2.0 PURPOSE AND NEED FOR PROJECT

The purpose of the proposed project is to construct a channel with the capability to accommodate transit of fully laden Very Large Crude Carriers (VLCCs) from multiple locations on Harbor Island into the Gulf of Mexico. Factors influencing the Applicant's need for the project include:

- Allow for more efficient movement of U.S. produced crude oil to meet current and forecasted demand in support of national energy security and national trade objectives,
- Enhance the PCCA's ability to accommodate future growth in energy production, and
- Construct a channel project that the PCCA can readily implement to accommodate industry needs.

Currently, crude oil is exported using Aframax and Suezmax vessels. The Suezmax vessels are sometimes light loaded (lightered) due to depth restrictions in the existing CCSC, and would continue to be light loaded when the current federally-authorized CCSC deepening project is completed. Reverse lightering translates into additional vessel trips, cost, man hours, operational risk, and air emissions. To efficiently and cost effectively move crude oil cargo, oil exporters are increasingly using fully loaded vessels, including VLCCs. Non-liquid commodity movements are also trending toward larger, more efficient vessels. In order to fulfill its mission of leveraging commerce to drive prosperity in support of national priorities, the PCCA must keep pace with the global marketplace.

The need for the proposed project is driven by the considerations below, which are explained in the following paragraphs:

- Pipelines from Eagle Ford and Permian Basins are being constructed to the Port of Corpus Christi and to Harbor Island. Crude oil terminals are also being planned at Harbor Island using the Federally-authorized -54-foot deep channel that limits the ability to fully load VLCCs, decreasing efficiency by requiring reverse lightering of these vessels.
- Bolstering national energy security through the growth of U.S. crude exports.
- Protecting national economic interests by decreasing the national trade deficit.
- Supporting national commerce by keeping pace with existing and expanded infrastructure being modified or already under development to export crude oil resulting from the large growth in the Permian and Eagle Ford oil field development, which has helped the U.S. recently become the top oil-producing nation in the world.
- Improve safety and efficiency of water-borne freight movements.

The infrastructure and proximity to the major Texas shale plays makes the Port an attractive location for efficiently exporting crude oil by VLCC vessels. The PCCA has received interest from new and existing customers for developing crude oil export terminals and facilities. Production and export of crude oil and natural gas have greatly increased over the years and are providing an economic boom to the Port and the region.

Investments at the PCCA that are directly aimed at product from the Eagle Ford Shale are over $100 million. In the latter part of July 2018, the PCCA sold more than $216 million in bonds to fund energy export products. A portion of this money will be used for the authorized deepening of the CCSC, but

also will help fund other improvements, including a crude oil export terminal under design at Harbor Island. The new oil export terminals being planned at the Port will have loading arms, handling equipment, storage tanks, and other related facilities for larger ships including VLCCs. Similar crude export facilities are being planned by multiple other entities at Harbor Island.

More efficient transport of crude in greater volumes is the impetus for the PCCA to deepen the channel to accommodate fully loaded VLCCs. Presently, the existing channel depth requires that current crude carriers, whether VLCCs or other vessels, not depart fully loaded from the Port, or that VLCCs remain offshore while smaller tankers transfer their cargo to the larger VLCCs, a process known as reverse lightering. The inefficiency of this process is compounded by some of these smaller vessels not being able to be fully loaded while moving through the Port.

Production from the Permian and Eagle Ford basins continues to increase, and several of the major midstream companies are currently undergoing major expansions to facilitate the export of greater volumes of crude. As these exports increase, the number of lightering vessels and product carriers will also increase, adding to shipping delays and congestion inside and outside of the Port. These delays and congestion will increase the cost of transportation, which in turn will increase the cost of crude oil with the ultimate consequence of making U.S. crude less competitive in the global market.

3.0 SITE ANALYSIS

The proposed project is located in the Gulf of Mexico, the southern portion of Corpus Christi Bay, and Redfish Bay near Port Aransas as shown in Sheet 1 of 23. The Port is located in Corpus Christi Bay on the south-central portion of the Texas coast, approximately 200 miles southwest of Galveston and approximately 150 miles north of the mouth of the Rio Grande. The CCSC provides deep water access from the Gulf of Mexico to the Port via Port Aransas, through Corpus Christi Bay. The CCSC extends from deep water in the Gulf of Mexico approximately 4.3 miles offshore through the Port Aransas jettied entrance, then continues for 21 miles westward to the Inner Harbor. The proposed project would be constructed within the limits of the CCSC from the Gulf of Mexico to Harbor Island, which comprises the Entrance Channel segment and approximately 2,000 linear feet of the Lower Bay segment of the CCSC. The Entrance Channel segment of the CCSC is currently maintained to a depth of -49 feet MLLW, and the Lower Bay segment to a depth of -47 feet MLLW. The CCSC has been federally authorized to a depth of -56 feet MLLW from the Gulf of Mexico to the end of the jetties in the Entrance Channel segment, and to -54.0 feet MLLW in the Lower Bay segment. Dredging work to reach the authorized depths is scheduled to begin in mid-2019.

Affected Waters

The proposed improvements to the CCSC would take place in the open water marine environment of the Gulf of Mexico and Corpus Christi Bay. Waters in the project area are navigable waters of the United States (WOUS) regulated by the USACE under Section 10 of the Rivers and Harbors Act of 1899. The areas of proposed channel deepening are unvegetated. Deepening of the CCSC would take place in WOUS, and the proposed improvements were detailed in Section 1.1 above, and were shown in Sheets 2 through 8 of 23. The estimated amounts of new work dredging and maintenance dredging were also listed in Sections 1.1 and 1.2. Similarly, waters occurring in the areas of proposed dredged material placement, whether for upland placement or for BU, are also navigable waters of the United States (i.e. subject to the ebb and flow of the tide) regulated by the USACE. The channel amounts were determined using Computer Aided Design (CAD) and Geographical Information System (GIS) analysis with proposed channel widths and projected daylight lines (where channel template meets existing bathymetry) using the most current bathymetric data available from the USACE and surveyed for this project. The estimated amount of WOUS was 1,664 acres between the projected side slopes of the

deepened channel. Of that, a very small patch of seagrass is mapped in the Aransas Pass within the jetties. Approximately two acres of upland at the southwest corner of San Jose Island falls within the daylight of the projected side slope of the turning basin expansion. The expansion footprint was based on empirical design criteria in Engineer Manual (EM) 1110-2-1613 *Hydraulic Design of Deep Draft Navigation Projects*, and without consideration of the potential use of sheet piling to reduce the side slope required. Additional ship simulation will be conducted in 2019 to determine if the required turning basin diameter can be reduced. A summary of potential impacts of the channel WOUS including wetlands is summarized in Table 3.1.

For placement impacts, GIS features based on the proposed template extent using existing National Oceanic and Atmospheric Administration (NOAA) bathymetry and CAD analysis were used in conjunction with existing seagrass and oyster habitat mapping downloaded from NOAA, Texas General Land Office (TGLO) and Texas Parks & Wildlife Department (TPWD). The National Wetland Inventory (NWI) data was used to identify potential mapped wetland habitat. Open water acreage was derived using a land, shoreline and water data set sourced from ESRI and Texas Department of Transportation (TXDOT), which was found to match aerial imagery well. Habitat features were clipped using the placement footprints and review of the mapped habitat was conducted using a current ESRI aerial (2018) to verify the nature of mapped features. A summary of potential impacts of the placement plan to WOUS including wetlands, and other special aquatic sites is provided in Table 3.2. The comments in the table show individually the results of aerial review in examining the nature of the mapped habitat. In several cases, the NWI identified ponded features early in the life of an active PA that have since been filled. In others, the feature had eroded away. In various cases, the BU feature is a shoreline restoration that would protect resources in the interior of the BU feature, such as M4, and not impact all the interior mapped acreage. Reductions of these acreages from being counted as adverse impacts are shown in the adjustment column, and the net result is shown as the estimated adverse impact. The bottom of the table summarizes the acreage that after considering the aerial review would likely be adversely impacted. For each impact at each site, measures that could minimize or replace the impacted habitat are identified

The PCCA's environmental precepts include a) wildlife habitat development, improvements, and replacement when modification to existing habitat is necessary and b) environmental sustainability in the development of PCCA facilities and in ongoing port operations. The PCCA's goal is to execute projects in a manner that restores resources impacted by a project, and to contribute to resource restoration as a result of project actions even if the project impacts are minimal. The PCCA's practice is to consider and incorporate BU activities where practicable in managing dredged material generated by channel projects.

