

## 5.0 CUMULATIVE IMPACTS

### 5.1 INTRODUCTION

Cumulative impact has been defined by the President's Council on Environmental Quality (CEQ) as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or persons undertakes such action." Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time. Impacts include both direct effects, which are caused by an action and occur at the same time and place as the action, and indirect effects, which are also caused by the action and occur later in time and are farther removed in distance, but which are still reasonably foreseeable. Ecological effects refer to effects on natural resources and on the components, structures, and functioning of affected ecosystems, whether direct, indirect, or cumulative.

In assessing cumulative impact, consideration is given to (1) the degree to which the proposed action affects public health or safety, (2) unique characteristics of the geographic area, (3) the degree to which the effects on the quality of the human environment are likely to be highly controversial, (4) the degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks, and (5) whether the action is related to other actions with individually insignificant, but cumulatively significant impacts, on the environment.

Cumulative effects can result from many different activities including the addition of materials to the environment from multiple sources, repeated removal of materials or organisms from the environment, and repeated environmental changes over large areas and long periods. More complicated cumulative effects occur when stresses of different types combine to produce a single effect or suite of effects. Large, contiguous habitats can be fragmented, making it difficult for organisms to locate and maintain populations between disjunctive habitat fragments. Cumulative impacts may also occur when the timings of perturbations are so close that the effects of one are not dissipated before the next occurs, or when the timings of perturbations are so close in space that their effects overlap.

The CAW developed a scope of work encompassing 36 parameters for 9 past, present, and reasonably foreseeable future projects (base projects) viewed as pertinent to the future condition of Corpus Christi Bay and the surrounding area. Parameters to be addressed include biological, physical, chemical, socioeconomic, and cultural attributes. The methodology described below was developed with the guidance and agreement of the CAW and the RACT.

#### 5.1.1 Cumulative Impact Assessment Methodology

This discussion describes the application of the cumulative impact assessment methodology to the preferred alternative. Projects evaluated in the preferred alternative assessment include the following:

Reasonably foreseeable future actions:

- Packery Channel
- JFK Causeway
- Joe Fulton International Trade Corridor
- La Quinta Gateway Project
- The Coastal Bend Regional Water Plan update as required by Senate Bill 1
- Kiewit Offshore Services Project

Past or present actions:

- Corpus Christi Ship Channel 45-foot Project
- Rincon Channel Federal Assumption of Maintenance
- Gulf Coast Strategic Homeport Navel Station Ingleside – Corpus Christi, Texas
- Mine Warfare Center of Excellence – Corpus Christi Bay, Texas
- Jewel Fulton Channel Federal Assumption of Maintenance

The CAW agreed that the following projects or documents were not in the foreseeable future or did not have any documents available. Impacts from these projects were not addressed due to the lack of available information.

- Multipurpose Deepwater Port and Crude Oil Distribution System at Port Aransas Safeharbor Project
- Baker's Port
- State of Texas Regional Water Plan for Region L
- Harbor Island Master Plan
- Rerouting of GIWW from Ingleside across Corpus Christi Bay (Feasibility Report due 2003)
- Modifications to GIWW between Ingleside and Rockport (Feasibility Report due 2003)

The study area for the cumulative impact assessment was limited to the north portion of Upper Laguna Madre, Corpus Christi Bay, Nueces Bay, Redfish Bay, and offshore waters from Aransas Pass to Packery Pass.

Direct impacts that could be quantified in acreage were considered for habitat assessment when information was available. Habitats for cumulative impact assessment were identified from reports developed for the above proposed projects and include SAV, wetlands, estuarine sand flats/mud flats/algal mats, open water, reef habitat, coastal shore areas/beaches/sand dunes. In addition to habitats, impacts to specific resource categories were addressed in a more qualitative manner based on information provided by documents reviewed for each project. These were described as biological attributes (bay bottom habitat, terrestrial habitat, plankton, benthos, finfish, shellfish, mammals, reptiles/amphibians, threatened and endangered species, and EFH), physical environment (air quality/noise, topography/bathymetry, sediment quality, water quality, freshwater inflow, circulation, and tides), and cultural/socioeconomic attributes (recreation, commercial and recreational fisheries, ship

accidents/spills, oil/gas production on submerged lands, cultural resources, public health, safety, and parks/beaches).

## 5.1.2 Evaluation Criteria

Cumulative effects were determined by reviewing impacts as described in the project documents and determined from recent habitat information obtained from Section 3.0. Acreage of each habitat in the study was determined from this assessment, if available.

### 5.1.2.1 Individual Project Evaluation

Individual project documents were reviewed for impacts to selected habitats based on the evaluation criteria described above. No attempt was made to verify or update published documents, nor were the disposal practices proposed in reviewed documents verified for current ongoing projects. In addition, no field data were collected to verify project impacts described in reviewed documents. Mitigation outlined in individual project documents may be in place or proposed. This analysis recognizes that some of the projects assessed are undergoing revisions that may alter their environmental impact. This analysis relied only on existing published documents. If acreage was available, it was summed for each habitat to obtain a cumulative acreage impact. It should be noted that because of the diverse mix of documents that were reviewed for cumulative impacts and because of the fact that not all documents used the same definitions or even the same categories of resources, it was sometimes necessary to lump or modify categories so that the quantities in this section may not be exactly comparable with those presented in sections 3 and 4 of this FEIS. However, every attempt has been made to make this section internally consistent, so that all projects included in Cumulative Impacts are evaluated comparably.

### 5.1.2.2 Resource Impact Evaluation

Biological/ecological, physical/chemical, and cultural/socioeconomic resource impacts were evaluated based on individual project reviews. In Table 5.1-1, a quantitative assessment of biological/ecological resources was prepared. A qualitative discussion of biological/ecological, physical/chemical resources, and cultural/socioeconomic resources were presented using information published in reviewed documents. The following is a brief description of the evaluated projects.

## 5.2 REASONABLY FORESEEABLE FUTURE ACTIONS

### 5.2.1 Packery Channel

Packery Channel is a potential environmental enhancement project that would provide a dredged channel across Padre Island between the Upper Laguna Madre and the Gulf of Mexico. The channel is located roughly north-northeast of the JFK Causeway, which crosses the Laguna Madre between the City of Corpus Christi and North Padre Island. The existing channel is largely the result of the modern dredging of a historically shallow cut between the historical pass and Laguna Madre.

