ENVIRONMENTAL ASSESSMENT

AND FINDING OF NO SIGNIFICANT IMPACT (FONSI)

TAMPA HARBOR - BIG BEND CHANNEL

NAVIGATION IMPROVEMENTS

DEPARTMENT OF THE ARMY
JACKSONVILLE DISTRICT CORPS OF ENGINEERS
P. O. BOX 4970
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REPLY TO ATTENTION OF

TAMPA HARBOR - BIG BEND NAVIGATION STUDY
HILLSBOROUGH COUNTY, FLORIDA
FINDING OF NO SIGNIFICANT IMPACT

I have reviewed the Environmental Assessment (EA) of the proposed action. Based on information analyzed in the EA, reflecting pertinent information obtained from other agencies, and special interest groups having jurisdiction by law and/or special expertise, I conclude that the proposed action will have no significant impact on the quality of the human environment. Reasons for this conclusion are, in summary:

1. There will be no significant adverse impacts to endangered or threatened species. The proposed action is in compliance with the Endangered Species Act and the District's Migratory Bird Protection Policy.

2. In coordination with the State Historic Preservation Officer, it was determined there would be no impacts on sites of cultural or historical significance.

3. State water quality standards will be met. Water Quality Certification will be obtained during project design.

4. We have determined that the proposed project is consistent with the Florida Coastal Zone Management Program. We have obtained concurrence in our determination from the State Clearinghouse.

5. Measures to eliminate, reduce, or avoid potential impacts to fish and wildlife resources will be implemented during project construction, including migratory bird nesting habitat.

6. Benefits to the public will be increased navigable capacity, increased vessel safety, improvements to the local economy, increased water quality benefits, and increased migratory bird nesting sites.

In consideration of the information summarized, I find that the proposed action will not significantly affect the human environment and does not require an Environmental Impact Statement.

20 SEP 96
Date

TERRY L. RICE
Colonel, Corps of Engineers
Commanding

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1.0. **PURPOSE OF AND NEED FOR ACTION**. The purpose of this study is to consider the feasibility of further modifying the existing Tampa Harbor Federal navigation project to include the Big Bend Navigation Channel. Particular emphasis is placed on deepening and widening the existing channels to accommodate the existing and prospective vessel fleet. The channels provide access to the authorized 43-foot Tampa Harbor channel.

The economic savings or benefits gained by maintenance dredging arise from the ability to reliably provide a navigation channel at the depth needed for deep draft transits. When project shoaling reduces the channel depth, certain losses will occur. If restrictive shoaling in Big Bend Channel is allowed to happen, definite economic losses will be realized in the form of higher transportation costs. The higher costs for goods entering or leaving through the channel will negatively impact the Bureau of Economic Analysis regional area and the Nation's trade balance.

The local pilots have complained of wind forces acting on the light loaded or empty barges when passing through the channel. Several groundings and collisions with channel markers have occurred and are attributed to wind forces. The wind in the area can be extreme.

1.1. **INTRODUCTION**. The existing Federal project in the study area is Tampa Harbor. The Tampa Harbor project provides a 43-foot channel to public phosphate terminals located in East Bay and Hillsborough Bay. Big Bend Channel is a privately constructed and maintained channel 34 feet deep by 200 feet wide from the main ship channel in Hillsborough Bay to and including a turning basin 1,000 feet long by 700 to 1,500 feet wide. Length of the project is about 2.2 miles.

A prior study on Big Bend Channel was conducted in combination with Alafia River and was submitted to the Board of Engineers for Rivers and Harbors in 1985 but was returned at the local sponsor's request. Numerous studies have been made on the existing Tampa Harbor project.

1.2. **AUTHORITY**. The present study is authorized by Senate and House Resolutions adopted 29 May 1979 and 14 November 1979, respectively. These resolutions request review of the Chief of Engineer's report on Tampa Harbor, Florida, printed in House Document 401, 91st Congress, 2nd Session, and other pertinent reports, with a view of determining if the authorized project should be modified in any way at this time, with particular reference to improvement and maintenance of the existing local project for Big Bend Channel.