Table 3.1: Channel Impacts to Gulf and Estuarine Bottom (See Sheet 2 through 4 of 23)

Channel Impacts to Waters of the U.S.		Channel Acres			Channel Impact		
Segment	**Impact**	**Toe to Toe**	**Total Including Side Slope**	**Side Slope Acreage**	**Upland Acreage**	**Seagrass Acreage**	**WOUS (Deepwater)**
New Entrance Channel Extension	Deepening from natural depth (varies -62 ft to -81 ft MLLW) to -77 ft MLLW + 2 ft adv. maint.+ 2 ft overdredge **(-81 ft MLLW)**	455.4	588.8	133.4	-	-	588.8
54-foot Authorized Entrance Channel Extension	Deepening from -56 ft MLLW to -77 ft MLLW + 2 ft adv. maint + 2 ft overdredge **(-81 ft MLLW)**	146.9	260	113.1	-	-	260
Existing Channel	Deepening from -56 ft MLLW to -77 ft MLLW +2 ft adv. maint +2 ft overdredge (-81 ft MLLW) and from -54 ft MLLW to -75 ft MLLW +2 ft adv. maint +2 ft overdredge **(-79 ft MLLW)**	518.9	734.8	215.9	2.00	0.11	732.69
Turning Basin (area outside of the existing basin footprint) and Flare	Deepen portions of the Lydia Ann Channel from between -54 ft MLLW to **-75 ft MLLW**	56.68	82.42	25.74	-	-	82.42
TOTAL		1,178	1,666	488	2.00	0.11	1,664

Table 3.2: Impacts to Mapped Aquatic Habitat (See Sheet 9 of 23)

Placement Option	Total Site Acres	Mapped Habitat									Open Water WOUS (ac.)
		Wetland					Seagrass				
		Acres	Predominant Type	Comment	Impact Review Adjustment	Est. Adverse Impact	Acres	Comment	Impact Review Adjustment	Est. Adverse Impact	
B1	80.0	-	-	-	-	-	-	-	-	-	80.0
B2	80.5	-	-	-	-	-	-	-	-	-	80.5
B3	83.8	-	-	-	-	-	-	-	-	-	83.8
B4	83.8	-	-	-	-	-	-	-	-	-	83.8
B5	83.8	-	-	-	-	-	-	-	-	-	83.8
B6	83.8	-	-	-	-	-	-	-	-	-	83.8
B7	124.0	-	-	-	-	-	-	-	-	-	124.0
B8	124.0	-	-	-	-	-	-	-	-	-	124.0
B9	124.0	-	-	-	-	-	-	-	-	-	124.0
HI-E	138.7	36.2	Estuarine and Marine Wetland	Features appear to have eroded away	-7.7	28.6	0.0	-	0.0	0.0	3.3
M3	332.6	-	-	-	-	-	17.1	Restoration of larger area to create marsh. Elevation could be suitable for seagrass establishment too.	-9.5	7.6	332.6
M4	702.6	68.9	Estuarine and Marine Wetland	Interior wetlands that would be avoided, and exterior would be integrated with through placement	-68.9	0.0	571.5	Interior acreage would not be impacted except at fringes. BU feature would protect this from further loss.	-571.5	0.0	546.3
PA9-S	329.3	-	-	-	-	-	3.1	Restoration of larger area to create uplands. In recent years aerials do not show evidence of Seagrass stands. If in existence seagrass is sparse and tenuous, most likely because of focused wave energy in the area.	-3.1	0.0	308.8
M10	769.9	-	-	-	-	-	2.5	Restoration of larger area to create marsh. Elevation could be suitable for seagrass establishment too. In recent years aerials do not show evidence of Seagrass stands. If in existence seagrass is sparse and tenuous, most likely because of focused wave energy in the area.	-2.5	0.0	752.9

Placement Option	Total Site Acres	Mapped Habitat									Open Water WOUS (ac.)
		Wetland					Seagrass				
		Acres	Predominant Type	Comment	Impact Review Adjustment	Est. Adverse Impact	Acres	Comment	Impact Review Adjustment	Est. Adverse Impact	
MI	362.2	211.7	Estuarine and Marine Wetland	Consists of entirely of unconsolidated shoreline to be restored	-211.7	0.0	-	-	-	-	262.1
NW_ODMDS	1180.4	-	-	-			-	-	-	-	1180.4
PA4	163.1	51.5	Freshwater Emergent Wetland	Identified within active PA or Feature appear to have eroded away	-51.5	0.0	0.0	Minor fringe impact. BU would protect much larger seagrass area from future losses.	0.0	0.0	3.3
PA6	269.8	143.0	Lake	Identified within active PA. Feature appears associated with earlier filling of this PA and is no longer apparent in current aerials.	-143.0	0.0	-	-	-	-	0.8
SJI	593.0	279.4	Estuarine and Marine Wetland	Consists of entirely of shoreline to be restored	-279.4	0.0	-	-	-	-	334.3
SS1	307.6	157.3	Estuarine and Marine Wetland	Would be replaced by created upland to protect seagrass area behind it from future loss	0.0	157.3	94.1	Restoration of shoreline to bolster against future erosion of much larger area of seagrass behind feature. Due to shifting uplands and erosion over recent years much of the seagrass no longer appears to be visible within aerials.	-43.3	50.8	81.4
SS2	94.8	36.5	Estuarine and Marine Wetland	Unconsolidated shoreline that eroded away during Harvey. Placement would restore protective shoreline for interior sand flats.	-36.5	0.0	-	-	-	-	-
TOTALS	**6111.7**	**984.5**				**185.9**	**688.3**			**58.5**	**4,673.9**
								Sum of all Habitat Acreage			6,346.7
									Estimated Adverse Impacts (Seagrass & Wetlands)		All Habitat
								Sum of all Impacted Mapped Habitat Acreage	244.4		4,918.2

4.0 PROJECT ALTERNATIVES FOR CHANNEL IMPROVEMENTS

4.1 Evaluation Criteria

Preliminary criteria were developed to evaluate how well initial alternatives fulfilled the purpose and need of the proposed project. The initial alternatives were screened using the following general criteria:

1) Increase Export Efficiency – Key factors that affected the ability to fully load vessels with crude oil due to constraints of the existing channel and authorized channel were considered. This included draft limitations along the CCSC segments between the Entrance Channel and Harbor Island. This criterion considered whether the alternative allowed a VLCC to move more fully loaded and whether it eliminated or reduced lightering. Lightering would be eliminated for vessels using Harbor Island and lightering would be reduced for vessels using docks at other locations within the CCSC system.

   Due to recent exponential growth in crude oil export, the Port of Corpus Christi has seen an increase in vessel tonnage. Several stakeholders' forecasts indicate that this trend will continue for a foreseeable future and beyond. As a result of PCCA's past investments in marine infrastructure and available capacity, PCCA has been capable of accommodating the recent historical shift in oil traffic from import to export. This trend is expected to continue as long as the Port's infrastructure allows it. There are concerns about future limitation to U.S. oil exports due to lack of or insufficient infrastructure capable of handling the export volumes. Lack of adequate infrastructure at U.S. ports including the Port Corpus Christi may lead to inefficient

shipping and ensuing crude price increase which may weaken the U.S.'s competitive edge (EIA 2018).

2) Ability to Serve Multiple Tenants – Part of the PCCA's mission is to meet the demand of commerce in the Coastal Bend region and throughout the world. To that end, PCCA plans its infrastructure to accommodate the needs of different stakeholders. PCCA has the ability to plan, fund, build and maintain marine infrastructures for common use such as navigation channels and dock infrastructure. PCCA owns and operates several public oil docks and bulk docks that are leased and used by different tenants. The ship channel is a common use infrastructure that is designed and operated to accommodate the different types of vessels used by PCCA's tenants. As cargo volume and vessel traffic increase, larger vessels are being used to improve shipping efficiency and reduce costs. To keep up with these trends, PCCA has undertaken several channel improvement programs. One is the dredging of the CCSC to a depth of 54-foot MLLW for which construction is imminent and will serve tenants all the way to the Inner Harbor. The other is this study to evaluate deepening up to the full depth required to accommodate fully loaded VLCCs. The terminal being planned by the PCCA at Harbor Island could be operated as a facility open for use to several users or companies, and the ability of a common use navigation channel can provide access for separate, multiple users. This criterion evaluates to what degree the alternative can benefit multiple tenants.