In addition to opening Packery Channel to the Gulf, the project will add two rock jetties at the Gulf end of the Channel and deepen and widen the existing channel and Inner Basin. The project also

TABLE 5.1-1  
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Project	Kiewit Offshore Services	Packery Channel	Raising Kennedy Causeway	Joe Fulton International Trade Corridor	La Quinta Gateway Project	Rincon Channel Federal Assumption of Maintenance	Gulf Coast Strategic Homeport Naval Station Ingleside	Mine Warfare Center of Excellence	Corpus Christi Ship Channel 52-foot Project	Total
<b>RESOURCE IMPACTS</b>										
Topography/Bathymetry	12,000 ft	3.5 statute miles	0.9 statute miles	NI	NI	NI	8.4 statute miles	NI	43 statute miles	55.8 statute miles
Shore/Beach/Dunes	NI	61 ac	NI	NI	1.8 ac	NI	NI	NI	NI	62.8 ac
Salt Marsh	NI	17.8 ac	11.5 ac	NI	2.1 ac	NI	1.2 ac	NI	NI	32.6 ac
Flats	NI	1.9 ac	NI	NI	NI	NI	112 ac	NI	NI	113.9 ac
Open Water	NI	7.1 ac	NI	NI	32 ac	NI	NI	NI	NI	39.1 ac
Oyster Reef	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI
Upland Wetlands	NI	NI	NI	11.2 ac	NI	NI	38.6 ac	NI	NI	49.8 ac
Shallow Bay Bottom Habitat (0 to -12 MLT)	NI	33.3 ac	NI	NI	27.1 ac	20 ac	207 ac	18 ac	40 ac (0 to -4 MLT) 359 ac (-4 to -12 MLT)	345.4/359 ac
Gulf of Mexico Bottom Habitat	NI	69.1 ac	NI	NI	NI	NI	NI	NI	526 ac	595.1 ac
Terrestrial Habitat	NI	42.2 ac	NI	45 ac	245 ac (excludes 869 ac cropland)	NI	614 ac	NI	NI	946.2 ac
Submerged Aquatic Vegetation (SAV)	NI	5.4 ac	NI	NI	2.4 ac	NI	1.1 ac	3.5 ac	5 ac	17.4 ac
Essential Fish Habitat (subtotal of salt marsh, flats, shallow bay bottom habitat, and SAV)	NI	58.4 ac	11.5 ac	NI	31.6 ac	20 ac	321.3 ac	21.5 ac	404 ac	868.3 ac
<b>MITIGATION/BENEFITS *</b>										
Upland Habitat	NI	NI	NI	1.1 ac	NI	5 ac	NI	NI	120 ac	126.1 ac
Bay Bottom Habitat	NI	NI	5 ac	NI	NI	NI	NI	NI	NI	5 ac
Shallow-Water Habitat	NI	NI	11 ac	5.2 ac	27.1 ac	NI	5.5 ac	NI	935 ac	983.8 ac
Submerged Aquatic Vegetation	NI	16.2 ac	NI	NI	7.2 ac	NI	1.6 ac	10 ac	15 ac	50 ac

TABLE 5.1-1 (Concluded)

Project	Kiewit Offshore Services	Packery Channel	Raising Kennedy Causeway	Joe Fulton International Trade Corridor	La Quinta Gateway Project	Rincon Channel Federal Assumption of Maintenance	Gulf Coast Strategic Homeport Naval Station Ingleside	Mine Warfare Center of Excellence	Corpus Christi Ship Channel 52-foot Project	Total
Wetlands (salt marsh, brackish, fresh)	NI	18 ac	NI	NI	5.9 ac	28 ac	42 ac	NI	26 ac	119.9 ac
Beach Nourishment	NI	91.3 ac	NI	NI	NI	NI	NI	NI	NI	91.3 ac
Dune Mitigation	NI	1.5 ac	NI	NI	NI	NI	NI	NI	NI	1.5 ac
<b>SOCIOECONOMICS</b>										
Environmental Justice	NI	NI	NI	NI	NI	NI	NI	NA	NI	NI
Community Cohesion	NI	NI	NI	NI	NI	NI	NI	NA	NI	NI
Relocations	NI	NI	1 business	NI	NI	NI	NI	NA	NI	1 business
Demand for Housing Units	3,150	3,150	NA	NA	4,600	NA	3,700	NA	Negligible	11,450
Population Increase	5,200	5,200	NA	NA	9,000	NA	14,900	NA	Negligible	29,100
<b>BENEFITS</b>										
<b>Temporary (Construction Phase)</b>										
Employment (avg. annual)		350	1,700	100	4,250	NA	535	NA	370	7,305
Wages (avg. annual)		NA	\$26.9 M	NA	\$210 M	NA	NA	NA	\$1.1 M	\$238 M
Total Output (avg. annual) (Nueces and San Patricio counties)		NA	\$114.3 M	NA	\$460 M	NA	NA	NA	\$23 M	\$597 M
Indirect Business Tax Impact (avg. annual)		NA	NA	NA	\$15 M	NA	NA	NA	\$900,000	\$15.9 M
<b>Permanent</b>										
Employment (avg. annual)		2,500	NI	90	6,400	NA	8,470	NA	71	17,530
Wages (avg. annual)		\$220 M	NI	\$38 M	\$233.4 M	NA	\$150 M	NA	\$21,000	\$641.4 M
Total Output (avg. annual) (Nueces and San Patricio counties)		NA	NI	\$115 M	\$680 M	NA	NA	NA	\$85,000	\$795.1 M
Indirect Business Tax Impact (avg. annual)		NA	NI	\$3.7 M	\$21.8 M	NA	NA	NA	\$3,700	\$25.5 M

NI = No impacts; NA = Not Available; M = million (dollars).

\* Except for CCSCCIP, all gains in the Mitigation/Benefits section of this table are from mitigation. For CCSCCIP, the only mitigation is the 15 acres of submerged aquatic vegetation; all others are from beneficial uses. Mitigation is determined based on Habitat Suitability Indices, while others were based on ratios to direct impacts. Mitigation may be completed or proposed.

involves the establishment of six dredged material PAs, including the use of some new work material for beach nourishment to counter the effects of wave erosion, providing storm damage reduction. The City of Corpus Christi has proposed recreational development in conjunction with the project; however, recreation is not part of the Federally cost-shared project.

The length of the proposed channel from the Gulf end of the jetties to the GIWW is approximately 18,500 feet (3.5 miles). The Packery Channel alignment follows an existing channel southeast of the GIWW for approximately 2.6 miles to a basin southeast of SH 361. From this basin the proposed new channel will extend approximately 0.9 mile toward the Gulf following a historic washover channel. Packery Channel will allow recreational and small commercial boats access between the GIWW and the Gulf. Traffic will not include large commercial ships, tows, deepwater draft barges, or any floating vessel with a draft greater than 4 feet.

