.

Black Drum (*Pogonias cromis*)

Black Drum is an estuarine-dependent species that occurs in open bays and estuaries. Mature Black Drum spawn in the open bay, in nearshore Gulf waters, or in connecting passes from January to mid-April. During spawning, eggs and sperm are released into the water column for fertilization. Black Drum larvae and juveniles move into upper bay areas and tidal creeks, where they remain until they reach about 4 inches in length and then move into the open bay. Black Drum remain in the bay until they reach sexual maturity (about 2 years) (Pattillo et al., 1997).

Adult and juvenile Black Drum are common and occur throughout the study area year-round (Nelson et al., 1992; Pattillo et al., 1997). Larval Black Drum occur from February through April over the continental shelf. Juveniles inhabit muddy bottoms in marsh habitats year-round and adults are predominantly estuarine, preferring unvegetated sand and mud bottoms and oyster reefs year-round (Nelson et al., 1992; Pattillo et al., 1997; Sutter et al., 1986).

Southern Flounder (*Paralichthys lethostigma*)

Southern Flounder are distributed throughout estuarine and coastal waters of the Gulf from Florida to Texas (Hoese and Moore, 1998). Spawning occurs during late fall and early winter in nearshore waters (Gilbert, 1986). Once they reach sexual maturity at 2 years of age, they begin migrating to the Gulf to spawn (Daniels, 2000; Pattillo et al., 1997). Juveniles and adults are demersal and prefer estuarine, riverine, or marine environments, depending on the hydrography (Pattillo et al., 1997). This species is found over unconsolidated clayey silts and organic muds or may be associated with seagrass meadows or flooded marsh

(Pattillo et al., 1997). Southern Flounder are carnivorous during most life history stages, feeding mostly on crustaceans (Gilbert, 1986).

Juvenile Southern Flounder are common to abundant throughout the study area January through October. Adults are most common in the study area from the spring through late fall. During late fall, they move to deeper offshore waters to spawn (Nelson et al., 1992; Pattillo et al., 1997; Reagan and Wingo, 1985). Within the study area, Southern Founder may occur in the tidally influenced emergent wetlands and within or adjacent to open-water areas.

3.3 FEDERALLY MANAGED SPECIES

Information regarding Federally managed species was obtained through the NOAA EFH Mapper (NOAA, 2021b), NOAA Gulf of Mexico Essential Fish Habitat: Offshore Products (NOAA, 2013), and NMFS Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2009).

NMFS and the GMFMC identified the study area as EFH for brown, pink, and white shrimp; Gulf stone crab; Blacknose, Spinner, Silky, Finetooth, Bull, Blacktip, Tiger Lemon, Atlantic Sharpnose, Scalloped Hammerhead, and Bonnethead sharks; Red and Gag Grouper; Scamp; Cobia; Dolphin; Greater and Lesser Amberjack; Red, Gray, Lane, and Vermilion Snapper; Red Drum; Little Tunny; King and Spanish Mackerel; and Sailfish. The categories of EFH that occur within the study area include estuarine water column, estuarine mud and sand bottoms (unvegetated estuarine benthic habitats), estuarine shell substrate (oyster reefs and shell substrate), estuarine emergent wetlands, seagrasses, and mangroves. Additionally, portions of the project located in marine waters include the marine water column, unconsolidated marine water bottoms, and natural structural features.

Within areas identified as EFH, Habitat Areas of Particular Concern may be designated to focus conservation priorities on areas that are important to the life cycles of Federally managed species and may warrant more-targeted protection measures. Designation of specific Habitat Areas of Particular Concern is based on ecological function, habitats sensitive to human-induced environmental degradation, stressors of development activities, and habitat rarity (Dobrzynski and Johnson, 2001). No Habitat Areas of Particular Concern are designated in the study area (NOAA, 2021b).

In addition, the EPA CWA Section 404(b)(1) (40 CFR 230) designates Special Aquatic Sites as sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs, and riffle and pool complexes. Triton Environmental Solutions (2021, 2022) and Mott MacDonald (2021, 2022) performed an aquatic survey and wetland delineation of the proposed placement sites for the CDP for SAV, live oysters, and wetlands. It should be noted that these surveys included a 500-foot buffer beyond the direct project footprint. No wetlands or SAV occur within the proposed channel dredging footprint, however a total of 16.61 acres of tidal wetlands and 122.46 acres of non-tidal wetlands would be impacted with construction of placement actions targeting BU. A total of 0.10 acres of live oyster reef habitat occurs at placement site HI-E. A total of 6.88 acres of SAV would be impacted by the CDP; 3.46 acres in PA4, 0.01 acres in SS1, and 3.41 acres in HI-E.

3.4 LIFE HISTORY CHARACTERISTICS OF FEDERALLY MANAGED SPECIES

The following describes the preferred habitat, life history stages, and relative abundance of each Federally managed species occurring in the study area. Table 3 describes the relative abundance and adult and juvenile presence of EFH managed species occurring in the study area. Relative abundance is defined as follows (Nelson et al., 1992):

- Highly Abundant: Species numerically dominant relative to others
- Abundant: Species often encountered in substantial numbers relative to others
- Common: Species generally encountered but not in large numbers and not evenly distributed over specific salinity zones
- Rare: Species present but not frequently encountered
- Not Present: Species not found in area

Brown Shrimp (*Farfantepenaeus aztecus*)

Adult brown shrimp are most abundant off the coasts of Texas, Louisiana, and Mississippi from March to December (Pattillo et al., 1997). They inhabit a wide range of water depths up to approximately 360 feet. Nonspawning adults prefer turbid waters and soft sediment. Brown shrimp eggs are demersal and are deposited offshore. The larvae begin to migrate through passes with flood tides into estuaries as postlarvae. Migration occurs at night, mainly from February to April, with some migration in the fall. Brown shrimp postlarvae and juveniles are associated with shallow vegetated habitats in estuaries but are also found over silty sand and nonvegetated mud bottoms. Postlarvae and juveniles occur in salinity ranging from 0 to 70 ppt. The density of postlarvae and juveniles is highest in emergent marsh edge habitat and SAV, followed by tidal creeks, inner marsh, shallow open water, and oyster reefs (Clark et al., 2004). Juveniles and subadults of brown shrimp occur from secondary estuarine channels out to the continental shelf, but prefer shallow estuarine areas, particularly soft, muddy areas, shell substrates, or plant-water interfaces (Baltz et al., 1993; GMFMC, 2004; Peterson and Turner, 1994; Rakocinski et al., 1992). Subadult brown shrimp migrate from estuaries at night on ebb tides during new and full moon phases in the Gulf. Their abundance offshore correlates positively with turbidity and negatively with low dissolved oxygen. Adult brown shrimp inhabit nearshore areas on the continental shelf and are associated with silt, muddy sand, and sandy substrates (GMFMC, 2004). Larval brown shrimp feed on phytoplankton and zooplankton. Postlarvae brown shrimp feed on phytoplankton, epiphytes, and detritus. Juvenile and adult brown shrimp prey on amphipods, polychaetes, and chironomid larvae and graze on algae and detritus (Lassuy, 1983d; Pattillo et al., 1997).

Table 3
Adult and Juvenile Presence for Identified Essential Fish Habitat Within the Study Area by Species

Common/Scientific Name*	Bay (Estuarine)		Marine (Gulf)	
	Juvenile	Adult	Juvenile	Adult
Brown shrimp (*Farfantepenaeus aztecus*)	common to highly abundant year-round nursery area	not present	spawning area year-round	major adult area spring, summer, fall
Pink shrimp (*Farfantepenaeus duorarum*)	common Aug-Jun	not present	nursery area year-round	present year-round spawning area in summer
White shrimp (*Litopenaeus setiferus*)	abundant July-Oct common Nov-Jun nursery area	common Apr-Jun abundant Sept-Nov	not present	present year-round spawning Mar-Oct
Blacknose Shark (*Carcharhinus acronotus*)	not present		present	
Spinner Shark (*Carcharhinus brevipinna*)	not present		present	
Silky Shark (*Carcharhinus falciformis*)	not present		present	
Finetooth Shark (*Carcharhinus isodon*)	present		present	
Bull Shark (*Carcharhinus leucas*)	common Mar-Oct	present	present	
Blacktip Shark (*Carcharhinus limbatus*)	not present		present	
Tiger Shark (*Galeocerdo cuvier*)	not present		present	
Lemon Shark (*Negaprion brevirostris*)	present		present	not present
Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)	present		present	
Scalloped hammerhead shark (*Sphyrna lewini*)	present		present	

Common/Scientific Name*	Bay (Estuarine)		Marine (Gulf)	
	Juvenile	Adult	Juvenile	Adult
Bonnethead Shark (*Sphyrna tiburo*)	present		present	
Red Grouper (*Epinephelus morio*)	not present		nursery area year-round	adult occurrence
Gag Grouper (*Mycteroperca microlepis*)	not present		not present	adult occurrence
Scamp (*Mycteroperca phenax*)	not present		not present	adult occurrence
Cobia (*Rachycentron canadum*)	nursery area year-round	not present	nursery area year-round	present summer
Dolphin (*Coryphaena hippurus*)	not present		present year-round	
Greater Amberjack (*Seriola dumerili*)	not present		present year-round	adult and spawning area year-round
Lesser Amberjack (*Seriola fasciata*)	not present		not present	present
Red Snapper (*Lutjanus campechanus*)	nursery area year-round	not present	nursery area year-round	not present
Gray Snapper (*Lutjanus griseus*)	nursery area	present year-round spawn Jun-August	not present	major adult area year-round spawn Jun-August
Lane Snapper (*Lutjanus synagris*)	present Jun-Nov nursery area	not present	nursery area	not present
Vermilion Snapper (*Rhomboplites aurorubens*)	not present		nursery area	not present
Red Drum (*Sciaenops ocellatus*)	common year-round nursery area	common year-round	spawning area fall and winter	present year-round spawning area fall and winter
Little Tunny (*Euthynnus alletteratus*)	not present		present	

Common/Scientific Name*	Bay (Estuarine)		Marine (Gulf)	
	Juvenile	Adult	Juvenile	Adult
King Mackerel (*Scomberomorus cavalla*)	not present		nursery area year-round	present year-round spawning area May-Nov
Spanish Mackerel (*Scomberomorus maculatus*)	nursery area year-round	common Apr-Oct	nursery area year-round	present year-round spawning area summer and fall
Sailfish (*Istiophorus platypterus*)	not present		present	

Source: Nelson et al. (1992); NMFS (2009); NOAA (2013, 2021b).

* Species according to Page et al. (2013).

Although adult brown shrimp typically inhabit offshore waters (Pattillo et al., 1997), there is a high probability that they occur within the study area, as the open-water habitat is supportive of habitat preferred by adult brown shrimp (e.g., turbid waters and soft sediments) (Lassuy, 1983d; Pattillo et al., 1997). Juvenile brown shrimp are abundant within mid and upper coast bays year-round, while adult brown shrimp are common to highly abundant from April to October (Table 3) (Nelson et al., 1992). In the Gulf, adult brown shrimp are common year-round and spawning year-round at depths greater than 40 feet (Nelson et al., 1992; Pattillo et al., 1997). Brown shrimp are likely to occur in the study and project areas.

Pink Shrimp (*Farfantepenaeus duorarum*)

Pink shrimp inhabit Gulf and estuarine waters and are pelagic or demersal, depending on their life stage. After spawning offshore, postlarval pink shrimp recruitment into the estuaries occurs in the spring and fall through passes. Juveniles can be found in SAV meadows where they burrow into the substrate; however, postlarvae, juvenile, and adults may prefer a mixture of coarse sand/shell/mud. Densities of pink shrimp are lowest or absent in marshes, low in mangroves, and greatest near or in SAV. Adults occur offshore at depths from 30 to 145 feet and prefer substrates of coarse sand and shell (GMFMC, 2004). Pink shrimp feed on phytoplankton and zooplankton. Postlarvae feed on phytoplankton, epiphytes, and detritus. Juveniles and adults prey on amphipods, polychaetes, chironomid larvae, algae, and detritus (Pattillo et al., 1997).