3) Flexibility to Accommodate Future Growth/ Expansion – This criterion considers the flexibility the alternative provides in being able to accommodate future growth in crude oil export tonnage and future growth in other sectors as well. Crude oil exports have exponentially increased in the last two years and are on pace to exceed the growth rate in 2018. Various long term projections predict much larger export tonnage if export infrastructure and the present bottlenecks in the supply chain end are improved. To that end, the ability to accommodate delivery from new crude export terminals or add capacity for exporting crude oil is important. In addition to crude oil, PCCA seeks to anticipate and be ready to accommodate all other future cargo needs and long term growth.

4) Minimize Environmental Impacts – All alternatives considered are located in the open waters of Corpus Christi Bay and the Gulf of Mexico. Therefore, environmental impacts would be limited to open water marine habitat and would primarily not involve terrestrial, wetland, or near-shore (tidal flats, beach, dunes etc.) impacts. Potential impacts to the marine environment are discussed below:

   Impact to Marine Habitats: Existing marine habitat mapping information including seagrasses, tidal wetlands, and oyster reef from TPWD, NOAA and TGLO were obtained and used to gauge the potential for impacts. As environmental marine field surveys were reviewed, preliminary site-specific habitat locations were identified. Because the channel will be constructed within the footprint of an existing channel, no new impact to undisturbed habitat would occur within that footprint. The incremental widening that may be required to maintain the recommended design slope would be minimal and would limit undisturbed habitat impacts.

   Other environmental impacts: Other environmental aspects that are considered for this criteria include potential impact of oil spills and air emissions from vessels and fuel transfer operations as described below. In conjunction with considerations of risk in criteria #5 below, potential impacts to environmental resources considers the location of major habitat resources (coastal shore, seagrass etc.), climatic (e.g. prevailing wind), and spill response factors. Impacts on air emissions considers how the alternative reduces transit and loading emissions from what would occur during lightered crude oil transfer operations.

5) Risk, Safety and Security – Safety and security are primary concerns for all vessels operating at the Port of Corpus Christi. Safety and security concerns include risk and challenges associated with oil spills and ensuing responses, fire and fire suppression activities as well as worker safety as they relate to offshore and onshore operations. Security also considers vulnerability to challenges to physical and operational security such as sabotage, and vandalism. Vulnerability to weather related events including wave height, winds and hurricanes is considered as well.

6) Ability to Contribute to Beneficial Uses – PCCA's environmental precepts include a) wildlife habitat development, improvements, and replacement when modification to existing habitat is necessary, and b) environmental sustainability in the development of port facilities and in ongoing port operations. Although this is normally in the context of executing projects in a manner that restores resources from the impacts of a project, the ability to contribute to resource restoration as a result of project actions regardless of project impact can be considered also. Continuing the practice of considering and incorporating BU where practicable in managing dredged material of its channel projects, as was done in the currently authorized -54-foot project, is desirable. The ability to do this under a given alternative is considered for this criterion.

4.2 Initial Alternatives Considered

The existing channel dimensions and the authorized channel dimensions are summarized as follows. As of July 2018, the CCSC has a dredged depth of -47 feet MLLW and plans are currently underway to dredge the channel to the authorized -54-foot MLLW depth, which would constitute the "No-Action" condition for the proposed channel deepening project. The CCSC is also planned to be extended into the Gulf of Mexico by 1.4 miles to the -56-foot MLLW contour as part of the federally-authorized project. The width of the channel varies as follows: from the current outer limit of the dredged channel (in the Gulf) to the Port Aransas jetties, the CCSC Entrance Channel is -47 feet MLLW deep with a width of 700 feet, and is authorized to -54 feet MLLW with a width of 700 feet. From the jetties to Harbor Island, the CCSC Entrance Channel is 600-feet wide. The remainder of channel to the La Quinta Junction has a width of 500 feet and is authorized to a width of 530 feet. It was against the limitation of the existing and authorized channel dimensions that initial alternative concepts were developed.

Initial alternatives considered to meet the project purpose included deepening the existing channel and offshore options that pump crude oil from onshore storage to offshore loading facilities. There are two basic types of such facilities: the simpler offshore single point mooring (SPM) buoy system, and the larger, more complex offshore platform or terminal system. An SPM system consists of onshore storage tanks (i.e. above ground storage tank farm) and pumps connected to pipelines leading offshore and terminating at an offshore buoy. The buoy is anchored to the seafloor that has floating loading hoses and mooring lines for the VLCC to hook up to and conduct loading operations. An SPM-based system can be built to provide loading abilities to a few vessels by adding SPMs, but would potentially require multiple pipelines depending on pipeline size and onshore pump capacity. An offshore platform or terminal system similarly uses onshore storage and pumps like the SPM, but the pipeline terminates into a pile-driven platform with conventional manifolds, loading arms and pipe racks, often with berths for several vessels. It is more complex and expensive than SPMs but typically provides more loading capacity. For both these options, the SPM or platform would have to be located in sufficiently deep offshore waters to account for draft, under keel and sea state. This would be between 13 or more miles offshore of Corpus Christi Bay at minimum considering the design depth. The following were the initial alternatives considered:

- **Alternative A – No Action**. No channel improvements and maintaining the channel at its existing depth. This option is equivalent to continuing with lightering and reverses lightering operations to offload and top off large vessels including VLCC's.

- **Alternative B – Channel Deepening**. This alternative consists of deepening the CCSC to -81 feet MLLW from the Gulf of Mexico to station 110+00, 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 MLLW 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 MLLW channel. As discussed in the purpose and need in Section 2.0, multiple entities including the PCCA are planning and permitting development of crude export terminals at Harbor Island. These terminals are being planned independently of this proposed deepening project. Therefore, they would be used to accommodate partially loaded VLCCs even if the deepening project were not implemented. It is assumed 2 to 3 berths would be built at PCCA's Harbor Island terminal, and two other facilities being planned, would be expected to provide between three and four more berths. Existing VLCC berth plans at Ingleside would provide three berths. Under this alternative, light-loaded VLCCs at Ingleside would top off at Harbor Island rather than lightering.

- **Alternative C – Offshore Single Point Mooring (SPM) Facility**. This alternative is an SPM-based system consisting of constructing onshore storage facilities, shore-to-SPM pipelines, and a series of SPMs to load several vessels simultaneously. Conceptually, the onshore storage could be those that would be installed in any one of the marine terminal facilities at Harbor Island or Ingleside if they were converted to offshore delivery, or it could be a new location on other undeveloped property. For purposes of the initial screening, it is assumed 3 to 4 SPMs, and the requisite onshore storage, pumps, and pipelines would be built to load 3 to 4 VLCCs. This number is in the range of facilities built in past offshore terminal projects such as the Louisiana Offshore Oil Platform (LOOP), Iraq's Al Basra Oil Terminal (ABOT), and Bulgarian/Greek Burgas-Alexandroupolis SPM facilities (Trans-Balkan Pipeline B.V.). This alternative would be located somewhere between 13 to 15 miles offshore.

- **Alternative D – Offshore Platform**. This alternative would be similar to Alternative C, except it would be constructed as an offshore platform or terminal. With a more complex system of pile-driven structures and loading arms, it is assumed that pipelines, arms, and berths to service a minimum of 4 vessels simultaneously would be constructed. A four-berth terminal was the constructed capacity of the ABOT. Similar to Alternative C, this alternative would be located in the 13 to 15 miles offshore band, and conceptually could rely on pumping from existing/planned storage either at Harbor Island or Ingleside, or a new location.

4.3 Performance of Alternatives

Alternative A (No Action) would not meet the purpose of the project, as it would neither provide for the short term need to more efficiently export crude oil, or provide the Port the capacity to respond to long term changes and future economic growth. However, it is retained only for NEPA purposes to compare action alternatives.