The proposed channel opening involves dredging a new channel from the Gulf into the existing basin area located southeast of the SH 361 bridge. Two rock jetties will extend from the shoreline southeastward approximately 1,400 feet paralleling the channel. The basin will be reconfigured and deepened to a consistent depth of -12 feet mean lower low water level (MLLW). The existing Packery Channel west of SH 361 that extends to the GIWW will be increased to 80 feet in bottom width and 7 feet in depth (USACE, 2003).

#### 5.2.2 JFK Causeway

The JFK Causeway is located in southeast Nueces County in the City of Corpus Christi on the northern end of the Laguna Madre providing a connection between the mainland and North Padre Island. The current causeway is approximately 4 feet mean sea level (MSL) with a 3,280-foot-long bridge, which provides a clear roadway width of 54 feet, including a divided four-lane road with a concrete median barrier and a vertical clearance of 80 feet above the water surface.

The proposed project would raise the existing JFK Causeway (Park Road 22) to a minimum of 9 feet above MSL from O'Connell Street on the mainland to a point 1,740 feet east of Aquarius Drive on Padre Island. The new portion of the bridge would be 2,850 feet with a 2,550-foot water opening at the west end of the causeway. No new through lanes would be added by the project, and the existing two lanes in each direction would remain upon completion of the project. Between O'Connell Street and the Laguna Madre, the existing four-lane divided highway would be converted to an urban freeway with four main lanes and frontage roads to provide access to abutting properties. A turnaround at the western bank of the Laguna Madre would aid local traffic access. During construction, one lane in each direction would remain open to traffic. The westbound traffic lanes would be completed first to ensure safe evacuation in case of an emergency during construction. The GIWW high bridge would not be modified as part of this project since it is already well above the 9-foot minimum elevation needed for safe evacuation during storm events. (Hicks & Company, 1999)

#### 5.2.3 Joe Fulton International Trade Corridor

The Joe Fulton International Trade Corridor (JFITC) is a proposed intermodal project to connect road, rail and marine traffic between IH 37 and US 181. The proposed project area is located

along the Port of Corpus Christi Inner Harbor in Nueces County, Texas, and is located north of the City of Corpus Christi, south of Nueces Bay, and west of Corpus Christi Bay. It would result in the construction of a two-lane roadway (one 12-foot lane in each direction and 10-foot shoulders) approximately 11.8 miles in length and a railroad corridor approximately 6.0 miles in length, parallel to a portion of the proposed roadway.

The JFITC would provide improved road and rail access to existing facilities on the north side of the Inner Harbor from the Tule Lake Lift Bridge to US 181. It would also facilitate development of approximately 1,100 acres of PCCA and Driscoll Foundation land between the Lift Bridge and Carbon Plant Road/IH 37. The new rail link would provide alternative service to the north bank area, eliminating the need for all rail traffic to pass over the Lift Bridge. The proposed road would provide alternative routing for industrial vehicles between US 181 and IH 37 and PCCA facilities, thus eliminating the need for traffic to traverse the downtown Corpus Christi area and the Harbor Bridge. The proposed route would provide an alternative for general traffic, including hurricane evacuation traffic from areas east of Corpus Christi Bay, independent of the Harbor Bridge and the Lift Bridge (Shiner, Moseley and Associates, 2001).

#### 5.2.4 La Quinta Gateway Project

The proposed La Quinta Gateway project involves the construction and operation of an intermodal container terminal and associated deep draft docking facility. The project would be located on PCCA-owned property (approximately 1,114 acres) in San Patricio County, Texas, between Reynold's Metals Company to the east, SH 361 and the City of Gregory to the north, US 181 and the North Shore Country Club Estates to the northwest and west, respectively, and Corpus Christi Bay to the south. The Corpus Christi Bay portion of the site is in Nueces County, Texas, adjacent to the La Quinta channel extension. The objectives of the modern container facility are to facilitate the need for increased container terminal capacity in the rapidly growing Gulf market and provide diversification for the PCCA.

The proposed cargo facility for the La Quinta Gateway project would be constructed over three phases to include: highway access via improvements to SH 35 and US 181, rail access via the Union Pacific Railroad ROW, water access via extension of the La Quinta Channel and a new 1,500-foot turning basin, a 295-acre marine terminal with stacked container and wheeled storage areas, a 3,800-linear-foot container wharf capable of accommodating three post-Panamax containerships simultaneously, nine gantry cranes with a boom reach capable of handling loading/off-loading activities, a 75-acre intermodal rail terminal along the east edge of the La Quinta property, four 6,000-foot loading tracks, a warehousing and distribution facility, and two dredged material placement areas totaling nearly 300 acres, including a 100±acre buffer zone located along the western boundary of the site (PCCA, 1999). Approximately 819 acres of the 1,114-acre project area is in row crop production, while 295 acres is predominantly in brushland used for grazing.

#### 5.2.5 Regional Water Plan

Senate Bill 1, passed in 1997, directed the TWDB to designate regional water planning areas, which were designated Regions A through P. Region N, the Coastal Bend Region, includes Aransas, Bee, Brooks, Duval, Goliad, Jim Wells, Kenedy, Kleberg, Live Oak, McMullen, Nueces, and San

Patricio counties. The CAW was interested in the impact of the preferred alternative on the Coastal Bend Regional Water Plan update and vice versa because of a potential substantial change in tidal amplitude and a substantial increase in population, and thus water needs, from the preferred alternative. As an examination of Sections 4.1.1 and 4.10 will reveal, changes in tidal amplitude are predicted to be minimal, as is the added need for infrastructure, since the projected increase in population with the preferred alternative is a fraction of 1 percent. Therefore, the Coastal Bend Regional Water Plan update will not be carried through the rest of the analysis of cumulative impacts.