Juvenile pink shrimp are common within mid coast bays, and adults are common on the mid to upper coast bays, while in the Gulf, adults are present year-round (Table 3) (Nelson et al., 1992; Pattillo et al., 1997). Pink shrimp are likely to occur in the study and project areas.

White Shrimp (*Litopenaeus setiferus*)

White shrimp inhabit Gulf and estuarine waters and are pelagic or demersal, depending on their life stage. Their eggs are demersal and larval stages are planktonic and both occur in nearshore Gulf waters. Postlarvae migrate into estuaries through passes from May to November with most migration in June and September. Migration occurs in the upper water column at night and at mid-depths during the day. Postlarval white shrimp become benthic once they reach the estuary where they seek shallow water with mud or sand bottoms high in organic detritus or rich marsh. Postlarvae and juveniles prefer mud or peat bottoms with large quantities of decaying organic matter or SAV. Densities are usually highest along marsh edge and in SAV, followed by marsh ponds and channels, inner marsh, and oyster reefs. Juvenile white shrimp prefer salinities less than 10 ppt and occur in tidal rivers and tributaries (Muncy, 1984). As juveniles mature, they migrate to coastal areas where they spawn. Adult white shrimp are demersal and inhabit soft mud or silt bottoms (GMFMC, 2004). Nonspawning adults are tolerant of temperatures between 45 and 100 ºF, and survival is high between 2 and 35 ppt, while spawning adults prefer salinity above 27 ppt. White shrimp larvae feed on phytoplankton and zooplankton. White shrimp post larvae feed on phytoplankton, epiphytes, and detritus. Juvenile and adult white shrimp prey on amphipods, polychaetes, and chironomid larvae, but also graze on algae and detritus (Pattillo et al., 1997). Adult and juvenile white shrimp are common to abundant in mid to upper coast bays throughout the year. Adult white shrimp also occur year-round throughout the Gulf to depths of about 131 feet (Table 3) (Muncy, 1984; Nelson et al., 1992; Pattillo et al., 1997). White shrimp are likely to occur in the study and project areas.

Blacknose Shark (*Carcharhinus acronotus*)

The Blacknose Shark is a common tropical and warm temperate species found on the continental shelf mainly over sand, shell, and coral bottoms to depths of 60 to 210 feet (Compagno, 1984; Driggers et al., 2007; Carlson, Charvet, Avalos, Blanco-Parra et al., 2021). These sharks undergo seasonal migrations to the northern portion of their range, where they reside from March to November. Although little is known about their migrations in the Gulf it is thought that they move offshore during the late autumn, winter, and early spring months (Driggers et al., 2007; Sulikowski et al., 2007). Blacknose Sharks reproduce once per year in the Gulf, which is in contrast to their biennial reproductive cycle in the south Atlantic (Carlson, Charvet, Avalos, Blanco-Parra et al., 2021; Sulikowski et al., 2007). They feed on small fish, including Pinfish (*Lagodon rhomboids*) and Porcupine Fish (Diodontidae) (Compagno, 1984). Adult and juvenile Blacknose Sharks occur in Gulf waters of the study and project areas (Table 3) (Bethea et al., 2008; NMFS, 2009).

Spinner Shark (*Carcharhinus brevipinna*)

The Spinner Shark is a common coastal pelagic species found both inshore and offshore to depths of approximately 240 feet, but most commonly at depths of less than 100 feet. It is a schooling species that commonly leaps spinning out of the water. Spinner sharks are highly migratory, although their patterns are poorly known. They move inshore during the spring and summer to spawn and feed and possibly southward, into deeper water, during the fall and winter. Spinner Sharks feed primarily on fish including sardines, herring, anchovies, catfish, mullet, bluefish, tunas, and jacks (Burgess and Branstetter, 2009; Compagno, 1984). Adult and juvenile Spinner Sharks are present in estuarine and Gulf waters of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Silky Shark (*Carcharhinus falciformis*)

Silky Sharks are a tropical, oceanic, coastal pelagic species that have a circumglobal distribution. They can be found along the edge of the continental shelf to depths of greater than 1,640 feet, preferring warmer waters, and often associated with deep-water reefs, islands, and insular slopes (Compagno, 1984; Rigby et al., 2017). Silky Sharks are quick moving, aggressive, and active sharks (Compagno, 1984). They give birth to live young with nursery areas typically found in shallower coastal waters while adults occupy deeper waters farther offshore. Silky Sharks leave the nursery areas as subadults to move to deeper offshore waters. Atlantic populations of Silky Sharks were on the decline through the 1990s as a result of longlines and purse seine fisheries, but since 2000 their numbers appear to be increasing (Rigby et al., 2017). They are primarily piscivorous, feeding on tuna, mackerel, sea catfish, and porcupine fish, but also crabs and squid (Compagno, 1984). Silky Sharks are likely to occur in the Gulf portions of the study and project areas and south Texas estuaries (Table 3) (NMFS, 2009; NOAA, 2021b).

Finetooth Shark (*Carcharhinus isodon*)

Finetooth Sharks are a Gulf species occurring in shallow coastal waters including bays, estuaries, along beaches, and near river mouths to about 66 feet. They are common in the Gulf during the summer when the water is warmer, migrating south in the fall and winter when water temperatures decline (Carlson, Charvet, Avalos, Briones Bell-Lloch et al., 2021). Documented nursery habitat is located off the Texas and Louisiana coasts (NMFS, 2009). They probably feed on small boney fish and cephalopods including mackerel, croakers, and mullet (Compagno, 1984; Carlson, Charvet, Avalos, Briones Bell-Lloch et al., 2021). Adult and juvenile Finetooth Sharks are found in the estuarine and Gulf portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Bull Shark (*Carcharhinus leucas*)

Bull Sharks are a common tropical and subtropical species having a wide range along the coast inhabiting shallow waters, especially in bays, rivers, and lakes. They frequently move between fresh and brackish water and can travel great distances inland. They are the only species of shark capable of existing in freshwater for extended periods (Simpfendorfer and Burgess 2009). Bull Sharks are viviparous, have a gestation period of a little less than 1 year, and it is assumed their reproductive cycle occurs every 2 years. Juveniles are found at depths less than 80 feet in shallow coastal waters, inlets, and estuaries (Compagno, 1984; NMFS, 2009). They have a diverse diet, feeding on sea turtles, birds, dolphins, bony fish, sharks, rays, shrimp, crabs, squid, and sea urchins (Simpfendorfer and Burgess, 2009). Adult and juvenile Bull Sharks are present in the estuarine and Gulf portion of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Blacktip Shark (*Carcharhinus limbatus*)

Blacktip Sharks are widespread inhabiting tropical and subtropical shallow waters and offshore surface waters of the continental shelf. This species commonly occurs in loose aggregations in bays, estuaries, off beaches, and near mouths of rivers (Burgess and Branstetter, 2009). They are viviparous (giving birth to live young), and young are born in coastal bays and estuaries in late May and early June after a 1-year gestation period. Their reproductive cycle occurs every 2 years. Juveniles inhabit shallow coastal waters from the shore to 82-feet deep (Burgess and Branstetter, 2009; NMFS, 2009). They feed mainly on pelagic and benthic fish, cephalopods, crustaceans, small rays and sharks (Burgess and Branstetter, 2009; Compagno, 1984). Juvenile and adult Blacktip Sharks occur in the Gulf and estuarine portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Tiger Shark (*Galeocerdo cuvier*)

The Tiger Shark is a global coastal pelagic species occurring in both very shallow and deep (up to 460 feet) waters (Compagno, 1984; Ferreira and Simpfendorfer, 2019). They prefer turbid areas, often occurring in river estuaries and near wharves and jetties in coastal waters. It is the only shark species in the Carcharhinidae family that is ovoviviparous (Compagno, 1984). Mating occurs in the spring with pupping the following spring to summer. Litters are produced every 2 years or less (Ferreira and Simpfendorfer, 2019). Tiger Sharks have the most diverse diet of any shark species, eating both plants and animals, including boney fishes, sharks and rays, sea turtles, sea birds, marine mammals, crustaceans, carrion of terrestrial wildlife, and floating garbage (Compagno, 1984; Ferreira and Simpfendorfer, 2019). They are one of the most aggressive and dangerous of the shark species, known to consume humans (Compagno, 1984). Juvenile and adult Tiger Sharks occur in the Gulf portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Lemon Shark (*Negaprion brevirostris*)

Lemon Sharks are a large coastal species that inhabit inshore waters of the continental and insular shelves occurring to depths of 300 feet, but favoring shallow areas (Compagno, 1984; Carlson, Charvet, Ba et al., 2021). They can be found around coral reefs, mangroves, docks, enclosed bays, sounds, and river mouths, occasionally venturing into the open ocean during migrations (Compagno, 1984; NMFS, 2009). The Lemon Shark is viviparous with mating occurring in shallow water during the spring and summer, followed by a 10- to 12-month gestation period, giving birth in shallow nursery areas (Compagno, 1984; Carlson, Charvet, Ba et al., 2021). The young feed mainly on boney fish, crabs, shrimp, and octopus while adults eat boney and cartilaginous fishes and sea birds (Carlson, Charvet, Ba et al., 2021). Adult Lemon Sharks occur in the estuarine portions of the study and project areas, and adults and juveniles are found in the Gulf portions (Table 3) (NMFS, 2009; NOAA, 2021b).

Atlantic Sharpnose Shark (*Rhizoprionodon terraenovae*)

The Atlantic Sharpnose Shark is abundant in warm temperate and tropical waters and is one of the most common shark species in the northern Gulf (Carlson, Charvet, Blanco-Parra et al., 2021; Hoese and Moore, 1998). Migrations are seasonal, limited to inshore/offshore movements, moving to deeper water in the winter and returning inshore during the spring (Compagno, 1984). They inhabit intertidal to deeper waters, often in the surf zone off sandy beaches, bays, estuaries, and river mouths mostly over mud and sand bottoms (Carlson, Charvet, Blanco-Parra et al., 2021). During the summer, juveniles and adults inhabit shallow inshore waters. They are viviparous, and mating occurs in June, with a gestation period of about 1 year using enclosed bays as nursery areas (Carlson, Charvet, Blanco-Parra et al., 2021; NMFS, 2009). Juvenile Atlantic Sharpnose Sharks are found in higher salinity estuaries and the surf zone during the summer (Hoese and Moore, 1998). They feed on fish, shrimp, crab, mollusks, and segmented worms (Carlson, Charvet, Blanco-Parra et al., 2021). Juvenile and adult Atlantic Sharpnose Shark occur in the Gulf and estuarine portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Scalloped Hammerhead Shark (*Sphyrna lewini*)

Scalloped Hammerhead sharks are a very common coastal, pelagic species, which occur over the continental shelf and deeper water, often entering bays and estuaries (Compagno, 1984). They are found inshore and offshore from intertidal and surface to depths of approximately 900 feet (Rigby et al., 2019). They migrate seasonally forming large schools of small migrating individuals that move to higher latitudes in the summer in certain areas (Compagno, 1984). Adults spend most of the time offshore, with females migrating to coastal areas to birth pups (Rigby et al., 2019). Juvenile Scalloped Hammerhead sharks occur close to shore in bays and nearshore coastal waters, moving to deeper waters as they grow before moving habitat offshore habitats (Rigby et al., 2019; Compagno, 1984). Adults feed on a variety of fish and cephalopods, while juveniles feed mainly on demersal fish, benthic reef fish, and crustaceans (Rigby et al., 2019; Compagno, 1984). Juvenile and adult Scalloped Hammerhead sharks occur in the Gulf and estuarine portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Bonnethead Shark (*Sphyrna tiburo*)

Bonnethead Sharks are an abundant coastal species inhabiting shallow estuaries and bays over grass, sand, or mud bottoms and in the Gulf at depths of 30 to 260 feet (Compagno, 1984; Pollom et al., 2020). They are found in small schools of three to 15 individuals, and very rarely alone (Compagno, 1984). Bonnethead sharks exhibit little or no long-distance migratory behavior, preferring to stay in one location (Heupel et al., 2006). They reproduce once a year, having the shortest gestation period of any of the shark species at 4½ to 5 months. Nursery areas are located inshore in shallow seagrass habitat (Pollom et al., 2020). Bonnethead sharks feed primarily on crustaceans including crabs (especially blue crabs), shrimp, barnacles, and bivalves (Compagno, 1984; Heupel et al., 2006). They are specialist hunters appearing to have higher food consumption rates than other species of shark (Pollom et al., 2020). Adult and juvenile Bonnethead Sharks are present in the estuarine and Gulf portions of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