Alternative B (Channel Deepening) does respond to both the short term and long term aspects of the purpose. It most directly addresses the purpose by providing a channel capable of accommodating transit of fully laden VLCCs from multiple locations on Harbor Island, providing full vessel draft access

to export facilities already being planned there. It improves the efficiency of crude transport by enabling full loading of VLCCs and eliminating or reducing lightering, and provides a deeper channel that could accommodate vessels for other commodities should tenants, cargo, and shipping needs change. The existing or planned terminals would provide more loading berths than the typical size of multiple point/berth offshore options, although offshore options that match the onshore berth numbers could be built at greater cost. The capacity to accommodate growth in crude is more flexible as new tenants or terminals can be developed on remaining water frontage near the channel. Onshore loading (as would be used in Alternative B) is generally faster due to the greater flow rates of loading arms achievable at onshore berths compared to pumping 13 or more miles to SPM loading hoses under Alternative C. Pumping and loading arms under Alternative D, offshore platform can be made to provide high capacity loading. Dredging approximately 46.3 MCY would be required for Alternative B within the existing channel and proposed extension. Most of the impact would occur in already deepened channel, and approximately 588.8 acres of undredged Gulf bottom would be dredged to provide the entrance extension. Benthic impacts would be temporary and benthic communities would be expected to recover within 1-2 years. No oyster reef or wetland and very minimal seagrass (0.11 acres) would be impacted. This option would provide ample material to beneficially use in the many seagrass, and shoreline, habitat sites impacted by Hurricane Harvey and long term erosion. The option could potentially reduce more than 485,000 metric tons (MT) of CO_2 emissions by eliminating or reducing reverse lightering when annual export rate averages additional 3.5 MMBPD. This option could reduce between approximately 38 and 112 tons of oxides of nitrogen (NO_x), and between 2,200 and 9,270 tons of volatile organic compounds (VOC), both USEPA criteria pollutants, depending on whether elimination of lightering at current (approximately 1.5 VLCCs/week serviced) or potential future export rates (4 to 8 VLCCs per week) is assumed.

Offshore Alternatives C (SPM) and D (Offshore Platform) do respond to the short term need of the purpose by enabling full loading of VLCCs and partially eliminating or reducing lightering. However, they are limited in responding to the longer term needs of future economic growth and changes in port tenants and shipping needs, because they are less flexible in accommodating different grades of crude due to pump distances and flushing that could be required to switch grades. The capacity to accommodate growth in crude would require building not only more onshore storage and pumps, but new pipelines and SPMs or platforms, which would tend to be more costly and difficult to add. These options could similarly reduce CO_2, NO_x and VOC emissions through lightering elimination or reduction, as Alternative B. However, more vessel hoteling and pumping emissions would be produced due to the offshore location. In contrast to Alternative B, for Alternatives C and D, offshore operations in the Gulf would present more safety and spill risk challenges. The main concern are proximity of these operations to sensitive receptors and coastal habitats such as the Padre Island National Seashore, San Jose Island, and the associated Kemp's ridley turtle nesting grounds and Piping plover critical habitat, and greater exposure to wind and wave climate of the open Gulf, which would make spill containment more difficult. These options would also be in a location where response times would be greater, and access by unauthorized personnel would be greater, again due to distance from the onshore location, further increasing the national security risk.

A summary of the initial screening of alternatives is provided in Table 4.1.

4.4 Screening and Selection of Channel Alternatives

The project alternatives were assessed using the screening criteria of increasing export efficiency, serving multiple tenants, accommodating future growth and expansion, and minimizing environmental impacts. The alternatives were compared with respect to their ability to meet the project need and purpose. Following the screening of possible action alternatives, the PCCA identified the No Action and the proposed channel deepening to Harbor Island as the alternatives to be evaluated for this project. The channel deepening project alternative would be completed primarily within the footprint of the existing CCSC, maintaining the same channel bottom width and necessitating only minor incidental

widening to maintain the required side slopes. The proposed channel deepening alternative would meet the purpose and need of the project compared to the No Action alternative, as described below.

No Action Alternative: No channel improvements would be constructed and the existing channel would be maintained at its width and depth following the completion of the ongoing -54-foot deepening project. This alternative would not meet the need and purpose of the proposed project, as it would neither provide for the short-term need to more efficiently export crude oil, or provide the PCCA the capacity to respond to long-term changes and future economic growth. The No Action alternative is retained for comparison against the proposed action alternative.

Channel Deepening to Harbor Island: The action alternative would be the deepening of the CCSC to a depth of -81 feet MLLW (-77 feet MLLW plus two feet of advanced maintenance and two foot of allowable overdredge) from the Gulf of Mexico to Harbor Island. This alternative would meet the project need and purpose by providing a channel with the capability to accommodate transit of fully laden VLCCs from multiple locations on Harbor Island, supporting the efficient export of crude products from the Port through the elimination or reduction of reverse lightering operations. The channel deepening is proposed to be constructed primarily within the footprint of the existing CCSC. The incremental widening expected to be required to maintain the recommended design slope would be minor, and impacts to undisturbed habitat in the Gulf of Mexico would be limited.

Table 4.1: Alternative Performance

Screening Criteria	OPTIONS			
	Alternative A No Action	**Alternative B Channel Deepening Project**	**Alternative C Offshore SPM Facility**	**Alternative D Offshore Platform**
1) Increase Export Efficiency	• No increase in export efficiency. Inefficient lightering process, involving more vessel calls, transit, and longer VLCC loading process will still occur • Would involve light-loaded VLCC transit on lower 3rd of CCSC • Increase in congestion with future growth from more lightering vessels	• Lightering can be eliminated or reduced, decreasing vessel traffic and shortening the duration of VLCC loading process • Would still require VLCC transit on lower 3rd of CCSC, but elimination or reduction of lightering transit would free up channel availability for future growth. • Multiple tenant accommodation discussed below would allow more fully loaded VLCC participation, increasing efficiency for more exporters	• Lightering can be eliminated or reduced, thereby reducing vessels involved and shorten VLCC loading process • Would eliminate VLCC transit. • Exporting participants would be more limited than channel option, and exporting nonparticipants who couldn't fully load VLCCs would resort to smaller vessels or lightered VLCCs, leaving this congestion component in place as growth occurs. See multiple tenant and future growth discussion below.	• Same as SPM for all attributes except where noted
2) Ability to Serve Multiple Tenants	• No Change	• Port can operate VLCC berths as public docks, servicing multiple tenants and shipping lines, encouraging healthy competition and raising revenue for the Port and local communities. • Centralized and integrated land use planning of developable land assets at Harbor Island. • Loading of different grades from onshore terminals would be easier compared to offshore options	• Difficult to plan multiple offshore SPMs connected individually to individual tank farms. • Accommodating different grades from different customers would be more cumbersome, requiring flushing of longer lengths of line to switch grades, compared to onshore terminals.	• Same as SPM for all attributes except where noted
3) Ability to Accommodate Future	• No accommodation of future growth • Vessel draft limitations	• Local and regional economy is enhanced as revenues are collected for ships calling at	• Multiple single SPMs may need to be planned by the industry. Multiple permits	• Same as SPM for all attributes except where noted • Expansion of platform to add

Screening Criteria	OPTIONS			
	Alternative A No Action	**Alternative B Channel Deepening Project**	**Alternative C Offshore SPM Facility**	**Alternative D Offshore Platform**
Growth/Expansion	• Increased vessel traffic due to large increase in reverse lightening	and products moving through the PCCA. • Efficient use of capital to achieve growth and meet overall crude export forecast for the nation • Allows for future growth within the PCCA under a single permitting process for deepening the channel	required for each individual project. • Future expansion of offshore SPM facility more difficult to accommodate new users. Limited users can access the facility at any one time due to complex financing and project development challenges.	more users even more difficult and costly than SPM
4) Environmental Impact	• No habitat impact • Increase in air emissions due to increase from reverse lightering activities. • CO_2 emissions would be greater than other options due to continuing lightering activities	• Construction largely being undertaken within existing channel limits. • New entrance channel extension would temporarily disturb 770.3 acres of 60-ft deep Gulf bottom, convert it to deeper bottom, but benthos would recolonize within a year, and water column would remain. Amount of conversion to deeper bottom would be insignificant compared to available Gulf Habitat. • Dredged material will be evaluated for beneficial use and building resilient community. • Potential to reduce more than 485,000 MT of CO_2 emissions by eliminating or reducing reverse lightering when annual export rate averages additional 3.5 MMBPD.	• Puts active loading facility and new pipelines in previously undisturbed part of Gulf of Mexico. • Permanent but negligible size (compared to available Gulf Habitat) of conversion of Gulf bottom and water column to SPM platform • No potential beneficial use of dredged material • Similar potential to reduce CO_2, NOx, and VOC from eliminating or reducing lightering vessel emissions. • Spillages are more likely to happen and not as easily confined or cleaned up. • Potential for higher vapor emissions and higher CO_2 emissions from vessels hoteling due to reduced loading rates. • Tugs needed for hose tending and VLCC	• Same as SPM for all attributes except where noted • Permanent but negligible size of conversion of Gulf bottom and water column to SPM platform – larger than SPM, but still negligible