#### 5.2.6 Kiewit Offshore Services Project

Kiewit Offshore Services, located north of the intersection of La Quinta Channel and Jewel Fulton Canal, plans to bring in large components of a proposed floating oil/gas platform and then tow the fabricated structure to the Gulf of Mexico. The existing depth of -45 MLT is adequate for vessel draft, however the channel width is too narrow. Kiewit Offshore Services proposes to widen 12,000 linear feet of the bottom width of the La Quinta Channel from the existing 300 feet to 400 feet. Widening would begin just north of Station 57+00, which is approximately 4,000 feet north of its intersection with the CCSC. Dredging would end at Station 174+10 on the east side of the channel and Station 180+00 on the west side of the channel. Widening of the channel would be box cut on a 1:1 side slope template, which should stabilize to approximately 2:1 or steeper. However, the bottom width of the channel can be extended about 50 feet on either side with limited relative change anticipated at the top of each slope. The approximately 800,000 cy of hydraulically dredged material would be placed on PA 13. To accommodate components of the platform, an area measuring 385 feet wide by 850 feet long would also be hydraulically dredged to a depth of -85 feet MLT from its existing depth of -45 feet MLT. Approximately 500,000 cy of material would be placed either on uplands located on Kiewit Offshore Services property or in PA 13. The channel widening is not expected to have any effect on SAV observed adjacent to the channel.

### 5.3 PAST OR PRESENT ACTIONS

#### 5.3.1 Corpus Christi Ship Channel 45-Foot Project

The existing channel extends from deep water in the Gulf of Mexico through a jettied entrance channel in Aransas Pass to Harbor Island and across Corpus Christi Bay to a land-locked channel south of Nueces Bay. A branch channel to La Quinta extending from the main channel along the north shoreline of Corpus Christi Bay is included in the project. According to the USACE (1975) the Corpus Christi Ship Channel was deepened from the existing 40-foot depth to an authorized depth of 45 feet. The 40-foot dimensions were authorized by the Rivers and Harbors Act of 1958, and the 45-foot dimensions were authorized by the Rivers and Harbors Act of 1968.

The 45-foot project provides maintenance dredging of the CCSC to authorized dimensions. Maintenance dredging is required periodically to insure sufficient carrying capacity in the channels for efficient and safe movement of commercial navigation. Shoaling within the channels would seriously hamper or halt deep-draft shipping within 2 or 3 years if maintenance dredging were discontinued. The outer bar and jetty channel to Harbor Island are normally maintained by a hopper dredge, with the dredged material placed in a designated open water placement area in the Gulf of



Mexico. The remaining portions of the CCSC are maintained by hydraulic pipeline dredge and materials placed in UCPAs, confined placement areas, and open-water placement areas in Corpus Christi Bay. Materials dredged from the landlocked portion of the channel south of Nueces Bay are placed in UCPAs. Variations of these procedures could occur as a result of improvements in dredging techniques and equipment or possible emergency conditions. Resource impact evaluation of the 45-foot project was not conducted due to the proposed impacts of the CCSCCIP.

### 5.3.2 Rincon Canal Federal Assumption of Maintenance

The USACE proposes to assume responsibility for maintenance of the Rincon Canal and Canal A in Corpus Christi Bay and the Rincon Industrial Park (RIP), and to use the dredged material for BU sites in the project area, where possible.

The Corpus Christi Rincon Canal System (CCRCS) is composed of several connecting channels constructed between 1967 and 1974. The Rincon Canal is a channel measuring 100 feet in width, 12 feet in depth, and 14,256 feet in length, and connects the CCSC to the RIP. The canal passes under US 181/Nueces Bay Causeway east of the northern end of the RIP. The CCSC serves as a connection between the CCRCS and the GIWW. The RIP is served by Canal A (150 feet in width, 12 feet in depth, and 4,980 feet in length), and Canals B and E, all of which connect to the Rincon Canal. Rincon Canal and Canal A compose that part of the system proposed for assumption of maintenance dredging by Federal entities. The proposed BU sites are located in Nueces County along the southwestern margin of Corpus Christi Bay, adjacent to the City of Corpus Christi and the RIP, which is part of the PCCA.

The channels are currently maintained using a cutterhead pipeline dredge. No changes in historical dredging practices would be proposed as a result of this action (USACE, 2000).

### 5.3.3 Gulf Coast Strategic Homeport Naval Station Ingleside (Naval Station Ingleside)

The U.S. Navy proposed a strategic homeporting action for 27 battleship surface vessels at eight locations on the U.S. Gulf Coast, including Naval Station Ingleside, Texas. Very little information was available regarding the execution of this project. Of the proposed actions, only dredging of navigation channels and turning basins are known to have occurred in the region. Additionally, waterfront facilities were constructed to support the homeported vessels. The following information is taken largely from the project EIS (US Navy, 1987).

The Naval Station Ingleside project site is located in and adjacent to the CCSC, from La Quinta to Harbor Island. Approximately 8.4 miles of the CCSC was proposed to be widened from 500 to 600 feet. The CCSC was to be hydraulically dredged to a depth of -46.5 feet MLT. A 105-acre turning basin was to be dredged to a depth of -41 feet MLT in the western 42 acres and -46.5 feet MLT in the eastern 63 acres. Dredging depths include 2 feet advance maintenance and 2 feet allowable over depth.

Approximately 13.2 mcy of material was proposed to be dredged, including 5.9 mcy from the CCSC and 7.3 mcy from the turning basin. Maintenance dredging is expected to occur every 5 years with an estimated volume of 6.4 mcy of material being removed from the CCSC and 6.5 mcy of material being removed from the turning basin over the 50-year life of the project. The dredged material was

proposed to be hydraulically removed and pumped to USACE-designated placement sites (EPA, 1987). Additionally, the EPA designated the Navy Homeport ODMS, under MPRSA, for the placement of virgin and maintenance material from the Entrance Channel. The physical location of the Navy Homeport ODMS coincides with BU Site ZZ.

#### 5.3.4 Mine Warfare Center of Excellence

Dredging approximately 400,000 cy for the U.S. Navy facilitated the construction of a Magnetic Silencing Facility (MSF) for use by the Mine Warfare Center of Excellence at Ingleside, Texas. This MSF is required to measure the magnetic signature of the mine warfare ships for utilization in mine warfare training. Construction of an entrance channel, turning basin and slip was required for the Avenger and Osprey Class Naval Vessels.

The entrance channel measured 150 feet wide and approximately 700 feet in length and will be dredged to -17 feet MLW. The turning basin measured 500 feet by 500 feet and was dredged to -17 MLW. To allow for placement of the MSF, a corridor measuring 520 feet by 270 feet was dredged to -25 feet MLW. The MSF consists of piers and sensor tubes. Two piers 300 feet in length were constructed parallel to one another 66 feet apart to allow docking of naval vessels between them. A walkway measuring 800 feet in length connects these piers to the shoreline.

An additional small craft pier was constructed adjacent to Naval Station Ingleside and CCSC. The pier measures 600 feet in length and accommodates utility boats used to support the mine warfare exercises and existing boats assigned to the station.