Red Grouper (*Epinephelus morio*)

Red Groupers are a demersal species occurring throughout the Gulf from depths of 10 to 660 feet (GMFMC, 2004). Adults are found mainly on muddy and rocky bottoms, usually resting on the bottom substrate. Juveniles prefer seagrass beds in shallower water and inshore reefs until they reach larger sizes when they move offshore to rocky bottom and reef habitats (Froese and Pauly, 2019; Brule et al., 2018). Spawning occurs offshore during the spring in the same areas as they reside. Eggs are pelagic, requiring at least 32 ppt for buoyancy. Juveniles prefer grass beds, shallow reefs, and rock formations that are utilized as nursery areas where they remain until mature before moving to deeper offshore waters. They feed mainly on fish, shrimp, crabs, octopus, and lobsters (GMFMC, 2004). Adult and juvenile Red Grouper occur in the Gulf portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Gag Grouper (*Mycteroperca microlepis*)

Gag Grouper are demersal and are most common in the eastern Gulf. Eggs are pelagic and are spawned from December through April (Koenig et al., 2018; GMFMC, 2004). Larvae are pelagic and most abundant in the early spring (GMFMC, 2004). Post-larvae and pelagic juveniles move through inlets into high salinity estuaries from April through May, where they become benthic and settle into grass flats and oyster beds (Koenig et al., 2018; GMFMC, 2004). Older juveniles move offshore in the fall to shallow reef habitat in depths of 3 to 170 feet. Adults prefer depths of 30 to 330 feet and utilize hard bottoms, oil platforms, and artificial reefs (GMFMC, 2004). Adult Gag Grouper school in groups of five to 50 individuals or may be found solitary (Koenig et al., 2018). They feed on estuarine-dependent organisms such as shrimp, small fish, and crabs during their juvenile stages. As they mature and move farther offshore, they become opportunistic predators, feeding on a variety of fish and crustaceans (Koenig et al., 2018; GMFMC, 2004). Adult Gag Grouper occur in Gulf waters within the study and project areas (Table 3) (NOAA, 2013, 2021b).

Scamp (*Mycteroperca phenax*)

Scamp are a deep-water demersal species that is widely distributed throughout the Gulf and found over ledges and high-relief rocky bottoms, congregating at depths of 40 to 240 feet in the Gulf (GMFMC, 2004; Afonso et al., 2018). It is estimated that this species lives for at least 30 years. Spawning occurs in aggregations at the shelf edge from February to July in the Gulf (Afonso et al., 2018). Eggs and larvae are pelagic and occur offshore in the spring (GMFMC, 2004). Juveniles can be found in shallow-water mangrove areas and at jetties (Afonso et al., 2018). Adult Scamp occur in Gulf waters within the study and project areas (Table 3) (NOAA, 2013, 2021b).

Cobia (*Rachycentron canadum*)

Cobia are a widely distributed large, pelagic fish, found over rocky shores, shallow coral reefs, and occasionally in estuaries (Collette et al., 2015; GMFMC, 2004). They are often associated with pilings, platforms, buoys, anchored boats, and flotsam (Florida Museum of Natural History, 2021a). Spawning occurs in large aggregations from April through September in coastal waters (Collette et al., 2015). While cobia rarely use estuarine environments, estuaries are important for most of their prey. They are a voracious predator often swallowing prey whole, feeding mainly on mantis shrimp, eels, crabs, squid, and Spanish Mackerel (Florida Museum of Natural History, 2021a; GMFMC, 2004). Adult and juvenile Cobia occur in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Dolphin (*Coryphaena hippurus*)

Dolphin are a pelagic offshore species often associated with *Sargassum* and other floating objects and found to depths of 280 feet. They travel together in small schools and exhibit north-south seasonal migrations (Collette et al., 2011a; GMFMC, 2004). Multiple spawning events occur throughout the year in open water when temperatures rise above 69.8°F (Collette et al., 2011a; GMFMC, 2004). Eggs and larvae are pelagic and commonly associated with *Sargassum*. Young billfishes often prey upon Dolphin larvae and juveniles are eaten by larger pelagic fishes, including other Dolphin. Adults feed on small oceanic fish, juveniles of larger pelagic fish, and invertebrates (GMFMC, 2004). Adult and juvenile Dolphin occur in the Gulf portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Greater Amberjack (*Seriola dumerili*)

Greater Amberjack occur throughout the Gulf to depths of 1,300 feet (GMFMC, 2004). Adults are pelagic and epibenthic, occurring near reefs, artificial structures, rocky outcrops, and wrecks, usually in small schools but may be solitary (Smith-Vaniz, Pina Amargos et al., 2015a). Little is known about the spawning habits of greater amberjack; however, it is thought migrations are related to reproduction (Florida Museum of Natural History, 2021b). Spawning occurs offshore from March to July near reefs and wrecks (GMFMC, 2004; Florida Museum of Natural History, 2021b). Juveniles are pelagic and associated with floating *Sargassum* mats and debris in the offshore nursery areas (GMFMC, 2004). Adult Greater Amberjack feed on benthic and pelagic fish, squid, and crustaceans while juveniles eat plankton and other small invertebrates (Florida Museum of Natural History, 2021b). Adult and juvenile Greater Amberjack are found in the Gulf within the study and project areas (Table 3) (NOAA, 2013, 2021b).

Lesser Amberjack (*Seriola fasciata*)

Adult Lesser Amberjack occur year-round in the northern Gulf and are near the bottom associated with oil and gas platforms and irregular bottoms at depths from 180 to 430 feet (GMFMC, 2004; Smith-Vaniz, Williams et al., 2015). Spawning occurs in the Gulf from September through December and again in February through March. There is no information on eggs, larvae, and post-larvae. Juveniles are found in the Gulf during late summer and fall, and small juveniles are associated with *Sargassum* mats (GMFMC, 2004). They feed primarily on fish and squid but will take dead bait (Smith-Vaniz, Williams et al., 2015). Adult Lesser Amberjack are found in the Gulf within the study and project areas (Table 3) (NOAA, 2021b).

Red Snapper (*Lutjanus campechanus*)

Red Snapper are demersal, found over sand and rock substrates, around reefs, and underwater objects to depths ranging from 10 feet for juveniles to 2,000 feet for adults (GMFMC, 2004; Anderson et al., 2015). However, adult Red Snapper prefer depths ranging from 130 to 360 feet (GMFMC, 2004). Spawning occurs in the Gulf from May to July and November to December, at depths of 60 to 120 feet over a firm sand substrate (Moran, 1988). Eggs are found offshore in the summer and late fall. Larvae, post-larvae, and early juveniles occur from July through November in shelf waters (GMFMC, 2004). Early and late juveniles are often associated with underwater structures or small burrows of low relief but are also abundant over barren sand and mud bottoms (Gallaway et al., 1999; GMFMC, 2004). Juvenile Red Snapper feed mainly on shrimp, but after age one, prey primarily on fish and squid (Anderson et al., 2015; GMFMC, 2004; Moran, 1988). Of the vertebrates consumed, most are not obligate reef dwellers, indicating that Red Snapper feed away from reefs (GMFMC, 2004). Juvenile Red Snapper are found in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Gray Snapper (*Lutjanus griseus*)

Gray Snapper can be demersal, structure, or mid-water dwellers inhabiting marine, estuarine, and riverine habitats. They inhabit depths to about 550 feet in the Gulf (GMFMC, 2004). Juvenile Gray Snapper are common in shallow water around SAV, mangrove roots, docks, pilings, and jetties, while adults tend to congregate in deeper Gulf waters around natural and artificial reefs. Spawning occurs offshore in groups from June to August around structures and shoals. Their eggs are pelagic, and the larvae are planktonic, both occurring in Gulf shelf waters and near coral reefs. Post-larvae migrate into the estuaries and are most abundant over *Halodule* and *Syringodium* grassbeds. Juveniles seem to prefer *Thalassia* grassbeds, seagrass meadows, marl bottoms, and mangrove roots, and are found in estuaries, bayous, channels, grassbeds, marshes, mangrove swamps, ponds, and freshwater creeks (Lindeman, Anderson, Carpenter et al., 2016; Pattillo et al., 1997). Juvenile Gray Snapper feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. Gray Snapper are classified as opportunistic carnivores at all life stages (Pattillo et al., 1997). In estuaries, juveniles feed on shrimp, larval fish, amphipods, and copepods. Adults feed primarily on fish, but smaller individuals will prey on crustaceans (GMFMC, 2004; Lindeman, Anderson, Carpenter et al., 2016). Juvenile and adult Gray Snapper are found in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Lane Snapper (*Lutjanus synagris*)

Lane Snapper are a demersal species occurring over multiple substrate types but are most commonly found near reefs and vegetated sandy bottoms in shallow inshore waters (Florida Museum of Natural History, 2021c). Lane Snapper appear to favor grass flats, reefs, and soft bottoms to depths of approximately 70 feet (GMFMC, 2004) but adult Lane Snapper can occur offshore in depths up to 430 feet near sand bottoms, natural channels, banks, and artificial and natural structures. They tend to remain in the same area their entire lives. Spawning occurs in aggregations in Gulf waters from March through September. Nursery areas include mangrove and grassy estuarine habitats in southern Texas and Florida and shallow waters with sand and mud bottoms along all Gulf states. Juveniles feed on estuarine-dependent organisms such as shrimp, small fish, and crabs. Lane Snapper are considered unspecialized, opportunistic predators, feeding on a variety of crustaceans and fish (GMFMC, 2004; Florida Museum of Natural History, 2021c). Juvenile Lane Snapper are found in estuaries and adult and juveniles are found in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Vermilion Snapper (*Rhomboplites aurorubens*)

Vermilion Snapper are a demersal species occurring in waters 60 to 660 feet deep over rock, gravel, or sand bottoms in the Gulf (GMFMC, 2004; Lindeman et al., 2016b). They often form large schools, especially the young (Lindeman, Anderson, Claro et al., 2016). Spawning occurs in offshore waters from April to September. Juveniles are found on hard bottoms, reefs, and artificial structures (GMFMC, 2004; Lindeman et al., 2016b). They feed on fish, benthic invertebrates, crabs, shrimp, and cephalopods (Lindeman, Anderson, Claro et al., 2016). Juvenile Vermilion Snapper are found in the Gulf portions of the study and project areas (Table 3) (NOAA, 2021b).

Red Drum (*Sciaenops ocellatus*)

Red Drum occupy a variety of habitats, ranging from offshore depths of 130 feet to very shallow estuarine waters. Spawning occurs in the Gulf near the mouths of bays and inlets from August through November, peaking in September and October (Pattillo et al., 1997). Eggs usually hatch in the Gulf, and larvae are transported with tidal currents into the estuaries where they mature. Adult Red Drum use estuaries but tend to migrate offshore where they spend most of their adult life. Red Drum occur over a variety of substrates including sand, mud, and oyster reefs and tolerate a wide range of salinities (GMFMC, 2004).