Screening Criteria	OPTIONS			
	Alternative A No Action	**Alternative B Channel Deepening Project**	**Alternative C Offshore SPM Facility**	**Alternative D Offshore Platform**
		• Potential to eliminate 38-112 tons annual NOx and 2,200- 9,270 tons of VOC from elimination of some lightering activity • Enables faster loading rates than SPM, reducing CO_2 emissions from hoteling vessels. • Ability to provide vapor recovery system and shore power to operate vessel systems for reduced emissions.	positioning during loading will have to transit over 30 miles (assuming support facilities are home based at Port Aransas) from the CCSC to service the platform increasing air emissions generated. • No technically feasible method for providing vapor recovery of vapour combustion systems for reducing emissions.	
5) Risk, Safety and Security	• More vessels in Harbor will make monitoring harder	• Severity of accidental spills would be reduced compared to offshore options as facilities and vessels are in a more controlled Port environment. • Environmental accidents better controlled at onshore facilities in protected waters. • Comprehensive spill response would be quicker than offshore options due to proximity to response resources • Incidents at onshore terminal can be more easily contained to avoid affecting other users. • Risk of in-channel vessel incident or allision present, but would be reduced greatly by slow vessel speed, multiple tug assist, and one way transit when bringing VLCCs in the	• Damage to subsea pipelines or the platform will render the facility unusable until repaired. • Environmental conditions such as high winds, high waves, and strong currents can be designed for, however potential is there for conditions that could restrict use of the facility. • Avoids potential for in-channel vessel incident, but trades it for more risk of pipeline failures due to miles of multiple necessary pipelines. • Comprehensive spill response times to address environmental accidents longer compared to onshore terminals	• Same as SPM for all attributes except where noted

Screening Criteria	OPTIONS			
	Alternative A No Action	Alternative B Channel Deepening Project	Alternative C Offshore SPM Facility	Alternative D Offshore Platform
		Port. • Loading spill incident would be closer to Redfish Bay seagrass and marsh areas, but would not significantly expose National Seashore or San Jose Island beaches to impact – Prevailing SE winds directed towards terminal shore which would help containment – Tidal transport may vary however • Strong security presence within the port environment to protect against deliberate damage and sabotage.	• Loading spill incident would not significantly expose Redfish Bay seagrass and marsh areas to impact, but an offshore facility may be potentially expose National Seashore or San Jose Island beaches to impact depending on the location – Prevailing SE winds directed towards beaches which would hamper containment • More accessible by non-authorized persons; can lead to accidental damage, deliberate damage and sabotage. • Higher risk to human safety with offshore operations. • Response time to the facility by emergency services will be greater and more costly due to offshore location.	
6) Ability to Contribute to BU	• Beneficial use occurring under the -54 foot project would continue. As before, since there would be no change in dredging or other actions that could contribute.	• New work dredging would provide 46.3 MCY of varying sandy, clayey and some silty material some of which could be used for ecological or construction BU. Channel maintenance material could also be used long term for future BU such as restoring subsided or submerged marsh.	• Would require virtually no dredging, and therefore would not provide material that could be used to construct BU features.	• Would require virtually no dredging, and therefore would not provide material that could be used to construct BU features.

5.0 ATTEMPTS TO AVOID JURISDICTIONAL AREAS AND MINIMIZE WATER QUALITY IMPACTS

The proposed project would require the dredging of earthen material from the existing CCSC and from the bottom of the Gulf of Mexico to create a channel of sufficient depth to allow for the operation of VLCCs. Because the purpose of the proposed project is to deepen the current CCSC to reduce navigation inefficiencies associated with the current channel, the proposed channel improvements must occur in navigable waters of the U.S. Alternatives to achieve the need and purpose of the proposed project that would avoid jurisdictional waters of the U.S. are not available.

The proposed channel deepening activities represent the minimum impact to the Gulf of Mexico and Corpus Christi Bay to achieve the proposed project objective of increasing navigational efficiency of the CCSC. The proposed project alternative is the least environmentally damaging practicable alternative. This alternative meets the proposed project need and purpose with the least impact to the Gulf of Mexico and Corpus Christi Bay environments. The proposed depth and channel dimensions were optimized by taking several factors into consideration. First, world fleet registry data from IHS Fairplay was used to analyze and identify the appropriate target vessel dimensions (including draft) from the variation in size among the VLCC fleet to identify the majority of vessels expected rather than the maximum possible. Second, the fully loaded draft for the design vessel was calculated assuming the American Petroleum Institute gravity for West Texas Intermediate (WTI) crude oil, which will be the predominant controlling grade of crude oil exported from the Port of Corpus Christi. This was done in lieu of assuming the largest VLCC carrying the heaviest crude oil possible for this Port (heavy sour). Appropriate under keel clearance in consideration of sea state and climatic factors and guiding navigation standards (USACE and World Association for Waterborne Transport Infrastructure [PIANC]) was added. Ship simulation was accomplished in December 2018 at the Maritime Institute of Technology and Graduate Studies (MITAGS) to verify the depths and under keel clearances were navigable under a range of conditions. Therefore, the depth of the proposed deepening has been optimized. Another factor that will be considered under 33 U.S.C. Section 408 approval and coordination with USACE Operations is to use the steepest channel side slopes and narrowest bottom width allowable for one way passage. December 2018 ship simulation at MITAGS also examined alternate channel bottom widths for one way VLCC transit. This is also being coordinated with the USACE for acceptability under 33 U.S.C. Section 408 approval. If approved and possible, steeper side slopes and narrower bottom widths will be planned for implementation.

Dredged material generated from the project is proposed to be placed within an ODMDS adjacent to the CCSC, and, for material judged by the project engineer to be suitable, would be placed in several locations along the coast and within Corpus Christi and Redfish Bays for BU. The new work and maintenance dredged material from the proposed project would be placed in an environmentally acceptable and economically feasible manner, considering technical and logistical feasibility. The section below describes the process of the identification and evaluation of the dredged material placement alternatives that meet these requirements and represent the least environmentally damaging practicable placement alternative(s).

5.1 Initial Placement Alternatives Considered

To help meet the planning objective of identifying practicable dredged material placement that considered engineering, economics and the environment, initial alternatives ranging from use of existing PAs and surrounding uplands, to potential BU concepts were considered.

5.1.1 New Terrestrial Sites

New terrestrial sites are more constrained by available contiguous land and parcel size, easement and access across roads, properties etc. needed for hydraulic pipelines. Near Harbor Island, surrounding uplands are limited, as they consist of Mustang Island and San Jose Island. Mustang Island has no sizable contiguous tracts within 10 miles that are not developed or are not natural barrier island, State or National refuge/parks, or aquatic habitat. The preponderance of tracts is small waterfront parcels. San Jose Island is a privately owned island that is almost entirely undeveloped natural barrier island and beach. Along with the planned crude terminal, Martin Midstream, and Gulf Copper are located on Harbor Island at the channel entrance which leave no available tracts for placement of dredged material. Therefore, BU and offshore placement in this vicinity was planned.

The next nearest mainland with larger tracts of land is Ingleside, 8 miles farther in, where several crude oil export facilities are being planned on the land nearest water. Flint Hills Resources, OXY Ingleside Energy Center, Kiewit Offshore, Chemours, Oxychem, Ingleside Ethylene, Cheniere, and Voestalpine Texas are existing facilities located along Ingleside. These limit upland placement options, and options to use material beneficially would be cost competitive due to the distance. New upland sites at farther distances would be less cost effective due to farther distances required to reach sizable contiguous tracts of land, could involve impacts to terrestrial wetlands, would require new property purchases, and routing and burial of temporary hydraulic pipelines across existing roads and properties. Depending on land elevation, pumping hydraulic pressure head limitations could be reached, which would force less cost effective transport by truck. These factors would complicate the usability and viability of terrestrial sites.