1.3. **DECISION TO BE MADE**. The decision to be made is whether improvements to the existing channel are feasible, to what extent the project should be modified, if dredging is required, and where to place the material.

1.4. **RELEVANT ISSUES.** The following issues have been determined to be relevant to the decision:

a. Water quality.

b. Navigation.

c. Manatees.

d. Seagrasses.

e. Migratory birds.

f. Historic, archeological, and cultural resources.

g. Recreation.

h. Aesthetics.

i. Economics.

1.5. **PERMITS REQUIRED.** The dredging and disposal of dredged material would require a State of Florida Water Quality Certification in accordance with the provisions of the Memorandum of Agreement between the U.S. Army Corps of Engineers and the State of Florida.

1.6. **METHODOLOGY.** An interdisciplinary team used a systematic approach to analyze the affected area, to estimate the environmental effects, and to write the environmental assessment. This included literature searches, coordination with agencies and private groups having expertise in particular areas, and field investigations.

2.0. ALTERNATIVES INCLUDING THE PROPOSED ACTION.

2.1. **INTRODUCTION.** The alternatives section is the heart of this Environmental Assessment. This section describes in detail the no-action alternative, the proposed action, and other reasonable alternatives that were studied in detail. Then based on the information and analysis presented in the sections on the Affected Environment and the Probable Impacts, this section presents the beneficial and adverse environmental effects of all alternatives in comparative form, providing a clear basis for choice among the options for the decisionmaker and the public. The heart to this section is the alternative comparison chart, Figure 1, page 5. This section contains five parts:

a. A description of the process used to formulate alternatives.

b. A description of alternatives that were considered but were eliminated from detailed consideration.

c. A description of each alternative.

d. A comparison of the alternatives.

e. The identification of the preferred alternative.

2.2. **HISTORY OF ALTERNATIVE FORMULATION.** Initially, numerous alternatives were considered and eliminated in the reconnaissance phase of the study (USACE, 1991). The general alternative of channel improvements was considered the most practical. This alternative was divided into dredging and disposal alternatives.

2.2.1. **Disposal alternatives.** Initial options considered were based on the Upland Disposal Area Study for the Final Environmental Impact Statement for the Environmental Protection Agency's Ocean Dredged Material Discharge Site for Tampa Harbor. Several sites were considered, including the most feasible, the Port Redwing Site located near the Big Bend Channel. These were compared to the use of the existing disposal areas, CMDA-2D, CMDA-3D and the designated ODMDS (Appendix F). Of these, the most economical was the use of the existing disposal area, CMDA-3D. The US Fish and Wildlife Service recommended through the preparation of the Fish and Wildlife Coordination Act Report several Beneficial Uses of Dredged Material which would aid wildlife or improve water quality. The first option was the expansion of Sunken Island for bird habitat which originated with the Audubon Society. The second option was generated by the Corps and the USFWS. It includes the filling of former dredge borrow areas near Whiskey Stump Key.

2.2.2. **Dredging alternatives.** The dredging alternatives were divided into width and depth categories. The U.S. Army Corps of Engineers, Waterways Experiment Station conducted a study using the Ships Simulation Model to determine the most feasible width design for the channel (WES, 1994) (Appendix D). The model is based on a simulated ship usage, local water and weather conditions, and licensed pilot navigation using those simulated conditions. The optimum channel dimensions were determined to be a 250-foot width with a 41-foot mean lower low water depth. The channel depths where evaluated between 35 and 45 feet at 1-foot increments. The most economical depth was determined to be 41 feet with 2 feet advanced maintenance.

2.3. **DESCRIPTION OF ALTERNATIVES.**

2.3.1. **No Action Alternative.** The No Action Alternative would leave the channel in its existing condition.