Estuaries are especially important to larval, juvenile, and subadult Red Drum. Juveniles are most abundant around marshes, preferring shallow, protected waters over mud substrate or among SAV (Stunz et al., 2002a). Juveniles show preferences for specific habitat types, occurring at higher densities in seagrass meadows (Stunz et al., 2002a) with higher growth rates in brackish emergent marsh and in seagrass meadows (Stunz et al., 2002b). Subadult and adult Red Drum prefer shallow bay bottoms and oyster reefs. Estuaries are also important for the prey of larval, juvenile, and subadult Red Drum. Their larvae feed primarily on shrimp, mysids, and amphipods, while juveniles prefer fish and crabs (GMFMC, 2004). Adults are an aggressive opportunistic ambush predator feeding primarily on blue crab, penaeid shrimp, and some benthic fishes (Chao, 2020). Adult and juvenile Red Drum are found in the estuarine portions and adults in the Gulf portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Little Tunny (*Euthynnus alletteratus*)

Little Tunny are found throughout the Gulf over the continental shelf in close inshore waters in depths less than 490 feet (Collette et al., 2011b; Florida Museum of Natural History, 2021d). Adults school according to size with other members of the Scombridae family, breaking apart during certain times of the year (Florida Museum of Natural History, 2021d). Spawning occurs March through November in offshore waters. *Sargassum* mats are utilized by early life history stages as habitat (GMFMC, 2004). Little Tunny are opportunistic predators feeding mainly on clupeids (herring, sardines, scad), crustaceans, squid, and tunicates (Collette et al., 2011b; Florida Museum of Natural History, 2021d). Sharks, billfishes, dolphin, and other carnivorous fish prey on Tittle tunny (Florida Museum of Natural History, 2021d). Adults and juveniles are found in the Gulf portions of the study and project areas (Table 3) (NOAA, 2021b).

King Mackerel (*Scomberomorus cavalla*)

King Mackerel are pelagic and found in Gulf coastal waters and outer reef areas at depths of 75 to 110 feet (Collette et al., 2011c; Florida Museum of Natural History, 2021e). Migrations occur along the east coast, dependent upon warm temperatures. Spawning occurs in the Gulf over the outer continental shelf from May to September (Collette et al., 2011c; GMFMC, 2004). Eggs are pelagic, occurring over depths ranging from approximately 100 to 600 feet in the spring and summer months (GMFMC, 2004). King Mackerel feed mainly on schooling fish, crustaceans, penaeid shrimp, squid, and occasionally mollusks. Juveniles feed on small fish (mainly anchovies) and invertebrates (Collette et al., 2011c). Adults and juveniles are found in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Spanish Mackerel (*Scomberomorus maculatus*)

Spanish Mackerel are pelagic, inhabiting depths from 30 to 120 feet throughout the coastal zone of the Gulf (Florida Museum of Natural History, 2021f; GMFMC, 2004). They frequent barrier islands and passes and are often found near the surface in very large schools (Florida Museum of Natural History, 2021f). They may also migrate seasonally into estuaries with high salinity, but this migration is infrequent (GMFMC, 2004). Spawning occurs in the northern Gulf from April through October, peaking in August and September. Larvae typically occur in the Gulf at depths up to 300 feet (Pattillo et al., 1997). Juveniles inhabit the Gulf surf and sometimes estuarine habitats. However, juvenile Spanish Mackerel prefer marine salinities and are not considered estuarine-dependent. Juveniles also prefer clean sand bottoms, but the substrate preferences of the other life stages are unknown (GMFMC, 2004). While Spanish Mackerel rarely use estuarine environments, estuaries are important for most of their prey (Pattillo et al., 1997). They feed on a variety of fishes, extensively herrings, but also on penaeid shrimp and cephalopods (Collette et al., 2011d; Pattillo et al., 1997). Spanish Mackerel are often preyed upon by sharks, tunas, and bottlenose dolphins (Florida Museum of Natural History, 2021f). Adults and juveniles are found in the Gulf and estuarine portions of the study and project areas (Table 3) (NOAA, 2013, 2021b).

Sailfish (*Istiophorus platypterus*)

Sailfish are an oceanic and epipelagic species generally found above the thermocline to depths of 130 feet (Collette et al., 2011e; NMFS, 2009). They often occur in loose aggregations over a large area, occasionally forming small schools most likely by size (Collette et al., 2011e). It is assumed that sailfish spawn in the Gulf from May to September due to the presence of larvae during these times, moving inshore into shallow waters to spawn (Collette et al., 2011e; NMFS, 2009). Sailfish are opportunistic feeders and prey mainly on fish, crustaceans, and cephalopods, occurring at the surface, mid-water, reef edges, and along the bottom (Collette et al., 2011e; NMFS, 2009). They are preyed upon by killer whales, bottlenose dolphins, and sharks, although not very often (NMFS, 2009). Adult and juvenile Sailfish are found in the Gulf portion of the study and project areas (Table 3) (NMFS, 2009; NOAA, 2021b).

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4.0 POTENTIAL IMPACTS TO EFH

Below is a discussion of the potential impacts associated with the No-Action Alternative and the Applicant's Preferred Alternative. Adverse effects of this project are actions resulting in the reduction of quality or quantity of EFH. Adverse effects analyzed include direct and indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to benthic organisms, prey species, and their habitat-wide impacts, including individual, cumulative, or synergistic consequences. Habitats of concern, such as oyster reefs, SAV, offshore sand, and artificial reefs addressed separately.

4.1 ALTERNATIVES ANALYSIS

4.1.1 No-Action Alternative

Under the No-Action Alternative, EFH would remain as described in Section 3.0. Existing conditions and associated changes to EFH would continue. Indirect impacts are described below.

The significance of the predicted global climate change is the possibility of increasing sea levels, coastal flooding, changing estuarine salinity, and associated impacts to biological communities. Indirect impacts due to climate change and USACE dredging and maintenance dredging operations would continue to have an impact to the aquatic communities.

Trends of tidal wetland loss would continue. Increased development, hydrologic alterations, drought, flooding, and temperature extremes could affect wetlands. Sea level change and climate change, including changes to hydrology, nutrient inputs, flood or tide timing and intensity could have a variety of impacts on wetlands.

Marshes throughout the study area are declining and would likely continue this trend as sea levels continue to rise. According to the NOAA Sea Level Rise Viewer (2022) 3-foot scenario model, tidal marsh appears to decrease in the study area compared to present day. There is a potential that marshes would migrate inland in response to rising sea levels in areas where the elevation and topography are conducive for establishment (Borchert et al., 2018; Guannel et al., 2014; Murdock and Brenner, 2016; Scavia et al., 2002). However, due to urban development of low-lying areas in the study area the likelihood marsh migration and establishment would be prevented in some areas (Borchert et al., 2018).

It is anticipated that future rising sea levels would force the landward migration of wetlands and marsh and cause major spatial shifts in the natural habitats along the coast. Fisheries habitat modeling in Galveston Bay with a 3.3-foot rise in sea level indicate that as sea level changes the total footprint of suitable habitat for early life stages of blue crab, brown shrimp, Southern Flounder, and Red Drum would increase, threefold. This increase would have a positive impact on fisheries, helping to offset reductions as wetlands are lost (Guannel et al., 2014).

Other studies suggest that with a rise in sea level, salt marshes initially decline, before transitioning from low-level marsh to tidal flat then to open water. This change would follow by a net increase in habitat quality resulting from marsh fragmentation (Fulford et al., 2014). This mirrors the effect on nursery production, which studies have shown is initially negatively affected by sea level change, but ultimately may produce positive changes in production due to the increase in marsh-edge habitat resulting from fragmentation. This salt marsh fragmentation would correlate with a positive effect on nursery fish production (Chesney et al., 2000; Minello et al., 2003; Park et al., 1989). Organic matter and nutrients are generated and utilized by fish and shrimp at the marsh edge, which benefits nekton productivity while the marsh is disintegrating. In the long-term it is likely harmful. After the marsh disintegrates, there is reduced organic productivity and less (or no) nursery habitat (Chesney et al., 2000; Rozas and Reed, 1993; Zimmerman, 1992).

Under the No-Action Alternative, it is likely that rising sea levels benefit most fish species (including commercial and recreational fisheries) due to larger areas of available habitats if new marshes are created. Undeveloped areas would most likely support landward migration of wetlands as sea level changes. According to Jim Tolan of the TPWD, who serves on the Association of Fish and Wildlife Agencies Climate Change Committee, their consensus is that assuming there is sufficient habitat, fisheries and oyster reefs should adapt with little net change associated with relative sea level change (pers. comm. J. Tolan [TPWD], 2020). In addition, Watson et al. (2017) indicated that the vulnerability of Spotted Seatrout, Red Drum, and blue crab to sea level change appears low since they can adapt to the projected changes.

Increasing salinities in many areas are anticipated with global climate change resulting from higher sea levels causing barrier islands to migrate inland (Scavia et al., 2002). Increases in salinity in wetland habitats may cause small reductions in the health and biological productivity of organisms. This may cause additional stress on some marsh vegetation, which could cause some habitat-related impacts. However, most organisms occupying these environments are ubiquitous along the Texas coast and can tolerate a wide range of salinities (Pattillo et al., 1997). Therefore, no adverse effects on fauna are expected due to salinity changes.

Under the No-Action Alternative, oyster reefs would remain as described in Section 2.1. See Section 4.2.4 (Oyster Reef) for a more detailed discussion of turbidity impacts associated with dredging.

Turbidity associated with maintenance dredging of the currently authorized deepening and widening projects would continue. Benthic organisms would continue to be buried by open-bay and ocean disposal of dredged material. No long-term effects to turbidity with the No-Action are anticipated. See Section 4.2.2 (Open Bay and Jetty Communities) for a more detailed discussion of turbidity impacts.

Under the No-Action Alternative, increased ship traffic and lightering would be expected which could slightly increase the probability of a petroleum spill. However, as described in Section 4.2.2, in the unlikely event a petroleum spill should occur, adult shrimp, crabs, and finfish are generally motile enough to avoid most areas of high oil concentration.

In the absence of BU placement to serve as protective barriers, the loss of habitat would continue, which could impact EFH. The ongoing erosion of shorelines at Harbor Island and Dagger Island combined with expected rising sea levels could expose large areas of estuarine habitat to erosive forces, leading to EFH loss.

4.1.2 Alternative 1: Channel Deepening (Applicant's Preferred Alternative)

The Applicant's Preferred Alternative could adversely affect life history stages of several Federally managed species. These include the following: all life stages of brown, pink, and white shrimp, Blacknose Shark, Spinner Shark, Silky Shark, Finetooth Shark, Bull Shark, Blacktip Shark, Tiger Shark, Atlantic Sharpnose Shark, Scalloped Hammerhead Shark, Bonnethead Shark, Red Grouper, Cobia, Dolphin, Greater Amberjack, Red Snapper, Gray Snapper, Lane Snapper, Red Drum, Little Tunny, King Mackerel, Spanish Mackerel, and Sailfish; adult Lemon Shark, Gag Grouper, Scamp, Lesser Amberjack; and juvenile Vermilion Snapper. The sections below detail the potential impacts to EFH for these, and recreationally and commercially important species listed in Section 3.2.

The following sections describe potential impacts to EFH based on the Applicant's Preferred Alternative (Table 4).

Table 4
Summary of Potential Aquatic Resource Impacts (acres)
Associated with the Applicant's Preferred Alternative

Project Component	Footprint	Open Water[1]	Seagrass[2]	Oysters[3]	Flats/ Beach[4]	Estuarine[5]	Palustrine[6]	Source
SS1	297.41	219.45	0.01	0	34.64	3.92	21.04	Applicant
SS2	45.21	13.74	0	0	24.20	1.25	11.25	Applicant
PA4	170.79	42.14	3.46	0	2.80	0.75	41.75	Applicant
HI-E	138.73	13.12	3.41	0.10	23.21	10.69	48.42	Applicant
SJI	441.23	163.29	0	0	199.01	0	0	Applicant
MI	362.21	205.58	0	0	124.11	0	0	Applicant
Channel Deepening/ Extension	1,182.33	1,182.33	–	–	–	–	–	NOAA (2010)
B1–B9	1,585.82	1,585.82	–	–	–	–	–	NOAA (2010)
New Work ODMDS	1,180.00	1,180.00	–	–	–	–	–	NOAA (2010)
Total	5,403.73	4,605.47	6.88	0.10	407.97	16.61	122.46	

[1] Open Water (E1UBL M1UBL, M2USN)
[2] Seagrass (E1ABL)
[3] Oysters (E1ABL)
[4] Flats (E2ABN, E2EM1N(1) E2USN, UPL [tidal flats above the high tide line were classified as upland])
[5] Estuarine (E2M1P, E2SS3N)
[6] Palustrine (PEM1C(1))

4.2 POTENTIAL IMPACTS TO EFH

4.2.1 Estuarine Wetlands and Submerged Aquatic Vegetation

No estuarine wetland or SAV habitat occurs within the proposed channel dredging for the Applicant's Preferred Alternative. The new work dredging footprint is limited to the deeper areas of the CCSC that would be separated from seagrass areas by Harbor Island during construction. The BU project footprints include areas where wetland and seagrass were delineated (Mott MacDonald, 2021, 2022; Triton Environmental Solutions, 2021, 2022, 2023). A total of 6.88 acres of seagrass and 139.07 acres of wetlands (16.61 acres tidal and 122.46 acres non-tidal) are estimated to be impacted with BU construction. Considering that the BU objective of PAs include protection of adjacent seagrass areas, the proposed placement of BU sites may be expected to benefit seagrass.