The small craft pier facilities are near Naval Station Ingleside, San Patricio County, Texas. The dredging portion of the project was performed at the confluence of the Jewel Fulton Canal and La Quinta Channel west of Ingleside, Texas (EPA, 1987).

#### 5.3.5 Jewel Fulton Canal Federal Assumption of Maintenance

The Jewel Fulton Canal is a small canal off La Quinta Channel located adjacent to Kiewit Offshore Services, Ltd. and Navy-owned property in Ingleside, Texas, which continues into Kinney Bayou. Channel improvements for this area are currently being planned.

### 5.4 RESULTS

#### 5.4.1 Ecological/Biological Resources

Biological and ecological resources will experience a net negative impact from increased turbidity associated with the dredging and dredged material placement required in the majority of the projects evaluated. Temporary disturbance of bay bottom due to open bay placement and channel dredging is anticipated to provide temporary negative impacts to benthos and SAV. Loss of freshwater marsh and upland habitat due to construction is expected to reduce food and nutrient sources. Not all projects will impact freshwater marsh or upland habitat. Long-term positive impacts from the preferred alternative for the CCSCIP are anticipated from the creation of seagrass, marsh, and shallow aquatic

habitat, which will increase nursery habitat for finfish/shrimp and provide rich substrate for benthic organisms. Birds will benefit by the periodic placement of dredged material on existing upland sites due to creation of temporary unvegetated nesting substrate. However, construction operations attributed to almost all evaluated projects may disturb nesting activity. Mammals, reptiles/amphibians, and terrestrial vegetation will be negatively impacted, temporarily, by placement of material on existing upland placement sites. Threatened/endangered species are not expected to be negatively impacted; in fact, some benefit may be realized from creation of marsh and unvegetated nesting substrate on existing placement sites. Although wetland vegetation will be negatively impacted where wetlands are damaged or destroyed by project construction, marsh creation projects will benefit wetland vegetation, resulting in an overall positive cumulative impact in the general study area. Except for the CCSCCIP, all gains in the Mitigation/Benefits section of Table 5.1-1 are from mitigation. For the CCSCCIP the only mitigation is for SAV; all others are from beneficial uses.

#### 5.4.1.1 Wetlands

The CCSCCIP preferred alternative will not impact any freshwater or brackish wetlands. Wetlands evaluated included salt marsh, freshwater, and brackish wetlands. Negative impacts (totaling 82 acres) are expected to wetland habitat from Packery Channel (17.8 acres); JFK Causeway (11.5 acres); the JFITC (11.2 acres), La Quinta Gateway Project (1.7 acres); and Naval Station Ingleside (39.8 acres). Mitigation for negative impacts associated with these projects include creation of 18 acres of wetlands for Packery Channel, 28 acres of salt marsh proposed for the Rincon Canal Project, 42 acres for Naval Station Ingleside; and 5.3 acres for La Quinta. The CCSCCIP preferred alternative will provide a BU of 26 acres of wetlands. A net gain of 44 acres for the Corpus Christi Bay area is predicted, based on the above totals.

According to studies conducted within the CCBNEP study area (that includes Aransas Bay, Corpus Christi Bay, and the Upper Laguna Madre) (White et al., 1998), marsh habitat constitutes approximately 97 percent (116,041 acres) of total vegetated wetland areas (119,425 acres) (marshes, scrub-shrub, and forested wetlands). Some of the findings in these studies reveal that salt and brackish marshes compose approximately 48 percent of the marsh system. As presented in these studies, the trend in vegetated wetlands is one of net gain from the 1950s to 1992 (including photointerpretation inconsistencies). However, loss of marsh habitat has resulted from agricultural or urban land conversion with additional loss due to dredging, filling, and draining. According to the studies, the greatest changes in habitat between the 1950s to 1979 has occurred in tidal flats due to permanent inundation. The response to permanent inundation has primarily resulted in conversion to open water or seagrass beds. Some losses included conversion to smooth cordgrass marshes along the upper reaches of the tidal flats that became more frequently flooded. According to the CCBNEP studies (White et al., 1998), some of the largest losses in tidal flats was in the Corpus Christi/Nueces Bay-Laguna Madre system.

#### 5.4.1.2 Finfish/Shellfish

Shallow water nurseries and spawning grounds are sensitive sites within the general study area. Shrimp and finfish production would be temporarily displaced due to dredging activity and open water placement of dredged material, and periodic loss of production would occur during

maintenance dredging. These areas will recover after activity has ceased, but the quality of the habitat will be reduced by repeated placement of dredged material. Dredging and placement activity will increase turbidity, which may impede gill function in finfish and shrimp not able to leave the area. Damage to marshes from placement of dredged material will reduce nursery areas available for finfish and shrimp. Potential contaminants that may be in bottom sediments will be retrained when dredging occurs, potentially exposing finfish and shrimp to contaminated materials. No contaminants in bottom sediments have been identified to date except from the Inner Harbor which will go to UCPAs. These impacts, except damage to marshes (Section 5.4.1.11), are associated with all dredging projects reviewed, as well as the CCSCCIP preferred alternative. Shallow bay bottom habitat (0 to -12 MLT) will be impacted by the following projects: Packery Channel (33.3 acres), La Quinta Gateway (27.5 acres), Rincon Channel Federal Assumption of Maintenance (20 acres), Naval Station Ingleside (207 acres), and the Mine Warfare Center of Excellence (18 acres). The CCSCCIP preferred alternative will impact 40 acres of shallow bay bottom (0 to -4 MLT) and 359 acres of bay bottom (-4 to -12 MLT). The CCSCCIP is the only project that identifies shallow bay depth differences; thus, all other impacts of shallow bay habitat are assumed at 0 to -12 MLT. BU sites for the preferred alternative will create approximately 935 acres of shallow water habitat; and the Naval Station Ingleside creates 5.5 acres. A net gain of approximately 235.7 acres of shallow water/bay bottom habitat will occur from mitigation and beneficial uses due to all projects reviewed.

As presented in Section 5.4.1.1, a net gain of 44 acres of wetland habitat is estimated. Approximately 595.1 acres of Gulf of Mexico ocean bottom are expected to be temporarily affected by the combined Packery Channel project (69.1 acres) and the CCSCCIP preferred alternative (526 acres). These temporary disturbances will be from the initial lowering of the channel bottom and resultant maintenance dredging, and beneficial use placement along beach shorelines. A small amount (7.1 acres) of Gulf bottom will be lost permanently to jetties for the Packery Channel project.