5.1.2 Initial Concepts

Therefore, initial planning efforts focused on existing PAs and potential BU, as new upland placement opportunities were limited. Initial BU concepts were generated by considering existing agency restoration plans such as TGLO's Texas Coastal Resiliency Master Plan, recent storm damage caused by Hurricane Harvey, and BU features implemented elsewhere on the Gulf Coast. Since the proposed action consists entirely of dredging the CCSC, practical limitations associated with placement of dredged material were a primary constraint. For dredged material placement, distance over which material must be pumped or transported by scow, required water depths for hopper or scow use, and access to stage and route hydraulic pipelines, all constrain where cost effective dredged material placement can be achieved. For hydraulic dredging, most cost effective dredging occurs within 5 miles, requiring one to multiple booster pumps beyond this distance which rapidly diminishes the cost effectiveness. An initial cost effectiveness limit of 10 miles was considered. Use of hoppers and scows can achieve placement over greater distances, but this is primarily in water and requires minimum depths for vessel draft. These technological constraints factored in planning dredged material placement. The major component of dredging driving placement capacity needed is the new work dredging to construct the Proposed Action. Initial planning focused on accommodating projected new work dredging volumes.

To help, further develop dredged material placement that considered environmental impact and BU opportunities, the Applicant conducted an initial agency coordination meeting held in Corpus Christi Texas on September 21, 2018 to obtain the input of Federal, State and local resource agencies including the USACE Galveston District. Representatives from the following agencies participated in the meeting and provided input on the initial planned PA use and preliminary BUs concepts presented during the meeting:

- University of Texas Marine Science Institute (UTMSI)
- UTMSI/Mission-Aransas National Estuarine Research Reserve
- Coastal Bend Bays and Estuaries Program
- Texas Parks and Wildlife Department (TPWD)
- Texas General Land Office
- Natural Resources Conservation Services
- U.S. Army Corps of Engineers (USACE)
- U.S. Environmental Protection Agency (USEPA) Region 6
- U.S. Fish and Wildlife Service (USFWS)
- Texas Department of Transportation

At the time that initial placement alternatives were originally conceived, only the new work quantities generated from the proposed project were considered to devise placement concepts. Figure 5.1, shown below, depicts the initial concepts presented during the agency coordination meeting. These concepts represented general categories of placement alternatives and the general vicinity where they would be located. Agency input generated a few more smaller initiatives, but did not result in major new BU sites being identified. However some concepts were reinforced and better defined based on discussions with agency representatives about site specific information and their knowledge of the ecosystem of Corpus Christi and Redfish Bays. These concepts were then analyzed in consideration of agency feedback, further conceptual development and volumetric analysis, and more research on constraints and impacts. The initial evaluation considered cost, existing technology, and logistics in light of the navigation purpose of the Proposed Action. Inherent in cost and existing technology was consideration of the aforementioned dredging method constraints, and inherent in logistics was consideration of needed placement capacities. The following synopsizes the initial concepts, evaluation, and initial screening.

5.1.2.1 Existing PAs for the Current Federally-authorized CCSCIP

The Applicant is the Non-Federal Sponsor for the authorized Federal project, and is therefore aware of commitments and long-term capacity of existing upland PAs required for the authorized project. The following uses for existing PAs were considered

- Use of existing capacity – Most of the existing PA capacity is dedicated to accommodating the new work dredging and 50-year maintenance of the Federally-authorized -54 foot project. Due to lack of uncommitted capacity, only two existing PAs were identified for use: PA4 and PA6

- Expansion of existing PA – M3, M9, and M10 expand existing PAs by using dredged material beneficially. M3 would convert featureless bay bottom to approximately 330 acres of estuarine/aquatic habitat behind Pelican Island. M9 and M10 would convert featureless bay bottom to approximately 329 and 770 acres of estuarine/aquatic habitat behind PA9 and PA10, respectively.

5.1.2.2 Existing 54 foot project BU sites

Existing BU sites were examined for inclusion where possible. According to PCCA, only a handful of sites were available while others lack capacity especially with priority and consideration given to the placement needs for the CCSCIP which is expected to be constructed over the next three years. Therefore, focus was shifted to expanded existing sites by adding adjacent estuarine/aquatic habitat features or dike raisings. Open-water, unconfined BU sites were avoided completely.

5.1.2.3 Bird Islands

Rookery islands or bird islands serve as nesting, breeding, foraging and rearing areas for birds because they are isolated from the mainland and are too small to sustain populations of predators. Dredged material is often used beneficially to construct or restore bird islands.

A recent study identified several existing or new bird islands in Aransas and Nueces counties. However, most were too small in regards to capacity or sited too far (more than 15 miles away) from the project to make construction economically feasible especially with the revised project footprint. The few options that were within the preferred pumping distance were surrounded by seagrass.

5.1.2.4 Oyster Pads

Beneficially using dredged material as the pad to restore or create new for oyster reef was considered during initial planning. As identified in the TGLO's Texas Coastal Resiliency Master Plan, this option would provide vertical relief need for the restoration of oyster reefs. However, agency feedback indicated that the salinity in the area was not optimal for recruiting or supporting oyster growth.

5.1.2.5 Marsh Restoration at Mustang Island

Marsh restoration opportunities along the bayside of Mustang Island were examined during early planning. However, the area is too far away from the project to make construction economically feasible. Additionally, public feedback during open houses held in September 2018 indicated concerns regarding impacts to existing, established marsh habitat during construction.

5.1.2.6 13A New BU Site

Creating a BU feature similar to existing BU 6 was contemplated adjacent to the existing PA13. This became a less favorable option due to distance. It was reconfigured in the second stage of placement plan development as a contingency upland extension to PA13.

5.1.2.7 New Work ODMDS

Use of the portion of this site for new work placement that is not being used by the -54 foot Federal Project was proposed. This site is a dispersive site, and Multiple Dump Fate (MDFATE) modeling was conducted to analyze the capacity for project use.

5.1.2.8 San Jose and Mustang Island Feeder Berms or Shoreline Repair

The project team reviewed recent aerials and LiDAR data on San Jose Island to determine that there was a substantial amount of repair for dune breaches and foreshore erosion. Similarly, the Texas General Land Office (TGLO) identified areas of both Mustang and San Jose Islands that have experienced historical receding at the rate of 2 feet or more per year. The large amount of sand that would be produced by the project could be used to repair or indirectly nourish these islands

5.1.3 Screening of Initial Concepts

Table 5.1 provides a summary of the screening of initial concepts. Some of these placement options have since been eliminated from further evaluation because of a change in project scope. The preferred alternative was determined to be deepening the channel to Harbor Island, a shorter reach, which requires less PAs. As a result some of the concepts identified during the agency coordination

meeting were also eliminated from further consideration. However, some of these were reconceived as different BU initiatives, such as expansion of existing PA and BU sites.