There may be short term increases in turbidity and associated reduced water clarity during the channel dredging and placement. Nichols et al. (1990) found that turbidity associated with dredging was widespread, having short-term effects on water quality. However, a study conducted in the Laguna Madre found that dredged deposits caused elevated turbidity for up to 15 months after deposition. Turbidity was strongest closest to PAs but were also detected for greater than 0.75 miles from those areas (Onuf, 1994). The short-term reduction in water clarity during the channel dredging and placement is not expected to have any lasting effects on SAV.

Wetland and SAV impacts would occur at proposed placement sites (see Table 4). Indirect impacts could occur during construction due to turbidity increases or physical disturbances. Best management practices used during construction, such as turbidity curtains, silt fencing, or construction matting, should avoid and minimize these indirect impacts. It should be noted that dredged material would be used at all PAs to either: 1) convert deep open water areas to protect adjacent shallow bathymetry that support or can establish tidal wetlands or SAV, or 2) restore eroding shorelines that would protect larger extents of SAV. For example, some of the proposed BU sites would restore eroding shoreline and upland near Harbor Island that may offer protection to SAV present across Redfish Bay. This action may help protect SAV that could be exposed if the shoreline is breached with the continued erosion expected under the No-Action Alternative. Other proposed placement sites would convert open water areas to create tidal estuarine wetlands or SAV habitat. Considering the beneficial use nature and objective of these PAs to protect or provide more area conducive to tidal wetlands or SAV establishment, Alternative 1 may positively impact tidal wetlands and SAV. During construction and operations there is some chance of spills which may also impact wetlands or SAV.

4.2.2 Open Bay and Jetty Communities

During construction of Alternative 1, temporary disturbances and impacts to plankton and nekton assemblages would occur.

Turbidity in estuarine and coastal waters can have a complex set of impacts on organisms (Hirsch et al., 1978; Stern and Stickle, 1978; Wright, 1978; Wilber et al., 2005). The release of sediment during dredging causes sediment plumes. The extent of the plume is determined by the direction and strength of the currents and winds, and the particle size. Suspended material can play beneficial and detrimental roles in aquatic environments. Turbidity from suspended solids interferes with light penetration and reduces photosynthetic activity by phytoplankton and algae (Wilber and Clarke, 2001). Such reductions in primary productivity would be localized around the immediate area of the dredging and placement operations and would be limited to the duration of the plume. Conversely, the decrease in primary production, presumably from decreased available light, can be offset by an increase in nutrients that are released into the water column (Morton, 1977; Newell et al., 1998). Nutrients may act to enhance the area surrounding dredging, increasing productivity. Studies of turbidity and nutrients associated with dredging found the effects are both localized and temporary (May, 1973). Due to the capacity and natural variation in phytoplankton and algal populations, the impacts to phytoplankton and algae from project construction, dredging within the project area, dredged material placement of new work and maintenance material, and placement of material for actions targeting BU would be temporary.

Reduced light penetration due to turbidity may have a short-term impact on zooplankton populations since they feed on the phytoplankton (Armstrong et al., 1987; Valiela, 1995). Such reductions would be localized around the immediate area of dredging and placement operations. Impacts to zooplankton from project construction would be temporary.

Teeter et al. (2003) found the area of high turbidity extended roughly to the edge of the fluid mud flow, or about 1,300 to 1,650 feet from the dredge discharge pipe. Modeling of dredged material discharge in the Laguna Madre, Texas, determined that turbidity caused by dredging was short lived and therefore impacts to the estuarine and offshore water column would be minimal (Teeter et al., 2003). Turbidity can be expected to return to near ambient conditions within a few months after dredging ceases.

Increased suspended sediments can impact juvenile and adult finfish by disrupting foraging patterns, reducing feeding, and loss of habitat for feeding and reproduction. However, these would be temporary and occurs only during project construction (Newcombe and Jensen, 1996; Clarke and Wilber, 2000). Fine particles can coat the gills of juvenile and adult finfish, ultimately resulting in asphyxiation (Clarke and Wilber, 2000; Wilber and Clarke, 2001). However, finfish and shellfish are motile enough to avoid highly turbid areas (Newcombe and Jensen, 1996; Collin and Hart, 2015). Under most conditions, exposure to sediment plumes would be for short durations (minutes to hours) (Clarke and Wilber, 2000; Wilber and Clarke, 2001; Newcombe and Jensen, 1996).

Effects of elevated turbidities on the adult stages of various filter-feeding organisms such as oysters, copepods, and other species include reduced filtering rates, and clogging of filtering mechanisms interfering with ingestion, respiration, and abrasion (Newcombe and Jensen, 1996; Wilber and Clarke, 2001; Stern and Stickle, 1978). These effects tend to be more pronounced when total suspended solid concentrations are greater than 100 milligrams per liter but are apparently reversible once turbidities return to ambient levels

(Newcombe and Jensen, 1996). More sensitive species and life stages (i.e., eggs, larvae, and fry) tend to be more impacted by longer exposure to suspended sediments than less sensitive species and older life stages (Germano and Cary, 2005; Wilber and Clarke, 2001; Wilber et al., 2005; Newcombe and Jensen, 1996). Many crustaceans (such as shrimp and crabs) are less impacted by elevated suspended sediments since these organisms reside on or near the bottom where sedimentation naturally occurs (Wilber and Clarke, 2001; Wilber et al., 2005). Higher turbidity may also provide a refuge for juvenile shrimp and fish from predation (Wilber and Clarke, 2001; Collin and Hart, 2015). Species less tolerant to elevated turbidities (i.e. Bay Anchovy, juvenile Gulf Menhaden, Atlantic Croaker, and silversides) could experience long-term impacts as a result of project construction, dredging, and placement activities with Alternative 1 compared to the No-Action Alternative whereas more tolerant species (i.e. Penaeid shrimp, Spot, Toadfish [*Opsanus beta*], and Hogchoker [*Trinectes maculatus*]) may not experience long-term impacts (Clarke and Wilber, 2000).

Sampling, analysis, and evaluation of sediment, water, and elutriate for the CCSCIP, Entrance Channel and Extension, were conducted in accordance with Marine Protection, Research, and Sanctuaries Act Section 103 to evaluate the potential for adverse environmental effects associated with dredging and open water ocean placement of new work sediments (USACE, 2003; Montgomery and Bourne, 2018; Terracon Consultants, Inc., 2023a, 2023b). Based on the results of these tests, no adverse environmental effects would be expected during dredging and placement of material.

Based on hydrodynamic and salinity modeling analysis by W.F. Baird and Associates (2022), minor increases in salinity are anticipated because of Alternative 1 compared to the No-Action. Average salinity levels are anticipated to increase less than 1 ppt in the Corpus, Nueces, Redfish, and Aransas bays. Near the channel deepening, a salinity change of ± 3 ppt can be expected (W.F. Baird and Associates, 2022). The salinity increase as a result of Alternative 1 is not expected to alter fauna. Most organisms occupying these environments are ubiquitous along the Texas coast and can tolerate a wide range of salinities (Pattillo et al., 1997). Tables 5 and 6 present salinity tolerances and maximums for common fish, shellfish, wetlands, and SAV within the study area.

Aransas Pass is the main route for larval transport of estuarine dependent species from the Gulf to local estuaries. Changes in hydrology due to the deepening of the CCSC could impact the recruitment of estuarine dependent species (Buskey, 2018; Valseth et al., 2021). Valseth et al. (2021) studied the potential impact that deepening the channel could have on the transport of Red Drum larvae through Aransas Pass. Their passive particle modeling indicated a slight reduction of the maximum velocity due to channel deepening. W.F. Baird and Associates (2022) found that under Alternative 1 current speeds are expected to decrease an average of 0.23 feet per second with the deeper entrance channel. Drought, wet, and normal conditions for the –47 foot channel (current conditions) and the –70-foot channel were modeled by Valseth et al. (2021). It was found that the changes in channel bathymetry had little effect on recruitment of Red Drum larvae, with the model predicting a slight increase in the number of larvae entering the estuary with the decreased velocities. The modeling only looked at passive particles and did not account for larvae with weak swimming capabilities. The slight decrease in velocity with Alternative 1 is not anticipated to have an impact on recruitment of estuarine dependent species.

Table 5
Salinity Tolerances of Common Fish and Shellfish Within the Study Area

Common Name	Scientific Name	Optimum Salinity Range (Salinity Maximum) (ppt)			Source(s)
		Larvae	Juveniles	Adults	
Brown shrimp	*Farfantepenaeus aztecus*	24–36 (40–69)	10–20 (45)	24–39 (45)	Saoud and Davis (2003), Doerr et al. (2015)
White shrimp	*Litopenaeus setiferus*	0.4–37 (N/A)	2–15 (41)	>27 (40)	Patillo et al. (1997), Doerr et al. (2015)
Blue crab	*Callinectes sapidus*	12–36 (43)	2–21 (N/A)	<10–33 (67)	Patillo et al. (1997), Guillory et al. (2001)
Eastern oyster	*Crassostrea virginica*	10–35 (39)	10–30 (44)	10–30 (44)	Cake (1983), Gulf Marine States Fisheries Commission (2012), Baggett et al. (2014), Hijuelos et al. (2016)
Gulf Menhaden	*Brevoortia patronus*	>29 (N/A)	5–30 (N/A)	>29 (67)	Patillo et al. (1997)
Sheepshead	*Archosargus probatocephalus*	5–25 (45)	0.3–44 (45)	0.3–44 (45)	Patillo et al. (1997)
Spotted Seatrout	*Cynoscion nebulosus*	20–35 (50)	8–25 (48)	20–25 (45)	Patillo et al. (1997), Odell et al. (2017)
Spot	*Leiostomus xanthurus*	6–36 (36)	0–30 (36)	15–30 (60)	Patillo et al. (1997), Odell et al. (2017)
Atlantic Croaker	*Micropogonias undulatus*	15–36 (N/A)	0.5–20 (40)	6–20 (70)	Patillo et al. (1997), Odell et al. (2017)
Black Drum	*Pogonias cromis*	9–34 (36)	9–26 (80)	9–26 (80)	Patillo et al. (1997), Odell et al. (2017)
Red Drum	*Sciaenops ocellatus*	8–36 (50)	20–40 (50)	20–40 (50)	Patillo et al. (1997), Odell et al. (2017)
Southern Flounder	*Paralichthys lethostigma*	10–30 (N/A)	2–37 (60)	20–30 (60)	Patillo et al. (1997), Munroe (2015)

Table 6
Salinity Tolerances of Common Wetlands/SAV Within the Study Area

Common Name	Scientific Name	Optimum Salinity Range (Salinity Maximum) (ppt)		
		California Coastal Conservancy (2022), Stachlek and Dunton (2013)	Koch et al. (2007)*	SMSFP (2022a–e), Irlandi (2006), Alleman and Hester (2010)
Smooth cordgrass	*Spartina alterniflora*	10–30 (50–60)	–	–
Black mangrove	*Avicennia germinans*	–	–	24–48 (96)
Shoal grass*	*Halodule wrightii*	–	5–45 (45)	5–39 (60)
Turtle grass*	*Thalassia testudinum*	–	14–62 (45)	>20–48 (60)
Manatee grass*	*Syringodium filiforme*	–	5–45 (45)	20–35 (45)
Clover grass	*Halophila engelmannii*	–	–	5–35 (74)

* Used the pulsed ranges.