#### 5.4.1.3 Terrestrial Habitat

Terrestrial vegetation present on any placement sites will be covered by deposition of the maintenance materials as a result of those reviewed projects requiring dredging activities. This vegetation consists mainly of opportunistic species that thrive on disturbed soils and are likely to return after the site has been dewatered. These species are not anticipated to make significant contributions as food or detritus sources. The following projects will cause a total impact of 996.2 acres to terrestrial areas: Packery Channel (42.2 acres), JFITC (45 acres), La Quinta Gateway Project (295 acres), and Naval Station Ingleside (614 acres). Approximately 819 acres of cropland potentially impacted by the La Quinta Gateway Project is not included as terrestrial habitat. Terrestrial vegetation found in the vicinity of the JFK Causeway will be destroyed during construction of the elevated bridge and causeway; however, the upland areas within the road ROW will continue to provide habitat for opportunistic species. Projects providing upland habitat include: 5 acres created for the Rincon Channel Federal Assumption of Maintenance, and a 120-acre upland site (BU Site E) west of the La Quinta Gateway Project for the CCSCCIP preferred alternative. For the Packery Channel project, dune mitigation of 1.5 acres of displaced dunes for restoring and revegetating has been proposed. A net loss of terrestrial habitat totals 877.2 acres among all of the reviewed projects.

#### 5.4.1.4 Mammals

The general study area is not considered high quality mammal habitat; however, terrestrial species will be negatively affected by periodic placement of dredged material on upland disposal sites and construction of facilities and roads associated with the projects. Habitat which attracted them will be covered, resulting in death to any slow moving or non-motile species. Others will be displaced; however for the upland disposal sites after dewatering, the habitat will likely return. Upland placement sites are not intended to be managed for mammal habitat.

#### 5.4.1.5 Reptiles and Amphibians

The general study area is not considered high quality reptile and amphibian habitat; however, land turtles, snakes, lizards, and others may be adversely affected by periodic placement of dredged material on upland placement sites or clearing of upland sites. Habitat which attracted them will be covered, resulting in death to nonmotile or slow-moving species remaining on the site during placement. After dewatering from a placement area, the habitat will likely return; however, placement sites are not expected to be managed for this purpose.

#### 5.4.1.6 Threatened and Endangered Species

Refer to Section 4.5 in this FEIS for a discussion of potential impacts to threatened and endangered species from the CCSCCIP preferred alternative. No significant impacts to threatened or endangered species are anticipated as a result of the reviewed projects in the general study area, with the exception of Packery Channel. The Biological Opinion for impacts to endangered and threatened species relative to Packery Channel has been issued by FWS. Piping plover critical habitat will be affected by the dredging of Packery Channel. Approximately 1.5 acres of critical habitat will be negatively impacted by the channel and jetties. In addition, 20 acres of beach nourishment will be placed on foraging beachfront areas for piping plover, yet would be considered a temporary impact.

#### 5.4.1.7 Benthic Habitat

Organisms present on open-bay bottom will be temporarily affected by the project due to excavation and placement of dredged materials. However, a 290.4-acre net gain will occur when considering beneficial uses creation and mitigation for bay bottom and shallow-water habitat, SAV, wetlands (salt marsh), and flats (see sections 5.4.1.1, 5.4.1.2, 5.4.1.10, and 5.4.1.11). Additional impacts associated with the loss of Gulf of Mexico ocean bottom will occur due to the opening of Packery Channel (69.1 acres: 7.1 acres permanent; 62 acres temporary) and the CCSCCIP preferred alternative (526 acres), a temporary impact. Dredging activity in association with these projects may temporarily reduce the quality of nearby benthic habitat from increased turbidity. Most organisms present in areas covered for open water placement sites will be permanently lost; however, recovery will occur after placement is completed. Recent studies in Corpus Christi Bay (Ray and Clarke, 1999) have indicated that recovery occurs at open-bay placement sites in less than 1 year. Opportunistic populations can overtake newly created benthic habitat increasing its value to foraging species.

Toxic materials may be present in roadway runoff, which will negatively affect the benthos in the immediate vicinity of the JFITC and the JFK Causeway. Piers constructed to support the causeway and bridge are expected to be colonized by animals such as barnacles, oysters, and limpets, providing habitat for crabs, shrimp, small fish, and other marine organisms. The creation of shallow-water unvegetated and vegetated habitat is expected to provide rich substrate for benthic populations to develop. Rock breakwaters associated with CCSCCIP BU sites and the jetties at Packery Channel are expected to be colonized by animals such as barnacles, oysters, and limpets, providing habitat for crabs, shrimp, small fish, and other marine organisms.

#### 5.4.1.8 Plankton

Increased turbidity during dredging and placement will decrease light transmittance necessary for photosynthesis of phytoplankton. Increased turbidity may also negatively affect zooplankton by damaging their filtering mechanism and impeding respiration. However, these impacts are temporary and local.

Toxic materials released during dredging of the projects, construction of the JFITC or the JFK Causeway, or traffic accidents on the bridge may have an adverse effect on plankton populations. However, data are not available to provide a quantitative analysis of the potential problem.

#### 5.4.1.9 Essential Fish Habitat

Section 305(b)(1)(A and B) of the Magnuson Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act, 16 U.S.C 1801 et seq.), as amended, requires that the Regional Fishery Management Councils submit, by October 11, 1998, amendments to their Fishery Management Plans that identify and describe EFH for species under management. The Act also requires identification of adverse impacts on EFH and the actions that should be considered to ensure that EFH is conserved and enhanced.

Based on direct impacts (868 acres) to submerged aquatic vegetation, salt marsh, shallow bay bottom habitat, and flats identified in the reviewed projects, the net gain from proposed mitigation and beneficial use areas amounts to approximately 290.4 acres, with the majority of this acreage proposed by shallow water habitat. Given the size of this bay system, and the net gains from the projects, EFH will not be adversely affected.

#### 5.4.1.10 Submerged Aquatic Vegetation

Based on the results of the document reviews, SAV will experience an area-wide increase. Approximately 5 acres are to be negatively impacted by the CCSCCIP and mitigated at a 3:1 ratio and approximately 935 acres of potential SAV habitat will be created in the BU sites. Four projects account for approximately 12.9 acres of negative impacts to SAV in the general vicinity. These include La Quinta Gateway Project (2.9 acres), Packery Channel (5.4 acres), Naval Station Ingleside (1.1 acres), and Mine Warfare Center of Excellence (3.5 acres). Negative impacts to seagrass habitat by these projects will be mitigated with 50 acres proposed for restoration.