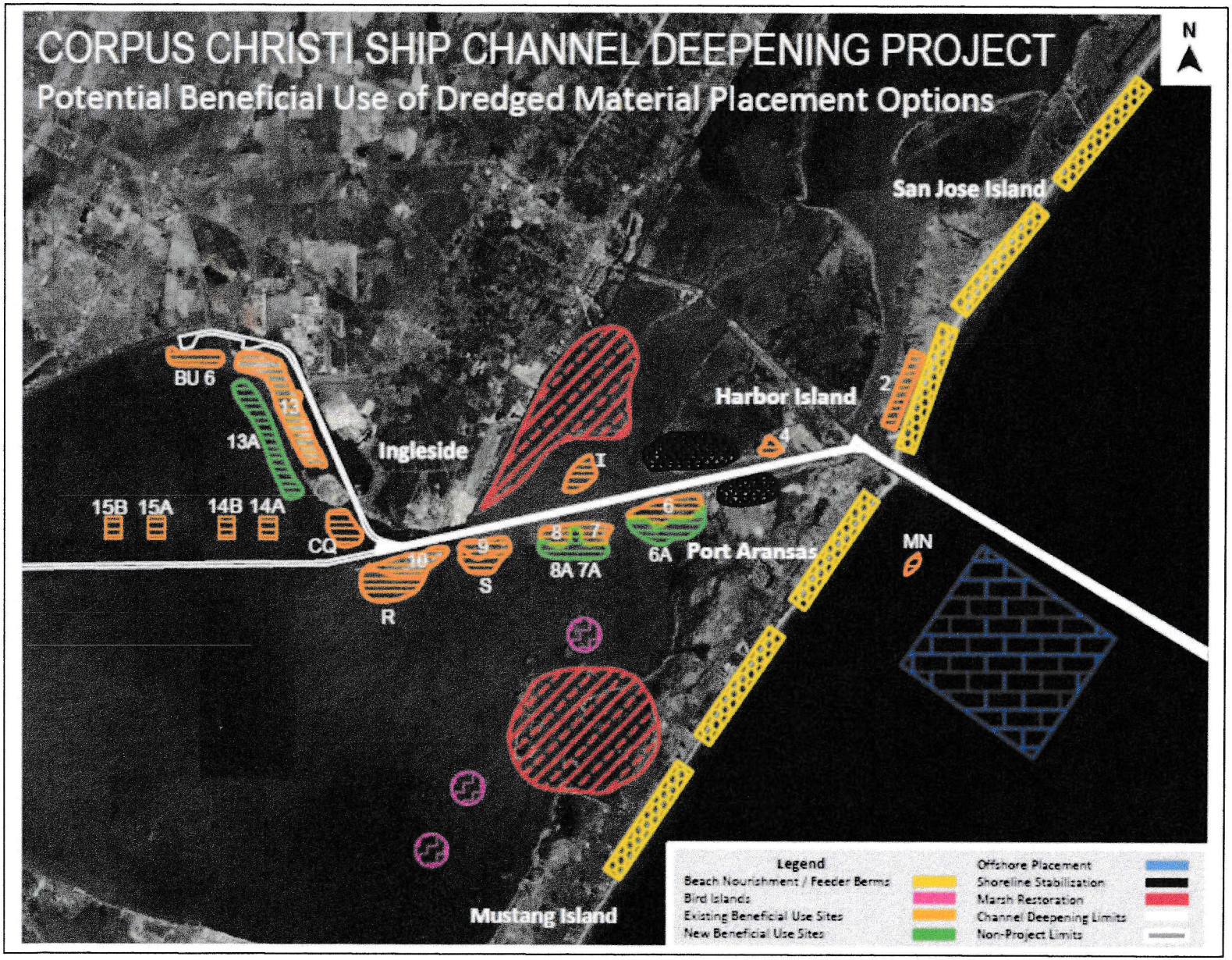

Figure 5.1: Initial Dredged Material Placement Concepts

Table 5.1: Initial Placement Area Screening

Concept	Logistics	Technology	Cost	Determination
New Terrestrial Upland Site	Too many issues involving infrastructure, distance, limited parcel size and availability	Pump distance and potential pumping constraints further inland	Logistics factors could make it costly to implement.	Eliminated
Existing PAs for the Current Federally-authorized -54 foot MLLW project	Limited available placement capacity	Feasible	Would be cost effective, but no capacity.	Eliminated for existing, but reconceived for expansion.
Existing 54 foot project BU sites	Limited available placement capacity	Feasible	Would be cost effective, but limited capacity.	Eliminated for existing, but reconceived for expansion.
Bird Islands	12 acre site size criteria limits capacity to place	Feasible	Would likely have higher unit implementation cost due to small size	Eliminated due to distance, and limited capacity
Oyster Pads	Distance from Harbor Island would be far.	Salinity in the area not optimal	Rock for cultch recruitment surface could be a major expense	Eliminated
Marsh Restoration at Mustang Island	Public concerns about impacting existing habitat	Feasible	Could be cost feasible	Eliminated
13A new BU Site	Distance from Harbor Island is far.	Feasible	Distance would make it more costly	Eliminated
NW ODMDS	Channel adjacent. Good option.	Feasible	Near channel. Minimal construction. Would be cost effective	Advanced
San Jose and Mustang Island Feeder Berms and Shoreline Repair	Channel adjacent. Good option.	Feasible	Near channel. Minimal construction. Would be cost effective	Advanced

5.2 Placement Alternatives Evaluated Further

The initial alternatives that were advanced or reconceived were refined. Given the large amount of materials that could be beneficially used, especially the large volume of sand in one the of the channel segments, and proximity of some of the desirable BU options, it became clear, a mix of existing offshore, expansion of existing BU sites and the Gulf side BU initiatives would be a viable, cost effective approach. Of 13 initiatives further refined, 11 were BU features that aimed to achieve a variety of shoreline restoration, land loss restoration, marsh cell expansion, and Gulf-side shoreline initiatives. The following alternatives were developed.

- M3 – Creation of an estuarine/aquatic habitat extension at Pelican Island. This would bring the elevation of an extension at this BU site to an elevation suitable to restore either marsh or seagrass.

- M4 – Restoring historic land and marsh loss at Dagger Island. This is an ecosystem restoration measure included in USACE's Coastal Texas study and the TGLO Coastal Resiliency Master Plan. Design of project elements will be coordinated to support TPWD's existing permit for this project.

- PA9-S – This option will extend the upland placement of dredged material behind PA9. This area was originally identified as Site R in the CCSCIP for the creation of shallow water habitat, but current projections from the PCCA are that there will not be enough material from that project to create that site.

- M10 – Creation of an estuarine/aquatic extension behind PA10. This would bring the elevation of an extension at this BU site to an elevation suitable to restore either marsh or seagrass.

- PA6 – Raising levees on PA6, after the CCSC CIP one time use, by 5 feet and filling it with 4 feet of new work material at the existing PA6 location.

- SS1 – Restoring eroded shoreline to a higher elevation than what was previous to prevent future land breaches as a result of storm events, the restored feature will be armored to protect the very large seagrass area behind Harbor Island.

- SS2 – Restoring shoreline washouts along the Port Aransas Nature Preserve/Charlie's Pasture as a result of Hurricane Harvey. Piping plover sand flat critical habitat located behind this breach would be protected again. Design of project elements will be coordinated with TGLO's restoration efforts for this area.

- PA4 – Reestablish eroded shoreline and land loss in front of PA4. The shoreline has undergone major erosion over the last few decades, and if it continues, would eventually expose the Harbor Island seagrass area to erosion and loss.

- SJI – Dune & shore restoration at San Jose Island using new work sands to repair severe damage caused by Hurricane Harvey.

- NW ODMDS – Placement in New Work ODMDS (Homeport).

- B1-B9 – Feeder berms offshore of SJI and Mustang Island that would be located within the active transport zone in front of the depth of closure, and indirectly nourish these barrier islands.

- HI-E – Restore eroded bluff at the junction of the CCSC, Aransas Channel and Lydia Ann Channel and will be armored to prevent future erosion. The bluff will be restored to its historic shape and

new work material will be placed behind the bluff with a levee raise around the site. According to USGS historical topographic maps for Port Aransas, Texas, SE/4 Aransas Pass 15' Quadrangle, this site appears to have been created from Aransas Channel spoils around 1967-1968.

- MI – Mustang Island beach nourishment, this feature is intended to directly place new work sands to enhance the shoreline from the south CCSC jetty five (5) miles along the Gulf side of Mustang Island.

5.3 Applicant's Proposed Placement Plan

All the proposed options would be viable due to proximity, material volume capacity, and need for material to achieve ecological restoration. The large volume of sands indicates that material placement would be better used for BU restoration of important coastal resources that were damaged by Hurricane Harvey and experience continuing erosion. The availability of other new work material such as clays could opportunely be used to stem land losses that would expose sensitive habitats to continual erosion. These materials would be better used in these initiatives than in upland placement that avoids the marine environment and provides no benefit. All options were selected, with M9 and M10 providing extra capacities as a contingency for unavailability of SJI. Therefore, more capacity was identified to provide flexibility in the plan. Table 5.1 lists the selected placement plan elements.