SMSFP = Smithsonian Marine Station at Fort Pierce

Vessel traffic would be expected to decrease with Alternative 1 compared to the No-Action Alternative. Vessels would be capable of fully loading at Axis and Harbor Island terminals (see Section 4.5 for further discussion), slightly decreasing the probability of a petroleum spill. In the unlikely event a petroleum spill should impact EFH, adult shrimp, crabs, and finfish are probably motile enough to avoid EFH impacted areas of high oil concentration. Larval and juvenile finfish and shellfish tend to be more susceptible to petroleum than adults and could be affected extensively by a spill during active immigration periods. Due to their lack of mobility, they are less likely to avoid these areas and could be negatively impacted if a spill were to occur. An oil spill in the project area could result in impacts to phytoplankton, algal, and zooplankton. However, since these organisms can recover rapidly from a spill, due primarily to their rapid rate of reproduction and to the widespread distribution of dominant species, long-term impacts would not be expected (Hjermann et al., 2007; Kennish, 1992).

Dredged material is to be used beneficially in placement actions targeting BU. This habitat could have the potential to be more productive than the open water habitat that would be lost under Alternative 1. Marsh creation should have a positive benefit to bay systems (Rozas et al., 2005). Compensatory mitigation is required, see Section 5.0 for a summary of mitigation proposed by the Applicant. Refer to the Applicant's 12-Step Permittee Responsible Compensatory Mitigation Plan (Triton Environmental Solutions, 2023) (Appendix K in the EIS) for detailed information regarding the mitigation proposed at BU site SS1.

4.2.3 Open Bay Bottom and Offshore Bottom Communities

Alternative 1 could temporarily reduce the quality of EFH in the vicinity of the project area and some individuals may be displaced. Impacts would be similar to those described in sections 4.2.1 and 4.2.2. Channel dredging (inshore and offshore) would impact 1,182 acres of open water/bottom habitat through excavation (NOAA, 2010) (see Table 4). For Gulf side placement actions, nearshore berms (B1–B9) would impact 1,586 acres of open water/bottom habitat (NOAA, 2010), MI and SJI beach nourishment placement would impact 275.19 acres of open water/bottom habitat (Mott MacDonald, 2021, 2022) and the ODMDS would impact 1,180 acres of open water/bottom habitat (NOAA, 2010) (see Table 4).

Direct aquatic resource impacts from inshore PA construction include 563.85 acres of open water/bottom habitat, 16.61 acres of tidal wetlands, 122.46 acres of freshwater wetlands, 84.85 acres of unconsolidated shorelines (tidal sand flats/algal flats/beach), 6.88 acres of seagrass, and 0.10 acres of oyster reef (Mott MacDonald, 2021, 2022; Triton Environmental Solutions, 2021, 2022, 2023) (see Table 4). As a result, this could impact food available to Federally managed species.

Excavation removes benthic organisms, whereas placement smothers or buries benthic communities. Dredging and placement of dredged material may cause ecological damage to benthic organisms in three ways: (1) physical disturbance to benthic ecosystems and organisms; (2) mobilization of sediment contaminants, making them more bio-available; and (3) increasing the amount of suspended sediment in the water column (Montagna et al., 1998). Dredging can reduce species diversity by 30 to 70 percent and the number of individuals by 40 to 95 percent. A similar reduction in benthic fauna biomass is expected within the boundaries of dredged areas (Newell et al., 1998).

Recolonization of areas impacted by dredging and dredged material disposal occurs through vertical migration of buried organisms through the dredged material, immigration of post larval organisms from the surrounding area, larval recruitment from the water column, and/or sediments slumping from the side of the dredged area (Bolam and Rees, 2003; Newell et al., 1998; Maurer et al., 1986). The response and recovery of the benthic community from dredged material placement is affected by many factors. These include environmental (e.g., water quality, water stratification), sediment type and frequency, and timing of disposal. Communities in these dynamic ecosystems are dominated by opportunistic species tolerant of a wide range of conditions (Bolam et al., 2010; Bolam and Rees; 2003; Newell et al., 2004; Newell et al., 1998). Although change may occur, these impacts would be temporary in some dredging and disposal areas (Bolam and Rees, 2003). Shallower, higher-energy estuarine habitats can recover between 1 and 10 months, while deeper, more-stable habitats can take up to 8 years to recover (Bolam et al., 2010; Bolam and Rees, 2003; Newell et al., 1998; Sheridan, 1999; Sheridan, 2004; Wilber et al., 2006; VanDerWal et al., 2011). The release of nutrients during dredging may also enhance benthic communities outside the immediate PA if the dredged material is not contaminated (Newell et al., 1998).

Because of the constant re-creation of "new" habitat via disturbance, new recruits continually settle and grow. Therefore, disturbed communities are dominated by small, surface-dwelling organisms with high growth rates. Consequently, dredged material placement from Alternative 1 may result in a shift in community structure rather than a decrease in production (Bolam and Rees, 2003; Montagna et al., 1998). Productivity could be enhanced following benthic community shift depending on the timing of dredged material disposal (Bolam and Rees, 2003).

Sampling, analysis, and evaluation of sediment, water, and elutriate for the CCSCIP, Entrance Channel and Extension, were conducted in accordance with Marine Protection, Research, and Sanctuaries Act Section 103 to evaluate the potential for adverse environmental effects associated with dredging and open water ocean placement of new work sediments (USACE, 2003; Montgomery and Bourne, 2018; Terracon Consultants, Inc., 2023a, 2023b). Based on the results of these tests, no adverse environmental effects would be expected during dredging and placement of material.

4.2.4 Oyster Reef

A total of 0.10 acres of live oyster reef habitat occurs in the footprint of placement site HI-E and would be directly impacted by the CDP. As described in the PCCA's mitigation plan (Triton Environmental Solutions, 2023; see Appendix K in the EIS), the Port plans to relocate these oysters from HI-E to the mitigation site within placement site SS1. They will be placed along the northwestern boundary, which is oriented adjacent to the proposed estuarine mitigation site and near a previously delineated live oyster reef. GLO (2021) indicates 32 acres of mapped oyster reef habitat occur in the remainder of the project area and 3.17 acres of oysters were mapped within a 500-foot construction buffer of the inshore PAs (Triton

Environmental Solutions, 2021, 2022). These oyster areas could be indirectly impacted by increased turbidity during construction of placement sites. Water column turbidity would increase during project construction that could affect survival or growth of oysters nearby. Temporary impacts to oysters include reduced filtering rates and clogging of filtering mechanisms, causing abrasion, and interfering with ingestion and respiration (Newcombe and Jensen, 1996; Stern and Stickle, 1978; Wilber and Clarke, 2001).

Average salinities in the project area range from 30 to 36 ppt, with dry years having salinity levels above 32 ppt and wet years around 25.5 ppt (Montagna et al., 2021). Oysters can tolerate relatively high salinities, temperatures, and increased water depths. However, some oyster predators (stone crabs [*Menippe mercenaria*] and oyster drills) and diseases (Dermo) may occur more frequently or in higher concentrations with higher temperatures and salinities (Cake, 1983; Murdock and Brenner, 2016; Soniat and Kortright, 1998). Oysters can survive in salinities ranging from 5 to 40+ ppt, they thrive within a range of 10 to 25 ppt where pathogens and predators are limited. The low-salinity end of the range is critical for osmotic balance. Oysters can survive brief periods of salinities less than 5 ppt by remaining tightly closed. They will remain closed until normal salinities are established or until they deplete their internal reserves and perish (Cake, 1983).

The slight increase in salinity that is expected resulting from Alternative 1 is not anticipated to cause any long-term impacts to oyster reefs in the project area. Increased nutrients from dredging activities could cause algal blooms that could impact oysters. However, potential changes in nutrients are expected to be localized and limited to a short time period.

As discussed in Section 4.2.2, modeling indicates that channel deepening would increase the average salinity in the Corpus Christ Bay system by less than 1 ppt (W.F. Baird and Associates, 2022). The slight salinity changes resulting from Alternative 1 are not anticipated to cause any long-term impacts to oyster reefs in the project area as oysters have the ability to tolerate a wide range of salinities as described above. Since oysters are filter-feeders, temporary increases in algal concentrations may have positive as well as negative effects on oysters. The historic loss of oysters in this system justifies increased awareness while activities are being monitored to avoid and minimize impacts to oysters.

4.3 POTENTIAL IMPACTS TO FEDERALLY MANAGED SPECIES

The potential for adverse impacts to Federally managed species within the project area is likely to differ from species to species, depending upon life history, habitat use (demersal vs. pelagic), distribution, and abundance.

4.3.1 Direct Impacts

Estuarine wetland and SAV habitat occur within the proposed project area of the Applicant's Preferred Alternative and would be directly impacted by the proposed project. Dredged material from channel deepening would be used beneficially around Corpus Christi and Redfish bays, and nearshore berms for beach nourishment along San José and Mustang islands. Additionally, new work dredged material would be placed in the New Work ODMDS.

Placement actions targeting BU in Corpus Christi and Redfish bays would create estuarine/aquatic habitat (according to the Applicant, see Appendix C in the EIS) that may potentially be more productive than the open-water habitat that would be lost because of the Applicant's Preferred Alternative. The aquatic community may benefit from higher productivity within the bay. The created estuarine/aquatic habitat would provide shelter for increased survival, food for growth, and spawning sites for enhanced reproduction. The estuarine/aquatic habitat would specifically benefit the Federally managed brown, pink, and white shrimp and red drum, providing nursery and foraging habitat. In addition, it may also benefit other commercially and recreationally important species around placement actions targeting BU. While the created estuarine/aquatic habitat may not function at the same level as a natural marsh, finfish and shellfish have the potential to be greater in these areas due to the conversion of open-bay bottom habitat to marsh (Minello, 2000; Minello and Caldwell, 2006). This would create a positive benefit to the bay system throughout the life of the project when compared to the No-Action Alternative (Rozas et al., 2005).

Direct impacts to EFH include temporary displacement of species in the immediate vicinity of the project feature locations and New Work ODMDS. Fish are motile enough to avoid highly turbid areas and are expected to rapidly return to these areas once dredging and placement are complete (Clarke and Wilber, 2000). Feeding habits of shrimp would not be impacted since shrimp typically reside on or near the bottom where sedimentation naturally occurs (Wilber and Clark, 2001; Wilber et al., 2005). Since benthic habitat is similar throughout the project area, finfish would be able to find suitable, undisturbed habitat during construction activities. As benthic habitat is recolonized, finfish would be able to utilize the benthic habitat from which they were temporarily displaced. Refer to Section 4.2 for more detailed information.

Dredging and placement activities are not expected to cause direct mortality to juvenile and adult pelagic finfish since they are motile and are capable of avoiding turbid areas associated with project construction (Clarke and Wilber, 2000). Penaeid shrimp use deeper water of the bay as a staging area from which they migrate to the Gulf during certain times of the year (GMFMC, 2004). The displacement of juvenile and adult finfish and shrimp during project construction would likely be temporary, and individuals should return to these specific areas once the project is completed. Juvenile and adult finfish and shrimp should experience minimal direct impacts from dredging and placement activities. Juvenile penaeid shrimp may be impacted due to their preference for burrowing in soft, muddy areas, although this activity is usually in association with plant/water interfaces.

Demersal eggs and larval finfish may be lost to physical abrasion, burial, or suffocation during dredging and placement activities due to their limited motility and sensitivity to elevated suspended sediments (Newcombe and Jensen, 1996; Wilber and Clark, 2001; Stern and Stickle, 1978; Germano and Cary, 2005; Wilber et al., 2005). Larvae in the latter stages of development are capable of some motility, which may allow for movement away from dredging and placement activities, thereby minimizing impacts. Predatory fish that feed on larval stages of Federally managed species may be temporarily displaced from the area resulting from dredging and placement. Section 4.2.2 provides a more detailed discussion on impacts to the aquatic communities.