As presented in the CCBNEP studies by Pulich et al. (1997), the Laguna Madre system has seen many changes since the 1950s, primarily in response to salinity changes. A summary of studies identified in the CCBNEP (Pulich et al., 1997) provide seagrass data results. In the Upper Laguna Madre from 1967 to 1988, shoalgrass increased; but from 1988 to 1994, shoalgrass decreased up to 60 percent with manatee grass becoming established in the northern part. Decreases since 1990 in the Upper Laguna Madre have been attributable to brown tide which reduces water clarity. Between 1958 and 1994, there has been an indication of an expansion of shoalgrass and widgeongrass on the backside of Mustang Island (Pulich et al., 1997). According to Pulich et al. (1997), general trends have shown that seagrass dynamics are highly variable with localized changes.

#### 5.4.1.11 Estuarine Sand Flats/Mud Flats/Algal Flats

For the purpose of this study, impacts resulting from the CCSCCIP preferred alternative to this habitat were included in the Essential Fish Habitat (Section 5.4.1.9). No negative impacts were found to estuarine sand flats/mud flats/algal flats due to the CCSCCIP preferred alternative. Of the projects reviewed, the Naval Station Ingleside project identifies potential impacts at the project site to 112 acres of low-quality sand flats, and Packery Channel construction impacts identifies 1.9 acres. No mitigation has been proposed for any of the projects reviewed for tidal flats.

#### 5.4.1.12 Open-Water Habitat

The construction of Packery Channel will cause the loss of approximately 7.1 acres of open-water habitat for jetty construction. No additional impacts are due to the CCSCCIP preferred alternative, with the exception of an anticipated loss from the conversion of deep-bay open-water to shallow-water marsh habitat and emergent islands in the BU sites. The benefit of the BU sites outweighs the impact of the loss of open water due to the high productivity to be created in these areas.

#### 5.4.1.13 Oyster Reef Habitat

No impacts will occur to oyster reef habitat from the CCSCCIP preferred alternative. Impacts to oyster reef habitat were not indicated by the reviewed projects.

#### 5.4.1.14 Coastal Shore Areas/Beaches/Sand Dunes

No significant or noticeable impacts are expected from the CCSCCIP preferred alternative. Impacts to coastal shore areas/beaches/sand dunes from the reviewed projects include approximately 63.0 acres from Packery Channel and 0.7 mile of shoreline for the La Quinta Gateway project. However, these impacts from Packery Channel result from beach nourishment with placement of sands on eroding beach and in shallow Gulf waters along the beach. Dune relocation and revegetation of 5,670 cy (approximately 1.5 acres) of dunes has been proposed for the Packery Channel project.

#### 5.4.2 Physical/Chemical Resources

Increases in both upland and submerged elevations from dredged material placement with the preferred alternative can be expected to change local circulation patterns.

#### 5.4.2.1 Topography/Bathymetry

Projects impacting topography/bathymetry include Packery Channel (3.5 miles), JFK Causeway (0.9 mile), La Quinta Gateway Project (32 acres), and Naval Station Ingleside (8.4 miles). The CCSCCIP will impact 43 miles. Periodic placement of maintenance material on open-water placement areas will temporarily decrease water depth in those areas until currents and wave action erode the dredged material away. Surface elevation will increase due to replacement of open bay with created marshes as BU sites and with the building of structures for reviewed projects.

#### 5.4.2.2 Noise

Noise impacts included in those projects associated with dredging will include operation and maintenance noise. This impact will be temporary, will move up and down the project area depending on the section being dredged, and is not expected to differ from current maintenance dredging for many of the projects.

#### 5.4.2.3 Air Quality

Objectionable odors (mercaptan, hydrogen sulfide) may result from the dredging of maintenance sediments containing high concentrations of organic matter in those reviewed projects requiring dredging. Temporary and intermittent maintenance dredging activities would emit nitrogen oxides and carbon monoxide primarily. During operation, pollutants expected to be emitted include nitrogen oxides, carbon monoxide, particulates, sulfur dioxides, and hydrocarbons. No reviewed projects are anticipated to violate the NAAQS because these projects require State air permits and compliance with permits would result in no adverse cumulative impacts on air quality.

#### 5.4.2.4 Water Quality

Contaminants originating from the Inner Harbor and contained in material displaced or dredged from the Inner Harbor to Station 1080+00 and in upper Corpus Christi Bay will be contained in UCPAs. Monitoring and management of the effluent from these sites will control the reintroduction of contaminants to the environment. All reviewed projects will comply with the requirements of NPDES during construction of the projects.

Although water quality in the general study area appears to be improving, dredging and placement operations are expected to temporarily degrade water quality in the project vicinity through increased turbidity and release of bound nutrients. This is true of all projects involving dredging and dredged material placement. No projects reviewed cited concerns with sediment contamination or nutrients, including the CCSCCIP preferred alternative.

Dredging and placement at proposed open water and upland placement areas may increase suspended solids, release contaminants and bound nutrients, and deplete oxygen. This impact is temporary and, except for turbidity, insignificant. If temporary degradation occurs, the study area should rapidly return to ambient conditions upon completion of dredging.



A slight impact to water quality may occur as a result of vehicular use of the JFITC and the elevated JFK Causeway. Stormwater runoff, which may contain oil and grease may also have minimal impacts to water quality.

#### 5.4.2.5 Salinity

Existing salinity condition is anticipated to be maintained as a result of dredging and maintenance of the majority of projects reviewed. Possible changes in hydrodynamics from the proposed JFK Causeway and Packery Channel may cause localized changes and, therefore, will not change the salinity structure of the Upper Laguna Madre or Corpus Christi Bay, as a whole (Hicks et al., 1999).

#### 5.4.2.6 Freshwater Inflows

No alteration to freshwater flow is anticipated from the preferred alternative or from any projects reviewed in this analysis.

#### 5.4.2.7 Turbidity

Reviewed projects requiring dredging and open water placement of dredged material will produce increased turbidity during dredging and placement. Continued use of open water placement areas may provide a source of continuing turbidity due to erosion by currents and wave action. Turbidity will also often occur in the immediate vicinity of the cutterhead dredge near the point of open-water placement and from runoff from construction sites during highway projects. Turbidity from these sources is expected to return to concentrations below ambient soon after cessation of dredging.

