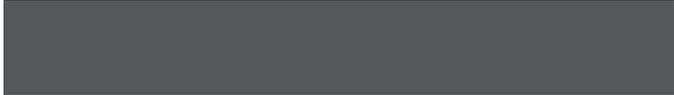




# Technical Memorandum

## Marina Dredging (South Basin) and McGee Beach Nourishment (E14048)

Corpus Christi, Texas  
December 21, 2016



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## Executive Summary

The City of Corpus Christi is considering dredging the South Basin of the Corpus Christi Marina, with the possibility of using the dredged material as a beach nourishment at McGee Beach. The proposed dredging would seek to improve access within the South Basin adjacent to the new “R Pier” and boat yard south of Coopers Alley L-Head. The dredging would also seek to improve maneuverability for sailboats during races that are frequently held in the marina.

Based on a preliminary site conditions assessment which included a bathymetric survey, a magnetometer survey, and reconnaissance-level bottom probing within the South Basin, the area in need of dredging for navigation improvements is unlikely to yield beach-quality sand. However, other areas within the South Basin may contain beach-quality material pending results of a more detailed geotechnical investigation and analytical testing (chemical screening). Therefore, to address both of the project goals (i.e., beach nourishment and navigation improvements), the technical feasibility, permitting requirements, and cost of two alternative dredging options were considered, as follows:

- Alternative 1 – Dredging for Beach Nourishment: Dredge sandy material as a dedicated beach nourishment project without targeting navigation improvements.
- Alternative 2 – Dredging for Navigation Improvements: Dredge non-beach-quality material adjacent to the L-Head and R Pier to improve navigation within the marina. This material would need to be disposed offsite, likely within an upland placement area.

The preliminary evaluations conducted as part of the present assessment suggest that both alternatives may be feasible as stand-alone projects. To further assess the feasibility of these alternatives the following actions are recommended:

- As mentioned above, a more detailed geotechnical investigation, supplemented with analytical testing, should be performed to assess the physical and chemical properties of the dredged material.
- The potential areas containing sand are adjacent to the breakwater. The geotechnical investigation should include engineering analysis to verify that dredging can be performed adjacent to the breakwaters without causing slope stability issues.
- If the City pursues Alternative 2, the availability of an upland dredged material placement area(s) within the inner harbor at the Port of Corpus Christi should be verified to develop a better estimate of the potential disposal costs.

Based on the assumptions and limitations stated above, a conceptual-level opinion of probable cost (including professional services and construction) was developed for each alternative, with the cost for Alternative 1 being \$917,000 and the cost for Alternative 2 being \$3,035,000. These estimates should continue to be refined as the project concept(s) progresses through more detailed levels of evaluation and design.



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## 1.1 Project Description

The City of Corpus Christi is considering dredging a portion of the South Basin of the Corpus Christi Marina (Figure 1) to (1) provide a borrow area for nourishment of McGee Beach and (2) improve boat access to the new “R Pier” south of Coopers Alley L-Head. Ideally, both goals could be accomplished through a single project if the area in need of dredging for navigation improvements contains beach-quality sand. Otherwise, the goals may need to be accomplished through two separate projects.

To help assess the feasibility of these project goals, field observations and data collection were performed as part of a preliminary site characterization, and cursory-level engineering and regulatory assessments were conducted. This report provides:

- A preliminary conditions assessment of the sediments within the South Basin;
- Estimation of the approximate dredged material volumes;
- Development of conceptual-level opinion of probable cost(s);
- Identification of potential permitting requirements;
- Development of a project execution timeline; and
- Recommendations for additional data collection.

Note that a similar project to nourish McGee Beach using sand imported by truck from an upland borrow source is being considered through a partnership between the City and the Texas General Land Office (GLO). The GLO project is part of a separate effort being supported by HDR. Although a permit application has been submitted to the U.S. Army Corps of Engineers for construction of the GLO project, the timeframe for construction has not been set. Shoreline change analyses performed for the GLO project has suggested that McGee Beach is relatively stable, with minor erosion occurring at the south end near the Emerald Beach Hotel. If shown to be feasible, the beach nourishment option described in the present study could help offset erosion in this area, thus serving a purpose similar to the GLO project. However, because the erosion rates at McGee Beach are relatively low, there does not appear to be an urgent need for near-term nourishment of the beach for storm damage reduction and/or recreational benefits.