Anticipated increases in turbidity may negatively impact the ability of some finfish to navigate, forage, and find shelter (Newcombe and Jensen, 1996; Clarke and Wilber, 2000). However, these impacts would be short lived (Clarke and Wilber, 2000; Wilber and Clarke, 2001; Newcombe and Jensen, 1996; Teeter et al., 2003). Shrimp spend at least some of their life cycle in areas where they are exposed to turbid conditions and are likely able to move from an area when it becomes inhospitable. Many crustaceans (such as shrimp and crabs) are not impacted by elevated turbidities since they typically reside on or near the bottom where sedimentation occurs (Wilber and Clark, 2001; Wilber et al., 2005). Finfish, shrimp, and other marine organisms in this area are accustomed to fluctuations in turbidity and should not be substantially affected by the temporary increase in turbidity resulting from the Applicant's Preferred Alternative. Section 4.2.2 provides a more detailed discussion on impacts to the aquatic communities. Dredged material suitable for BU placement is not expected to pose contamination issues (see section 4.2.2 for further details). Oil or other chemical spills may adversely impact Federally managed species. Larval and juvenile finfish tend to be more susceptible to spills than adults and could be affected extensively by a spill during their active migration periods. Due to their lack of mobility, larval and juvenile finfish are less likely to avoid these areas and could be negatively impacted by a spill.

The Applicant's Preferred Alternative would result in permanent loss of open-bay bottom habitat and offshore areas for placement in the New Work ODMDS. The potential harm of some individual organisms from turbidity-related impacts would be minimal compared with the existing conditions and would not substantially reduce populations of Federally managed species. Federally managed species are motile and avoid areas during dredging and placement and would be able to return to the area after these activities are completed (Clarke and Wilber, 2000).

Compensatory mitigation to offset unavoidable impacts to wetlands, SAV, and oysters must be implemented. These include 122.46 acres of palustrine wetlands, 16.61 acres of estuarine wetlands, 6.88 acres of SAV, and 0.10 acres of oyster reef. The PCCA will utilize BU site SS1 to construct the mitigation site. The objective of mitigation is restoration through the reestablishment of 32.94 acres of estuarine wetlands, 42.08 acres of palustrine wetlands, 6.88 acres of SAV, and 0.10 acres of oyster reef (Triton Environmental Solutions, 2023; see Appendix K in the EIS). Creation of EFH at the mitigation site could benefit Federally managed species from the higher productivity of marsh, SAV, and oyster reef habitats. The mitigation proposed by PCCA is summarized in Section 5.0.

4.3.2 Indirect Impacts

Indirect impacts of the Applicant's Preferred Alternative include a reduction in prey for Federally managed species due to the mortality or displacement of benthic species, associated with dredging and placement activities. Since benthic organisms serve as prey for finfish, their mortality may temporarily reduce finfish feeding. Disturbances to the benthic environment would be temporary and impacts would be minimal.

4.4 CUMULATIVE AND SYNERGISTIC IMPACTS

A cumulative impacts assessment takes into consideration the impact on the environment, which results from the incremental impact of the proposed action when added to other past, present, and reasonably foreseeable actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over time. Impacts include both direct and indirect effects. Direct effects are caused by an action and occur at the same time and place as the proposed action. Indirect effects are caused by the action, occur later, and are farther removed in distance; however, they are still reasonably foreseeable. Ecological effects refer to effects on natural resources and the components (including listed species), structures, and functioning of affected ecosystems, whether direct, indirect, or cumulative.

The CDP would directly affect the estuarine habitats and fauna in the study area due to dredging and placement activities. Channel dredging (inshore and offshore) would impact 1,182 acres of open water/bottom habitat through excavation (NOAA, 2010). For Gulf side placement actions, nearshore berms (B1–B9) would impact 1,586 acres of open water/bottom habitat (NOAA, 2010), MI and SJI beach nourishment placement would impact 275.19 acres of open water/bottom habitat (Mott MacDonald, 2021, 2022) and the ODMDS would impact 1,180 acres of open water/bottom habitat (NOAA, 2010).

Direct aquatic resource impacts from inshore PA construction include 563.85 acres of open water/bottom habitat, 16.61 acres of tidal wetlands, 122.46 acres of freshwater wetlands, 84.85 acres of unconsolidated shorelines (tidal sand flats/algal flats/beach), 6.88 acres of seagrass, and 0.10 acres of oyster reef (Mott MacDonald, 2021, 2022; Triton Environmental Solutions, 2021, 2022, 2023).

Past, present, and reasonably foreseeable actions with dredging or construction activities, and resultant ship traffic, can increase erosion or turbidity and potentially impact EFH. Pipeline installation can also have direct impacts to EFH; however, horizontal directional drilling can avoid and minimize potential impacts. If any of these projects undergo construction in timeframes that overlap with the Applicant’s Preferred Alternative, there could be minor, temporary, and localized cumulative effects to EFH. Desalination projects could have impacts to EFH during extreme drought conditions by contributing to increased salinities, and those impacts could be exacerbated by hydrosalinity impacts of the Applicant’s Preferred Alternative. Various infrastructure can convert potential EFH, and any EFH conversions associated with placement actions may contribute to cumulative impacts of habitat loss. Ecosystem restoration initiatives typically yield beneficial effects on EFH, and in conjunction with the proposed actions PAs could result in beneficial cumulative effects.

Despite the potential for cumulative effects on EFH, most effects from projects are assumed to occur primarily during construction, and those impacts are typically localized, temporary, and minor. Some projects are also assumed to have permanent impacts associated with their physical footprint, such as noise, air emissions, or induced traffic and growth. The proposed action’s impacts could contribute to cumulative effects where they overlap with impacts of past, present, and reasonably foreseeable actions. Even though potential temporary and permanent impacts may be associated with past, present, and reasonably foreseeable actions, it is also assumed that these projects were or would be implemented in compliance with applicable laws and regulations that exist to avoid and minimize project impacts, particularly Endangered Species Act, Coastal Zone Management Act, Marine Mammals Protection Act, and the MSFCMA. Lastly, beneficial cumulative impacts may be expected when considering the Applicant's Preferred Alternative PAs in combination with restoration actions that are planned within the study area by State and Federal agencies, non-governmental organizations, and private entities. These include actions outlined in the Texas Coastal Resilience Master Plan.

5.0 MITIGATION MEASURES

The PCCA was required to propose a compensatory mitigation plan compliant with 33 CFR 332 Compensatory Mitigation for Losses of Aquatic Resources. A compensatory mitigation plan was prepared by the Applicant for impacts to wetlands, SAV, and oysters (Triton Environmental Solutions, 2023). The following section summarizes the mitigation plan, see Appendix K of the EIS for more detailed information.

The proposed channel of the Applicant's Preferred Alternative would not directly impact oyster reef, seagrass, wetlands, or other special aquatic sites (e.g., mudflats). However, the proposed dredged material placement would involve areas of wetlands, seagrass, and oysters, and minor areas of existing PAs previously identified as tidal flats. These impacts would occur over the course of constructing BU sites that would restore and enhance estuarine aquatic resources, including wetlands and seagrass or restore eroded shorelines that protect large areas of these resources. Table 7 summarizes the proposed impacts by BU site.

Table 7
Summary of Proposed Impacts by BU Site (acres)

Site	Footprint	Open Water[1]	Seagrass[2]	Oysters[3]	Flats/ Beach[4]	Estuarine[5]	Palustrine[6]
SS1	297.41	219.45	0.01	0	34.64	3.92	21.04
SS2	45.21	13.74	0	0	24.20	1.25	11.25
PA4	170.79	42.14	3.46	0	2.80	0.75	41.75
HI-E	138.73	13.12	3.41	0.10	23.21	10.69	48.42
SJI	441.23	163.29	0	0	199.01	0	0
MI	362.21	205.58	0	0	124.11	0	0
Total	1,455.58	657.32	6.88	0.10	407.97	16.61	122.46

[1] Open Water (E1UBL M1UBL, M2USN)

[2] Seagrass (E1ABL)

[3] Oysters (E1ABL)

[4] Flats (E2ABN, E2EM1N(1) E2USN, UPL [tidal flats above the high tide line were classified as upland])

[5] Estuarine (E2M1P, E2SS3N)

[6] Palustrine (PEM1C(1))

The CDP will permanently impact 44.63 acres of special aquatic sites requiring mitigation to offset these permanent losses. These include 21.04 acres of palustrine wetlands and 23.59 acres of EFH including 16.61 acres estuarine wetlands, 6.88 acres of SAV, and 0.10 acres of live oysters. The PCCA proposes to utilize SS1 to construct their Permittee Responsible Mitigation (PRM) site. All actions associated with the PRM site are to be conducted in accordance with the 2008 Final Compensatory Mitigation Rule (33 CFR 332.3).

The objective is restoration through the re-establishment of 32.94 acres of estuarine wetlands, 42.08 acres palustrine wetlands, 6.88 acres of SAV, and 0.10 acres of live oysters by returning historic functions to a degraded aquatic resource. The proposed mitigation site is 75.12 acres and would be contained within the

SS1 footprint. The site would be surrounded by dredged material on three sides and connect to the bayward edge of Brown and Root Flats to the north, which would provide a critical hydrologic connection.

Table 8 presents a summary of proposed mitigation.

Table 8
Summary of Proposed Mitigation (acres)

Resource Feature	Direct Impacts	Mitigation Ratio	Mitigation Reestablishment
Palustrine Wetlands	21.04	2:1	42.08
Estuarine Wetlands	16.61	N/A[1]	32.94
Seagrass	6.88	1:1	6.88[2]
Live Oyster	0.10	1:1	0.10[3]
		Total	75.12[4]

[1] Estuarine mitigation determined by Hydrogeomorphic modeling.

[2] Seagrass acreage contained in tidal channels within the 32.94-acre estuarine mitigation area.

[3] Live oyster will be placed immediately adjacent to the PRMs boundary

[4] Total acres of special aquatic sites restored through PRM.

5.1 PROPOSED WETLAND MITIGATION

The Applicant proposes to beneficially place dredged material from the project across approximately 1,455.58 acres. Placement of material at SS1 would impact 3.92 acres of estuarine wetlands and 21.04 acres of palustrine wetlands. These wetlands would likely erode over time if the proposed placement does not occur. Additionally, the proposed placement would create approximately 252.75 acres of suitable elevations for marsh coastal prairie habitat. Placement of material at SS2 would impact 1.25 acres of estuarine wetlands and 11.25 acres of palustrine wetlands. The placement of material would restore the site to pre-Hurricane Harvey elevations and contours. Additionally, the restoration will create approximately 34.28 acres of suitable elevations for marsh habitat. Placement of material at PA4 would impact 0.75 acres of estuarine wetlands and 41.75 acres of palustrine wetlands. Since these wetlands are in the confines of a former DMPA, they are considered of lower value than naturally occurring wetlands. The BU placement at PA4 would restore the shoreline along with PA4 and return the site's functionality as a DMPA. Placement of material at HI-E would result in impacting 10.69 acres of estuarine wetlands and 48.42 acres of palustrine wetlands. The BU placement at HI-E would restore the shoreline along with PA4 and return the site's functionality as a DMPA. The restoration of degraded DMPAs represents a reduction in project impact compared to the construction of new DMPAs. Placement of material at MI would not result in any impacts to wetlands. The BU placement at MI and SJI will nourish eroding beaches.

Altogether the BU placement across the six sites would impact 139.07 acres of wetlands. The PCCA proposes to utilize SS1 to construct their PRM site. All actions associated with the PRM site are to be conducted in accordance with the 2008 Final Compensatory Mitigation Rule (33 CFR 332.3).

The USACE Hydrogeomorphic model for the Northwest Gulf of Mexico Tidal Fringe Wetlands was used to calculate compensation requirements for estuarine wetlands. Based on this analysis, the PCCA proposes to construct a 32.94-acre estuarine mitigation site within SS1 to fully compensate for direct estuarine wetland impacts. Additionally, the site would provide excess functional capacity units providing ecological lift as well as offset to temporal loss and potential cumulative effects.

The mitigation objective is restoration through the re-establishment of 32.94 acres of estuarine wetlands, 42.08 acres palustrine wetlands, 6.88 acres of SAV, and 0.10 acres of live oysters by returning historic functions to a degraded aquatic resource. The proposed mitigation site is 75.12 acres and would be contained within the SS1 footprint. The site would be surrounded by dredged material on three sides and connect to the bayward edge of Brown and Root Flats to the north, which would provide a critical hydrologic connection.