#### 5.4.2.8 Circulation/Tides

Temporary, minor changes in circulation in the vicinity of open water placement areas containing newly placed materials are expected upon construction dredging and with the maintenance dredging process. Circulation is expected to return to existing conditions when the majority of the material has eroded away. No changes in turnover and tides are expected as a result of dredging the reviewed projects. Hicks et al. (1999) predicts a small, localized effect in hydrodynamics as water is allowed to move through a 2,550-foot water opening in the proposed JFK Causeway, rather than the present exchange through Humble Channel and the GIWW only. Changes in circulation will occur with the opening of Packery Channel.

#### 5.4.2.9 Sediment Quality

Potentially contaminated sediments from the Inner Harbor reach of the CCSCCIP will be placed in UCPAs. Monitoring and management of the effluent from these sites will control reintroduction of these contaminants to the environment. Decreased ship traffic resulting from the preferred alternative may decrease the potential for spills that may eventually contaminate sediments in the study area.

#### 5.4.3 Cultural/Socioeconomic Resources

Cultural impacts are anticipated to be minimal as a result of the CCSCCIP preferred alternative. There is a low probability that unknown submerged archaeological sites, excluding shipwrecks, may be impacted.

Socioeconomic impacts relate mainly to an increase in population, an increase in demand for housing, and impacts to land use. These impacts would occur in Nueces and San Patricio Counties primarily in the following communities: Corpus Christi, Portland, Ingleside, Ingleside-by-the-Bay, and Aransas Pass. The population increase that would result from the projects evaluated would be approximately 29,000 (assuming complete build-out of all projects). This increase in population would provide the impetus for a local demand of approximately 11,450 housing units. One business would be relocated as a result of the construction of the Raising Kennedy Causeway project. No EJ or community cohesion impacts would result from any of the projects evaluated. Land use impacts include development of approximately 1,300 acres of vacant land in San Patricio County, expanded roadways and rail-lines on the north side of the Corpus Christi Bay and within the Inner Harbor area of Corpus Christi. The Packery Channel project would impact approximately 25 acres of currently vacant land, although approximately 20 of these acres would be converted to public parkland (including parking and other structures). Cumulative impacts related to an increase in visitor usage of parks and recreational areas was not evaluated, as these impacts were not addressed in any of the documentation prepared for any of the reviewed projects.

Socioeconomic benefits are grouped into benefits that would occur during project construction, and those that would occur after project construction is complete. The projects that were reviewed would provide an increase in annual employment of approximately 7,305 jobs (includes indirect and induced jobs), and wages for these jobs would be approximately \$238 million annually. Total economic output within San Patricio and Nueces Counties would be approximately \$597 million annually, and indirect business taxes for local and State government would be \$15.9 million annually. After construction on all reviewed projects is complete, there would be an increase in annual employment of approximately 17,530 annual jobs, and wages for these jobs would be approximately \$641.4 million annually. Total economic output within San Patricio and Nueces Counties would be approximately \$795.1 million, and indirect business taxes for local and State government would be \$25.5 million annually.

Secondary effects would occur as a result of the reviewed projects. Increased tourist and recreational usage of North Padre and Mustang islands is anticipated as a result of potential secondary development due to improved access resulting from the JFK Causeway. The Packery Channel Project would also increase tourist and recreational usage in the North Padre Island area. Economic development in this area is anticipated to result in increased commercial, and residential development on North Padre Island. Transportation access will be improved with new channel development projects and maintenance of existing channels. Transportation safety will be improved in all channel projects and hurricane evacuation for Padre Island will be improved due to the JFK Causeway project.

#### 5.4.3.1 Oil and Gas Production on Submerged Lands

Current oil and gas pipelines are placed to accommodate existing channel dimensions. The majority of the reviewed project documents did not address oil and gas production; however, no change in oil and gas production is anticipated as a result of the projects evaluated for cumulative impact assessment.

#### 5.4.3.2 Ship Accidents/Spills

A decrease in the number of vessels will occur with the CCSCCIP preferred alternative relative to the No-Action alternative and may occur due to the other channel improvement or maintenance projects reviewed, which may decrease potential for spills. The potential for accidental releases related to dredging activity will exist; however, spill prevention plans can minimize impacts. No additional impacts are anticipated.

#### 5.4.3.3 Historic Resources

Historic and archeological resources are expected to be impacted by the CCSCCIP preferred alternative (see Section 4.7). None of the reviewed projects conflict with sites currently listed on the NRHP or are designated as SALs.

#### 5.4.3.4 Recreation

The Corpus Christi Bay area is widely used by recreational fishermen and boaters. Turbidity associated with dredging and placement is anticipated to temporarily damage local fisheries in small portions of the general study area. Restricted areas are likely to be associated with the U.S. Navy projects (Naval Station Ingleside and Mine Warfare Center). Channel improvement projects like those reviewed provide greater access to and throughout the bay for recreational fishermen and boaters. Increased tourism would likely be a response to the opening of Packery Channel and the development of ancillary park facilities. Cumulative impacts associated with aquatic habitat are addressed in Sections 5.4.1.2, 5.4.1.7, and 5.4.1.9.

#### 5.4.3.5 Commercial and Recreational Fisheries

Many commercially and recreationally important species of shrimp and finfish are common in the general study area, specifically, red drum, spotted sea trout, black drum, mullet, southern flounder, brown shrimp, and pink shrimp. These species may be adversely affected by degradation of open-bay bottom foraging habitat due to open-water placement, but recovery is speedy (Ray and Clarke, 1999). Refer to Section 4.2.1.2 in this FEIS for impacts to commercial and recreational fisheries with the CCSCCIP preferred alternative. Opening Packery Channel is expected to increase opportunities for recreational fisherman.

#### 5.4.3.6 Public Health

No impacts to public health are expected from the reviewed projects.

#### 5.4.3.7 Safety

The primary purpose of elevating the JFK Causeway to a minimum of 9 feet MSL is to enhance public safety, particularly during natural emergencies such as hurricanes. Safety impacts to other reviewed projects were not indicated except for the CCSCCIP preferred alternative, which would improve safety in the CCSC from channel widening and the addition of barge lanes.

#### 5.4.3.8 Parks and Beaches

No impacts to parks and beaches are expected from the reviewed projects except the Packery Channel Project. Beach will be removed due to channel construction, and beach nourishment in two areas will temporarily prevent use by the public.

### 5.5 CONCLUSIONS

Cumulative impacts due to past, existing, and reasonably foreseeable future projects, along with the CCSCCIP preferred alternative, were found to produce a net positive cumulative impact in the CCSC area. Although some parameters would experience negative impacts, most of these impacts would be temporary and minor. Benefits realized through creation and protection of wetlands, seagrass, and marsh habitat by the preferred alternative and some other projects resulted in a net positive impact assessment.