**Figure 1: Project Location**

## 1.2 Existing Site Conditions

HDR performed a cursory (reconnaissance-level) site condition survey on September 19, 2016. To obtain additional site information, a meeting with Mr. Peter Davidson, the marina superintendent/director, was conducted on September 22, 2016. Mr. Davidson indicated that dredging is desired within a portion of the South Basin, as shown in Figure 2, to improve boat access. The desired channel depth is 12 ft to accommodate the deeper-draft boats that access the boat yard (for service) on the south side of Coopers Street L-Head, and a minimum width of 150 ft is desired to accommodate maneuvering by sailboats during frequent races that are held in the marina.



**Figure 2: Desired Dredging Area for Navigation Improvements**

Field data collection for the present study was completed on October 12, 2016. Probing with an aluminum pipe was performed for cursory-level characterization of the general composition and texture of bottom sediments. Probing was performed at 14 locations within the South Basin as shown in Figure 3. The probe was used to feel for rocks or shells, as well as to help determine the sediment type and any distinct sediment layers. Where possible, sediment samples were collected with the tube for visual observation, but formal testing and classification was beyond the scope of the current assessment. Most locations within the South Basin contained very soft, muddy material (unconsolidated silts and clays) that would be unsuitable for beach placement. An example of this material is shown in Figure 4. Two locations near the breakwater (shown in blue in Figure 3) felt very firm and likely contained predominantly sandy material, although samples were not able to be collected with the tube to confirm the sediment type. This material could potentially be placed at McGee Beach, pending the results of further geotechnical and analytical analyses. Several other locations appeared to contain a mud/sand mixture that was not considered to be beach quality.

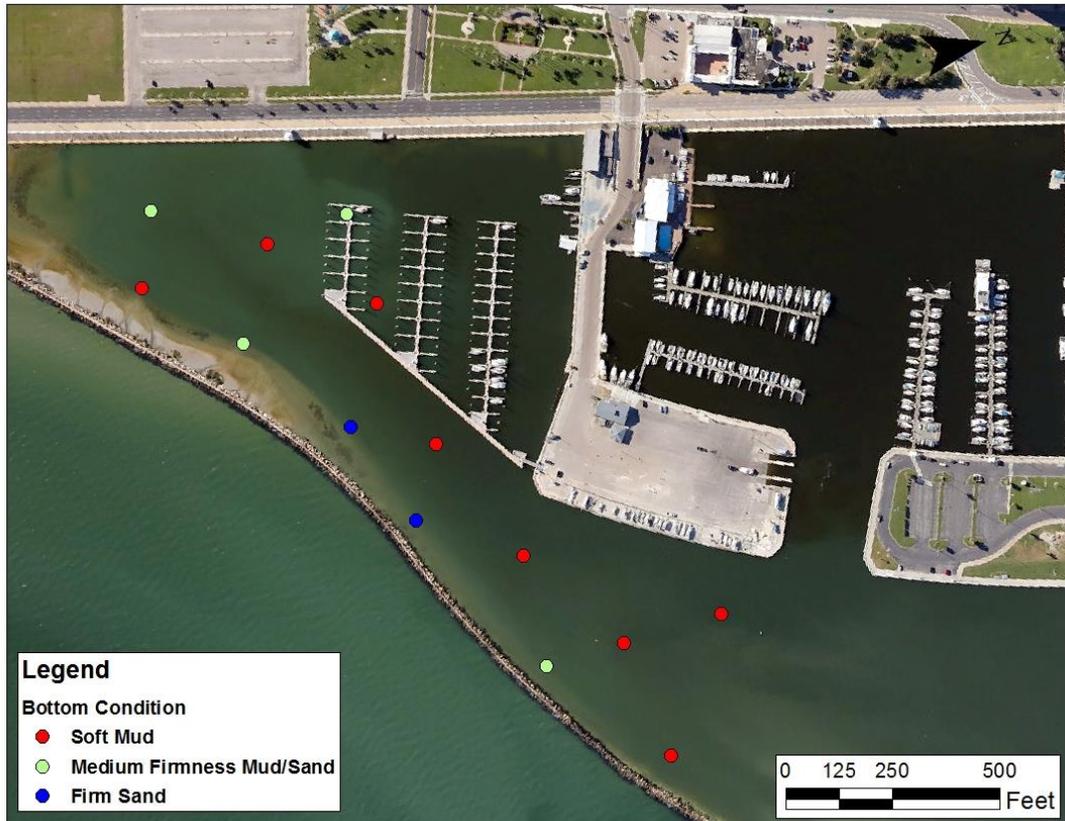


Figure 3: Bottom Probing Locations and Results



**Figure 4: Typical muddy material found in the South Basin**

In addition to the field probing, HDR reviewed results of a previous geotechnical investigation performed as part of the 2003 nourishment of McGee Beach that was constructed through a partnership between the City and the Texas General Land Office. The borrow areas identified for the 2003 project were located farther north (near the entrance to the marina outside the breakwaters, and near Sunfish Island). The geotechnical borings did not cover the southern portion of the marina that is being considered for the current project.