The PCCA proposed a 2:1 mitigation ratio for impacts to palustrine wetlands to ensure no net loss of wetland function. To compensate for 21.04 acres of unavoidable impacts, approximately 42.08 acres of palustrine wetlands would be restored.

5.2 PROPOSED SEAGRASS AND OYSTER MITIGATION

Through the BU placement across the six sites, the Applicant estimates the project would impact 6.88 acres of seagrass. Placement of material at PA 4, HI-E, and SS1 would impact 3.46 acres, 3.41 acres, and 0.01 acres of seagrass, respectively. These impacts are necessary to restore the former DMPAs to a usable capacity as opposed to the creation of new DMPAs. Any new DMPA within the same distance from the preferred project as PA4 and HI-E would result in significantly more impacts to seagrass than the preferred project. Additionally, since the Applicant designed SS1 and PA4 to protect the Redfish Bay, approximately 2,400 acres of seagrass, the project benefits to regional seagrass, outweigh the impacts.

PCCA would relocate 6.88 acres of impacted seagrass from PA4, HI-E, and SS1 to fully compensate for unavoidable impacts. Seagrass plantings would be within the tidal channels (8.24 acres) that would be located within the estuarine mitigation site. These would provide a beneficial hydrologic connection to the mitigation site and adjacent tributary.

PCCA would relocate 0.10 acres of live oysters impacted at HI-E to the mitigation site for reestablishment. Oysters would be relocated to the northwestern boundary of SS1. This site is adjacent to the proposed estuarine mitigation site and near a previously delineated 1.88 acre oyster reef. Elevations at this site and live oysters immediately adjacent indicates suitable habitat conditions for relocation of the oysters.

Additional information regarding the mitigation work plan, maintenance plan, performance standards, monitoring requirements, long-term and adaptive management are detailed in Appendix K of the EIS.

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6.0 CONCLUSIONS

The Federally managed species listed in this document utilize estuarine and Gulf habitat during some portion of their life for spawning, food, development, and/or protection. The Applicant's Preferred Alternative would have negative impacts, both directly and indirectly, to EFH in the project area. However, BU of dredged material also has the potential to enhance EFH.

The deepening of the CCSC would temporarily affect EFH by disturbing bottom sediments and increasing turbidity in both the marine and estuarine water column in the vicinity of the dredging activity, which can have adverse effects on finfish and shellfish species. Dredging would also directly affect estuarine and Gulf bottom habitats. Considering the nature of the sediments that would be dredged and the temporary nature of the dredging, these impacts are expected to be minimal. No long-term adverse environmental impacts would be expected from dredging or placement of sediments.

Compensatory mitigation to offset unavoidable impacts to wetlands, SAV, and oysters must be implemented. These include 21.04 acres of palustrine wetlands, 16.61 acres of estuarine wetlands, 6.88 acres of SAV, and 0.10 acres of oyster reef. The PCCA will utilize SS1 to construct the mitigation site. The objective of mitigation is restoration through the reestablishment of 32.94 acres of estuarine wetlands, 42.08 acres of palustrine wetlands, 6.88 acres of SAV, and 0.10 acres of oyster reef (Triton Environmental Solutions, 2023; see Appendix K of the EIS). Creation of EFH at the mitigation site could benefit Federally managed species from the higher productivity of marsh, SAV, and oyster reef habitats. The mitigation proposed by PCCA is summarized in Section 5.0.

There are no Habitat Areas of Particular Concern in the project area (NOAA, 2021b). Coordination with NMFS is ongoing. The Draft EIS initiated EFH consultation under the MSFCMA. NMFS provided EFH Conservation Recommendations to the USACE on the project in August 2022 (Attachment 1). Coordination with NMFS with respect to the MSFCMA was concluded in November 2022. NMFS provided additional EFH Conservation Recommendations on the project in February 2024 that will be addressed in the Record of Decision.

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Attachment 1

NOAA NMFS EFH Conservation Recommendations Letter – August 2022

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
https://www.fisheries.noaa.gov/region/southeast

August 9, 2022 F/SER46: CS/RS

Mr. Jayson Hudson
Regulatory Division,
Policy Analysis Branch
U.S. Army Corps of Engineers
2000 Fort Point Road
Galveston, Texas 77550

Dear Mr. Hudson:

NOAA's National Marine Fisheries Service (NMFS) Habitat Conservation Division received your response letter dated August 5, 2022, regarding our recommendations to improve the U.S. Army Corps of Engineers' (USACE) essential fish habitat (EFH) assessment provided to you by our letter of August 1, 2022. The NFMS has reviewed the following additional information provided with your response letter: (1) Waters and Wetlands Delineation Report for the San Jose Island Beneficial Use (BU) Site dated January 2022, (2) Waters and Wetlands Delineation Report for Five BU Sites dated June 2021, and (3) the aquatic survey report for San Jose Island BU Site dated January 14, 2022. Your August 5, 2022, letter states the USACE has provided the best scientific information available regarding the effects of the action on EFH and disclosed all of the measures the applicant has proposed to take to avoid, minimize, or offset such effects in the EFH Assessment. Based upon this information, NMFS will provide initial conservation recommendations in accordance with the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (Section 600.920; P.L. 104-297).

As stated in our previous comment letter, the Applicant's Proposed Action Alternative will have direct impacts to EFH resulting in approximately 4,605.47 acres of open water/bay bottom, 6.88 acres of seagrass, 0.10 acre of oyster reef, 407.97 acres of sand flat/beach, 16.61 acres of estuarine tidal wetland, and 181.22 acres of palustrine wetland habitats. The Applicant, Port of Corpus Christi Authority (PCCA), has stated the BU plan will mitigate for the proposed EFH impacts. However, neither the BU plan or the draft Environmental Impact Statement (EIS) adequately describe how direct impacts to the various categories of EFH will be adequately offset. In addition, the PCCA has not demonstrated how their Proposed Action Alternative has avoided and/or minimized EFH impacts as required by the USACE's mitigation rules. Based on the information provided in the draft EIS, we believe Alternative 2 appears to be the environmentally preferable alternative. In addition, the draft EIS does not quantify any net effects of other project alternatives. The NMFS requests the methodology used for the alternatives analysis and for the selection of the preferred alternative be further refined in the final EIS.

While the NMFS generally supports the BU of dredged material for beach nourishment and marsh creation, or to restore eroded shorelines and dunes of barrier islands along the Gulf of Mexico, unavoidable direct impacts to EFH such as seagrass, tidal sand/mud flats, algal mats, and oyster reefs from the BU construction should be adequately mitigated for. According to the USACE's 2008 Mitigation Rule, applicants must compensate for unavoidable impacts by way of restoration, establishment, enhancement, and/or preservation of aquatic resources for the purpose of offsetting unavoidable adverse impacts which remain after all appropriate practicable avoidance and minimization has been achieved. The applicant has not demonstrated how they will offset direct impacts to seagrass and oyster reefs through restoration, establishment, and/or enhancement of shallow water habitat within the same watershed the impacts are taking place. The PCCA states in the draft EIS no mitigation for direct impacts to seagrass will take place because the restoration of "SS"1 and "PA4" shorelines would protect Redfish Bay and its 2,000+ acres of existing seagrass meadow. The PCCA is not proposing to mitigate for the direct loss of 6.88 acres of seagrass because they argue the protection of the bay far outweighs the direct impacts to seagrasses. The NMFS does not support this reasoning and continues to be concerned there will be a net loss of EFH resources if no mitigation of direct impacts to seagrass is provided. The recommended mitigation ratio for seagrass in Texas is 3:1; therefore, we recommend the applicant should be required to provide a total of 20.64 acres of seagrass compensation for those direct impacts. The applicant also states there will be direct impacts to 0.10 acre of oyster reef, but there is no discussion of compensation for the loss of oyster resources. We also recommend the applicant be required to mitigate for the loss of oyster resources or demonstrate how restoration, creation, and enhancement activities associated with BU placement will offset impacts to oysters and/or oyster reef habitat at a mitigation ration of 2:1, totaling 0.20 acres of oyster reef.

The NMFS is concerned the project as currently proposed would result in a net loss of EFH from the conversion of habitat and would adversely impact EFH and associated marine fishery resources in Corpus Christi Bay system. Therefore, the NMFS recommends the Department of the Army authorization for this project not be authorized as currently proposed in the Applicant's Proposed Action Alternative. Should new information become available, NMFS reserves the right to provide additional conservation recommendations in response to the final EIS. Section 305(b)(4)(A) of the MSA requires NMFS to provide EFH conservation recommendations for any federal action or permit which may result in adverse impacts to EFH. Therefore, NMFS Habitat Conservation Division recommends the following to ensure the conservation of EFH and associated marine fishery resources:

EFH Conservation Recommendations

1. The NMFS encourages the USACE to consider selecting Alternative 2 as the preferred alternative. In addition, the applicant should provide a complete alternative analysis which demonstrates the preferred alternative selected will be resolved with the requirement to identify the least environmentally damaging practical alternative. If PCCA continues to pursue the Applicant's Proposed Action Alternative, additional documentation should be required to demonstrate their efforts to avoid and minimize impacts to EFH.

2. It is unclear whether adequate benefits to EFH will be provided to offset aquatic impacts as described in the dredged material management plan. Therefore, the PCAA should also be required to quantify a future without project versus a future with project estimate of aquatic resource functions and values using available habitat evaluation procedures or other applicable analyses to quantify placement site impact and benefits.

3. The preliminary mitigation analysis and approximate total acres of impacts to EFH provided in the draft EIS should be refined to verify: (1) the final assessment of acres of impacts to each EFH category, (2) description of the ecological assessment methodologies used and results of the impact and mitigation calculations, (3) the types of mitigation required, and (4) the final mitigation project design. Fill in estuarine water column and estuarine mud/sand/shell bottoms EFH that convert healthy bay habitats to uplands should also be included among the habitat types assessed and requiring mitigation. Estimates of all direct and indirect project related impacts to tidally influenced EFH should be refined for inclusion in the project's final EIS.

4. Should the Department of the Army authorization permit unavoidable impacts to EFH, then a mitigation plan and monitoring plan should be developed which fully compensates for all EFH impacts. We also request the EFH mitigation plan be coordinated with NMFS prior to issuance of a USACE permit. To avoid additional mitigation for temporal impacts, NMFS also recommends the authorization include special conditions requiring the implementation of the mitigation plan concurrent with the deepening of the channel and placement of BU dredged material.

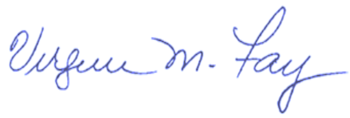
5. The USACE should implement in-kind compensatory mitigation for direct and secondary EFH impacts (seagrass and oyster reef habitat) resulting from the proposed BU placement activities. The amount of mitigation should be based upon a functional assessment and a mitigation compensatory ratio of 3:1 for seagrasses and 2:1 for oyster reef habitats. To avoid additional mitigation for temporal impacts, the NMFS also recommends implementation of the mitigation plan concurrent with the construction of the development.

6. If after three years of post-construction seagrass and oyster reef monitoring of BU placement areas reveal additional EFH impacts have occurred, then the applicant should develop a compensatory mitigation, monitoring, and contingency plan designed to offset those observed ecological losses.

Consistent with Section 305(b)(4)(B) of the MSA and NMFS' implementing regulation at 50 CFR 600.920(k), your office is required to provide a written response to our EFH conservation recommendations within 30 days of receipt. Your response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the proposed activity. If your response is inconsistent with our EFH conservation recommendations, you must provide a substantive discussion justifying the reasons for not implementing the recommendations. If it is not possible to provide a substantive response within 30 days, the USACE Galveston District should provide an interim response to NMFS, to be followed by the detailed response. The detailed response should be provided in a manner to ensure that it is received by NMFS at least 10 days prior to the final approval of the action.

We appreciate your consideration of our comments. If you wish to discuss this project further or have questions concerning our recommendations, please contact Charrish Stevens at (713) 715-9613, or by email at charrish.stevens@noaa.gov.

Sincerely,



Virginia M. Fay
Assistant Regional Administrator
Habitat Conservation Division

cc:
NOAA: NOAA NEPA
F/SER: Silverman, Rosegger
F/SER4: Dale, Scarpa
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