Table 5.2: Selected New Work Placement Plan (See Sheet 9 of 23)

Placement Option	Description	Placement Capacity (CY)	Proximity to New Work Dredging Operations	Provides Environmental Benefit
M3	Estuarine/aquatic habitat creation adjacent to Pelican Island	3,798,000	Located approximately 6 miles from Harbor Island	This option will convert featureless bay bottom to approximately 300 acres of estuarine/aquatic habitat.
M4	Restoring historic land and marsh loss at Dagger Island	867,000	Located approximately 7 miles from Harbor Island	This option will restore eroding marsh habitat for native shorebirds and coastal wildlife. Design of project elements will be coordinated to support TPWD's existing permitted project.
PA9-S	Upland Placement Site Expansion behind PA9	9,000,000	Located approximately 8 miles from Harbor Island	This option does not restore aquatic habitat, it will convert featureless bay bottom to upland.
M10	Estuarine/aquatic habitat creation adjacent to PA10	10,933,600	Located approximately 10 miles from Harbor Island	This option will convert featureless bay bottom to approximately 770 acres of estuarine/aquatic habitat.
PA6	5 foot levee raise and fill	1,796,400	Located approximately 4 miles from Harbor Island	This option does not create any environmental benefit.
SS1	Restoring eroded and washed out shoreline	4,800,000	Located approximately 3 miles from Harbor Island	This option restores an eroded shoreline landmass and provides protection to Harbor Island Seagrass area.
SS2	Restore shoreline washouts along Port Aransas Nature Preserve as a result of Hurricane Harvey	669,700	Located approximately 2 miles from Harbor Island	Shoreline restoration that fills in the washouts caused by Hurricane Harvey that protects Piping Plover critical sand flat habitat.
PA4	Reestablish eroded shoreline and land loss in front of PA4	3,020,000	Located approximately 2 miles from Harbor Island	This option provides protection to Harbor Island seagrass area.
HI-E	Bluff and Shoreline restoration with site fill	1,825,000	Located less than 1 mile from Harbor Island	This option restores an eroding bluff and shoreline to its historic profile.
SJI	Dune and beach restoration San Jose Island	4,000,000	Located directly next to Channel Dredging Operations	This option restores several miles of beach profile that was washed away as a result of Hurricane Harvey.
NW ODMDS	Place on New Work ODMDS (Homeport)	13,800,000	Located directly next to Channel Dredging Operations	This option does not create any environmental benefit.
B1-B9	Feeder berms offshore of SJI and Mustang Island	8,100,000	Located less than 10 miles from Channel Dredging Operations	This option will nourish beach shoreline by natural sediment transport processes.
MI	Beach Nourishment for Gulf side of Mustang Island	2,000,000	Located directly next to Channel Dredging Operations	This option will nourish beach shoreline by direct sediment placement.
Scenarios for new work placement capacity provided and needed.		64,609,700	Total Capacity Provided	
		60,609,700	Total capacity less SJI (should that option become unavailable)	
		46,283,590	Total NW placement capacity required for Channel Preferred Alternative – Base Option	
		14,326,110	Additional Capacity less SJI (should that option become unavailable)	

6.0 SUMMARY OF PROPOSED PROJECT IMPACTS AND MITIGATION FOR AQUATIC HABITATS

As shown in Table 5.2, the majority of placement options involves BU to restore aquatic habitat or protect impacted resources, and would overall benefit seagrass, estuarine/aquatic habitats, and coastal habitats. The options that indicate estuarine or aquatic habitat restoration (M3 and M10) would be targeted to restore either tidal marsh or seagrasses, dependent on further agency input and final project impact offset needs. At similar elevation to tidal marsh, portions of the site could be left unvegetated and configured to restore sand or mudflat habitats. The remaining impacts to seagrass or wetlands provided in Table 3.2 would be offset by reconfiguring these sites to be able to host the impacted habitat. Placement would be configured to provide the elevations needed conducive to successful planting or recruitment of either tidal marsh or seagrass vegetation species. As an example, at M3, part of the impacted seagrass could be offset by dedicating part of the created habitat to seagrass colonization, since planned elevations would be conducive to recruitment and establishment. Table 6.1 below provides a summary of the proposed new work placement in terms of the impact and the restoration provided. As shown, the proposed restoration of approximately 1,100 acres of aquatic habitat would exceed the actual adverse impacts of approximately 244 acres of special aquatic sites. PCCA proposes to use this restoration to offset these impacts, with the amount of the proposed acreage required to offset the impacts to be determined in consultation with the USACE. Placement volumes for these features have been initially determined assuming tidal marsh elevation. However, the DMMP has enough flexibility in the placement capacity to allow variation of the needed elevations of M3 and M10 to be configured as either habitat as necessary without constraining the overall needed placement. The table also provides an estimate of the acreage of mapped special aquatic sites that would be directly protected by features proposing to restore or bolster eroding shoreline features. This was estimated using geospatial data, using estimates of the mapped acreage directly behind the restored feature. As shown, large areas behind these features would be subject to more wind, wave, tidal flow, and vessel wake erosion from eroded land and shoreline.

7.0 CONCLUSION

The PCCA understands that discharges into waters of the United States should not occur unless it can be shown that the discharge would not result in an unacceptable adverse impact on the aquatic ecosystem. It is also understood that if there is a practicable alternative to the discharge, the discharge should not occur. A practicable alternative is not available that would meet the proposed project requirements and achieve the project purpose. The proposed project would increase crude oil export efficiency for the Nation, reducing trade deficits, and fostering economic development. The result of the proposed action would be a more efficient channel to export crude oil. The proposed project meets the project purpose and need. The placement alternatives were developed in coordination with resource agencies, and considered public input during open house meetings at the start of the project. The resultant proposed placement alternatives make extensive use of BU to address ecological restoration needs that agencies desire. The volume of material and volume of sands are valuable assets, and the dredging and placement presents a unique and major opportunity to address restoration needs in this estuary and barrier island system.

Table 6.1: Summary of Project Impacts and Proposed Restoration

Placement Option	Description	Restoration Action	Acres				Comments
			Proposed Restoration Seagrass or Marsh	Adverse Impacts to Special Aquatic Sites (SAS)	SAS Protected	Conversion of Open Water to Upland	
HI-E	Estuarine/Marine Wetland	Restoring protective uplands and armored bluff for protection of significant seagrass acreage which lies behind	0.0	28.6	264.4	3.3	Predominantly unconsolidated shore impacted Predominantly Estuarine and Marine Wetland protected
M3	Estuarine/aquatic habitat creation adjacent to Pelican Island	Convert featureless bay bottom to approximately 330 acres of estuarine/aquatic habitat.	330.0	7.6			Seagrass impacted
M4	Restoring historic land and marsh loss at Dagger Island	Restore eroding marsh habitat for native shorebirds and coastal wildlife. Design elements will be coordinated to support TPWD's existing permitted project.		0.0	615.4		Predominantly seagrass protected
PA9-S	Upland placement expansion converting 309 acres of bay bottom to upland, adjacent to PA9.	none		0.0		308.8	
M10	Estuarine/aquatic habitat creation adjacent to PA10	Convert featureless bay bottom to approximately 770 acres of estuarine/aquatic habitat.	770.0	0.0			
MI	Mustang Island Beach Nourishment	Nourishment creating 250 ft of aerial beach, utilizing » 2,000,000 CY of sand as storm surge and wave attenuation		0.0			
SS1	Restoring eroded shoreline and armoring to protect Harbor Island seagrass area	Restore eroding shoreline to its historic profile. Protects Harbor Island seagrass area	0.0	208.1	1,552.1		Predominantly unconsolidated shore impacted Predominantly seagrass protected

Placement Option	Description	Restoration Action	Acres				Comments
			Proposed Restoration Seagrass or Marsh	Adverse Impacts to Special Aquatic Sites (SAS)	SAS Protected	Conversion of Open Water to Upland	
SS2	Restore shoreline washout along Port Aransas Nature Preserve as a result of Hurricane Harvey	Restores two washouts of shoreline along the Port Aransas Nature Preserve as a result of Hurricane Harvey.	0.0	0.0	333.0		Predominantly Estuarine and Marine Wetland (sand flats) protected
PA4	Reestablish eroded shoreline and land loss behind PA4	Restores historically eroding shoreline and land protecting Harbor Island seagrass area.	0.0	0.0	750.6	3.3	Predominantly seagrass protected
PA6	Dike raise	none	0.0	0.0			
SJI	Dune & shore restoration San Jose Island	Restore several miles of beach profile washed away as a result of Hurricane Harvey.		0.0			
NW ODMDS	Place on part of New Work ODMDS	none		0.0			
B1-B9	Feeder berms offshore of SJI and Mustang Island	Nourish beach shoreline by natural sediment transport processes.		0.0			
		TOTAL	1,100.0	244.3	3,515.6		