Bathymetric and magnetometer surveying was also conducted on October 12, 2016. Survey results are presented in Figure 5. Elevations within the desired dredging area typically range from -9 ft to +2 ft NAVD88. (According to tidal statistics published by the National Oceanic and Atmospheric Administration, the mean tide level in Corpus Christi Bay is approximately +0.4 ft NAVD88.) The purpose of the magnetometer survey was to help identify any pipelines or other sub-surface features that might pose a hazard or obstruction to dredging. Although the docks, bulkheads, vessels and other ferrous/steel objects within the marina interfered with magnetometer readings, no linear magnetic features were detected that would indicate the presence of a pipeline.

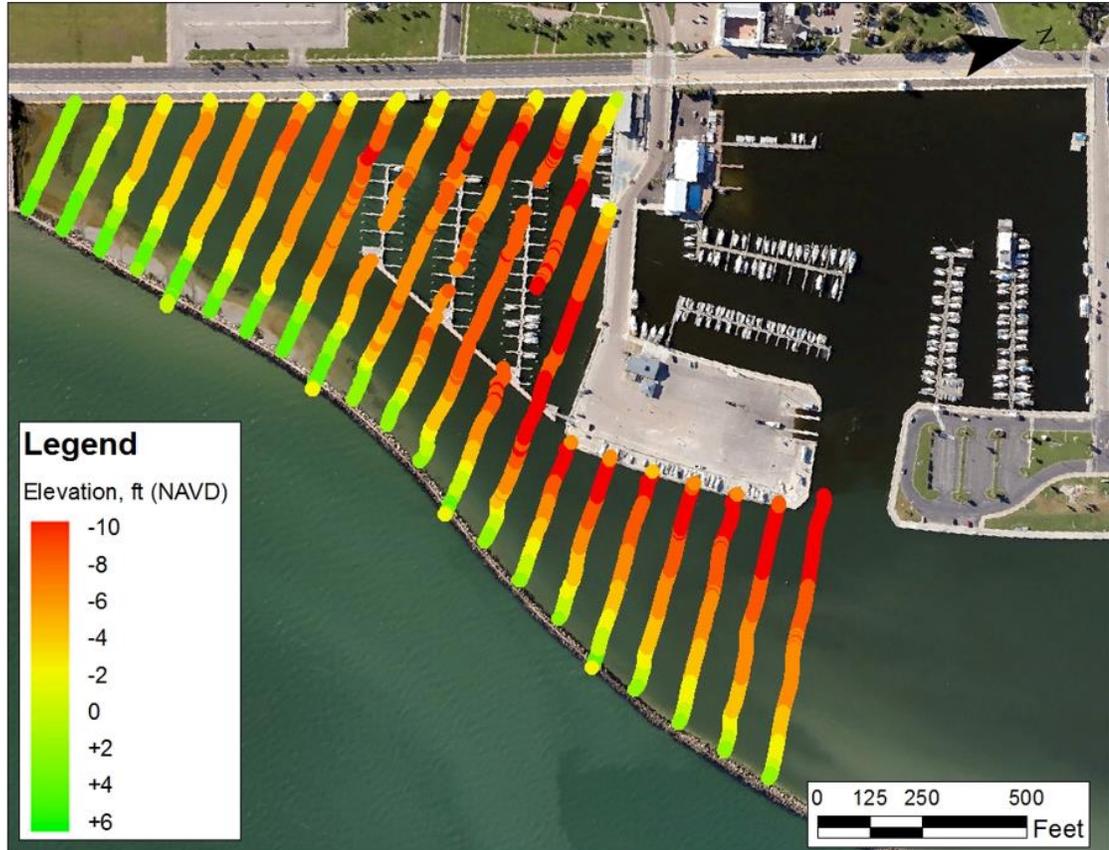


Figure 5: Elevations within South Basin

### 1.3 Regulatory and Permitting Considerations

#### 1.3.1 Existing Conditions

Based on reconnaissance-level observations by an HDR field biologist, estuarine emergent wetland is present along the full extent of the southern end of the marina adjacent to the concession and walkway area. Gulf cordgrass (*Spartina alterniflora*) and black mangrove (*Avicennia germinans*) were present within this area. Scattered estuarine emergent wetland was observed along the western side of the breakwater within the marina, totaling approximately 700 feet. No rooted submerged aquatic vegetation was observed; however, water clarity was poor. Floating seagrass blades were observed. No living oyster was observed.

The mean high water line was estimated to be at the edge of estuarine vegetation within the southern end of the marina and up to the breakwater at the slight bend eastward.

#### 1.3.2 Nationwide Permit

A dredging-only activity without beach nourishment could most likely be approved under U.S. Army Corps of Engineers (USACE) Nationwide Permit (NWP) 35 – Maintenance dredging of existing basins. This NWP allows for the excavation and removal of accumulated sediment for maintenance of existing marina basins, access channel to

marinas or boat slips, and boat slips to previously authorized depths or controlling depths for ingress/egress provided it does not impact wetlands, seagrass, or other special aquatic sites (Spartina, mangroves, oysters). Additionally, the dredged material cannot be placed within waters of the United States; therefore, the dredged material would need to be placed within an upland disposal site, likely requiring development of a sampling and analysis plan (SAP) to show that the material does not contain any unacceptable contaminant levels.

A small amount of estuarine wetland may be present at the southern end of the desired dredging area shown in Figure 2, but this could most likely be avoided in order to comply with NWP 35 and general conditions. As previously noted, floating seagrass was observed during the site visit; however, living/rooted seagrass most likely does not occur within the desired dredging area. If seagrass is determined to be present within the desired dredging area, an Individual Permit would be needed prior to dredging.

### 1.3.3 Individual Permit

Dredging within the marina and placing the dredged material on McGee Beach for nourishment would require an Individual Permit from USACE. Agency coordination would most likely be minimal since the marina and McGee Beach are active recreational areas that are not considered “sensitive areas,” and are not known to have occurrences of threatened and endangered species.

Regardless of whether the dredged material is used for beach nourishment, dredging within the southern area of the marina would require an Individual Permit if dredging occurs within the estuarine emergent wetlands. Impacts to estuarine wetlands would require mitigation, and impacts to mangroves and Spartina would likely require additional mitigation.

## 1.4 Project Alternatives

The City has two overall goals for this project. The first is to dredge the marina, and the second is to nourish McGee Beach. Both goals could be accomplished with one project if the desired dredging area contains beach-quality sand. Unfortunately, based on the field probing performed as part of the present assessment, the desired dredging area does not appear to contain beach-quality sand. Therefore, two alternative project concepts are presented for accomplishing the City’s goals.

### 1.4.1 Alternative 1 – Dredging for Beach Nourishment

The first alternative consists of dredging the area adjacent to the breakwater where the field probing suggested firmer, sandy material may be present (see Figure 6). This sandy material is more likely to be suitable for beach nourishment. However, dredging in this area would not address the navigation improvements desired by the Marina. For initial evaluation of this concept, it was assumed the area would be dredged to a depth of -5 ft NAVD, yielding up to approximately 20,000 cy of material for beach nourishment, widening McGee Beach by up to approximately 25 ft. Note that the most recent nourishment at McGee Beach utilized river sand that is much coarser than the typical sand in the bay. If the sand in the South Basin is finer than the existing sand on McGee

Beach, it will equilibrate to a flatter slope, providing less width along the upper (visible) portion of the beach.

The dredging could be performed with a small cutterhead (pipeline) dredge. Due to the proximity and potential impacts to wetlands, an Individual Permit would likely be required. In addition, a detailed geotechnical investigation would be needed to better assess the gradation and composition of the material, to perform analytical (chemical) testing to ensure the material is free of contaminants, and to make sure that the dredging would not present stability issues for the breakwater.



**Figure 6: Alternative 1 – Dredging for Beach Nourishment**

#### 1.4.2 Alternative 2 – Dredging for Navigation Improvements

The second alternative consists of dredging the area immediately east of Coopers Street L-Head and the new R-Pier (see Figure 7) to allow larger boats to access the boat yard on the L-Head, and to provide additional maneuvering space for sailboats. This area is proposed to be dredged to approximately -11.5 ft NAVD to allow for approximately 12 ft of water depth at mean tide level, yielding approximately 45,000 cy of dredged material. Based on the field probing performed during the current assessment, the material in this area appears to be predominantly soft mud which would not be suitable for placement on McGee beach. Disposal of this material would likely require an upland placement area, requiring the material to be excavated mechanically (such as with an excavator mounted on a barge), loaded into scows, transported to an unloading (pump-out) site, and then pumped to an upland disposal location (assumed here to be a federal dredged material

placement area (DMPA) along the inner harbor at the Port of Corpus Christi). A detailed geotechnical investigation would be needed to better characterize the physical composition of the material, and analytical testing would be needed to test for potential chemical contaminants. The dredging for this alternative could likely be covered under a Nationwide Permit, although additional USACE coordination would be required for disposal of the dredged material into a federal DMPA.



**Figure 7: Alternative 2 – Dredging for Navigation Improvements**

As previously mentioned, both dredging alternatives would require more detailed field data collection to verify their feasibility and cost. This would include the following:

- **Geotechnical Analysis:** Perform geotechnical analysis to better determine the sediment composition, particularly if beach-quality sand is being targeted. In addition to borings for soil classification, the geotechnical investigation should include slope stability analysis for any potential dredging near the breakwater and L-Head.
- **Sediment Analytical Testing:** Chemical testing is recommended to determine if the sediments contain any substances that would make the material undesirable for beach nourishment, or require special considerations or handling if the material will be designated for upland disposal. If the material is to be placed in a federal DMPA, a sampling and analysis plan (SAP) incorporating the analytical testing would be required.

- For Alternative 2, coordinate real estate agreements with USACE and the Port of Corpus Christi to use DMPA's within the harbor. Application and receipt of real estate agreements can take 10 to 14 months.
- Environmental Delineation: For Alternative 1, an environmental survey would be needed to formally verify the presence and limits of any jurisdictional habitat such as wetlands that may need to be considered during the USACE permitting process.

## 1.5 Opinion of Probable Construction Cost

Tables 1 and 2 provide conceptual-level opinions of probable construction costs (costs) for initial planning considerations. As details of the project(s) are better developed, particularly with respect to sediment quality (for Alternative 1) and disposal location (for Alternative 2), more accurate costs can be established. The total project cost for Alternative 1 is estimated to be approximately \$917,000, with the cost for construction being approximately \$581,000. The total project cost for Alternative 2 is estimated to be approximately \$3,035,000, with the cost for construction being approximately \$2,747,000. However, these costs can vary depending on items such as:

- Equipment availability and fluctuations in fuel and transportation costs.
- General conditions requested of the contractor / professional services by the owner.
- Economic climate at the time of bidding. Typically, when contractors have less workload, one can expect lower prices for construction projects, especially with marine-based construction.
- For Alternative 2, the actual dredging cost could vary significantly depending on the location of the upland DMPA.

The costs stated above include a 35% contingency. It is recommended that contingencies not be deducted or reduced at this planning stage of the project. Key assumptions and clarifications of the cost opinion include:

1. Dredge areas were calculated for the areas shown in Figure 6 and Figure 7.
2. The dredging depth for Alternative 1 was assumed to be -5 ft NAVD to match adjacent elevations without creating a deeper area adjacent to the breakwater.
3. The dredging depth for Alternative 2 was assumed to be -11.5 ft NAVD to allow for 12 ft of water depth at mean tide level (MTL), as requested by the marina superintendent/director (MTL is approximately +0.5 ft NAVD).
4. As previously mentioned, for Alternative 2 the DMPA was assumed to be an existing federal site within the Port of Corpus Christi inner harbor.

**Table 1. Conceptual-Level Opinion of Probable Cost for  
Alternative 1 (Dredging for Beach Nourishment)**

<u>ITEM</u>	<u>QUANTITY</u>	<u>UNIT</u>	<u>UNIT PRICE</u>	<u>EXTENSION</u>
<b>1. Construction</b>				
<i>Mobilization/Demobilization</i>	1	LS	\$250,000	\$250,000
<i>Pipeline Dredging and Placement at McGee Beach</i>	20,000	CY	\$7	\$140,000
<i>Grading at Beach</i>	1	LS	\$10,000	\$10,000
<i>Bathymetric and Pre-Dredge Hazard Surveying (Marina)</i>	1	LS	\$15,000	\$15,000
<i>Beach Profile Surveying</i>	1	LS	\$15,000	\$15,000
			35% Contingencies:	<u>\$151,000</u>
			<b>Subtotal (Construction):</b>	<b>\$581,000</b>
<b>2. Professional Services</b>				
<i>Geotechnical Data Collection and Analysis</i>	1	LS	\$50,000	\$50,000
<i>Sediment Analytical Testing</i>	1	LS	\$30,000	\$30,000
<i>Surveying at McGee Beach</i>	1	LS	\$15,000	\$15,000
<i>Engineering Design (Dredging and Beach Nourishment)</i>	1	LS	\$100,000	\$100,000
<i>Permitting</i>	1	LS	\$50,000	\$50,000
<i>Bidding-Phase Services</i>	1	LS	\$10,000	\$10,000
<i>Construction Administration</i>	1	LS	\$50,000	\$50,000
			10% Contingencies:	<u>\$31,000</u>
			<b>Subtotal (Professional Services):</b>	<b>\$336,000</b>
			<b>Total:</b>	<b>\$917,000</b>

**Notes:**

- (a) Mobilization/Demobilization cost assumes construction plant will include a small cutterhead dredge, equipment for placing the dredging pipeline, and beach grading equipment.
- (b) Depending on project timing, an updated design survey may be required for the marina. The cost for an additional design survey is not included in the estimate above.



**Table 2. Conceptual-Level Opinion of Probable Cost for Alternative 2 (Dredging for Navigation Improvements)**

ITEM	QUANTITY	UNIT	UNIT PRICE	EXTENSION
<b>1. Construction</b>				
<i>Mobilization/Demobilization</i>	1	LS	\$300,000	\$300,000
<i>Mechanical (Bucket) Dredging</i>	45,000	CY	\$5	\$225,000
<i>Material Transport (Scows)</i>	45,000	CY	\$5	\$225,000
<i>Dredged Material Pump-out from Scows to DMPA</i>	45,000	CY	\$20	\$900,000
<i>Tipping Fee for Dredged Material Disposal</i>	45,000	CY	\$8	\$360,000
<i>Aids to Navigation (Daybeacons)</i>	1	LS	\$10,000	\$10,000
<i>Bathymetric and Pre-Dredge Hazard Surveying</i>	1	LS	\$15,000	\$15,000
			35% Contingencies:	<u>\$712,000</u>
			<b>Subtotal (Construction):</b>	<b>\$2,747,000</b>
<b>2. Professional Services</b>				
<i>Geotechnical Data Collection and Analysis</i>	1	LS	\$50,000	\$50,000
<i>Develop Sediment Sampling and Analysis Plan (SAP)</i>	1	LS	\$5,000	\$5,000
<i>Sediment Analytical Testing</i>	1	LS	\$30,000	\$30,000
<i>Engineering Design (Dredging)</i>	1	LS	\$75,000	\$75,000
<i>Permitting</i>	1	LS	\$30,000	\$30,000
<i>USACE Real Estate Application for DMPA</i>	1	LS	\$12,000	\$12,000
<i>Bidding-Phase Services</i>	1	LS	\$10,000	\$10,000
<i>Construction Administration</i>	1	LS	\$50,000	\$50,000
			10% Contingencies:	<u>\$26,000</u>
			<b>Subtotal (Professional Services):</b>	<b>\$288,000</b>
			<b>Total:</b>	<b>\$3,035,000</b>

**Notes:**

- (a) Mobilization/Demobilization cost assumes construction plant will include trackhoe on barge, tug, scows, pump-out system, and pipeline from scow to DMPA.
- (b) Cost for material disposal assumes dredged material will be transported on scows to transfer location within inner harbor, and then pumped to a federal DMPA. Actual location of DMPA has not been determined.
- (d) Depending on project timing, an updated design survey may be required for the marina. The cost for an additional design survey is not included in the estimate above.

## 1.6 Project Schedule

An estimate of the time required for project execution (including data collection, engineering, permitting, and construction) was developed using conceptual level planning. This timeline is provided to help illustrate the anticipated duration of the project from a start date which has not yet been determined. As details of the project are further developed and identified, a more accurate schedule can be established. For the concepts presented herein, the duration of the project is estimated to be approximately 16 months, which includes approximately 12 months for obtaining an Individual Permit from USACE. If a Nationwide Permit can be obtained instead, the schedule might be reduced by several months. The schedule could also vary depending on several other items including:

- Contractor and equipment backlog and availability.
- For Alternative 2, identification of a viable DMPA. If the material is placed in a federal DMPA, up to 14 months could be required to obtain a real estate agreement from USACE.
- Weather conditions.
- Construction schedules and working restraints.
- Actual dredging volume.
- Coordination with USACE and the Port of Corpus Christi on use of a DMPA within the inner harbor.