2.3.2. **Dredging Plan**. The Federal project would start at the main ship channel and extend 10,200 feet with a channel 41 feet deep (with 2 feet of required advanced maintenance) by 250 feet wide which would connect to a turning basin. The channel widening would occur on the north side of the channel. The turning basin would be part of the Federal project and is irregularly shaped to provide a turning diameter of 1,200 feet. The Federal project would also include a channel 200 feet wide and 41 feet deep (with 2 feet of required advanced maintenance) which extends from the southern edge of the turning basin a distance of 2,700 feet to the coal dock facilities. The berthing area for the coal dock would be deepened to 41 feet (with 2 feet of required advanced maintenance) at 100 percent non-Federal expense. The berthing area for the phosphate dock would also be deepened to 41 feet plus 2 feet of advanced maintenance at 100 percent non-Federal expense. The project would also include the area called the east channel. It extends eastward from the turning basin at a project depth of 41 feet over a bottom width of 200 feet. with an advanced maintenance depth of 2 feet. With all disposal options within efficient pumping distance, the use of a hydraulic, pipeline dredge with a cutter-head is the method of choice for cost estimating purposes. Standard State and federal manatee protection conditions would be implemented during dredging to eliminating impacts to the species (Exhibit I). Turbidity monitoring is would also be implemented to insure that State water quality standards are met. The dredge plan also includes the periodic maintenance of the channel and the placement in disposal area CMDA-3D. It is estimated that the frequency of maintenance dredging would be 9 years between cycles. Beneficial uses of that material will be looked for and analyzed at that time.

2.3.2. **Alternative Disposal Plan C1/C2 (CMDA-3D)**. The entire project (Federal and Non-Federal) would be placed in Disposal Area CMDA-3D. The estimated island capacity is not sufficient at this time to hold the dredged material from the proposed construction of the project at Big Bend. Initial diking would be required in order to place all the material into 3D. Work would be scheduled to avoid the migratory bird nesting season (1 April-31 August).

2.3.3. **Alternative Disposal Plan C4 (Sunken Island).** This alternative is a one time only proposal. It is considered a beneficial use of dredged material as defined by Section 204 of the Water Resources Development Act of 1992. The materials could come from either the construction of the new channel or periodic maintenance of the channel. Approximately 95,000 CY of material is needed for the west and northwest banks of the island to mitigate erosion. Placement would be along roughly 3200 feet of shoreline to extend the shoreline outward an average of 100 feet at an elevation of 3 feet above mlw. The land would then be graded from a land surface elevation of +3 feet above mlw to a bay bottom elevation of about 5 feet below mlw. Figure F-4, Appendix F, provides a cross section of the shoreline extension. Material placed in that area is still susceptible to continued erosion. *Spartina alternaflora* would be used to provide vegetative stabilization to the shoreline. The south side of the island would be extended with one or two sawtooth-shaped land areas. Development of those land areas would require an estimated 310,000 CY to raise the existing bay bottom of 5 feet below mlw to land surface elevation of 5 feet

above mlw. *Spartina sp.* plants would be planted along 2700 feet of shoreline on the eastern and southeastern banks of the sawtooth land area(s). The planting zone for *Spartina sp.* would extend from the shoreline to about 50 feet off shore. Mangroves stands are expected to rapidly develop in the Spartina planting areas. The elevation of the bay bottom adjacent to the sawtooth-shaped land areas would be raised to create shallow bay areas suitable for the development of mudflats and marsh habitats. That filling would require an estimated 140,000 CY to raise the bay bottom from 5 feet below mlw. The resulting bay depth would be 1 to 2 feet below mlw. Plan and cross sectional views of the sawtooth extension(s) and adjacent bay areas are in Figure F-4, Appendix F. Dredged material from Big Bend would be pumped a distance of about 3 miles to Sunken Island. Material may need to be stock-piled to facilitate the construction process. Silt curtains would be used to control the level of turbidity entering the bay. Specialized construction equipment may be required, such as hydraulic amphibious excavators. Work would be scheduled to avoid the migratory bird nesting season (1 February-31 August) for the island.

2.3.4. **Alternative Disposal Plan C3 (Whiskey Stump Key).** This alternative is a one time only proposal. It is considered a beneficial use of dredged material as defined by Section 204 of the Water Resources Development Act of 1992. The materials could come from either the construction of the new channel or periodic maintenance of the channel. Two large holes and one small hole exist on the east and west side of Whiskey Stump Key shown on Figure F-3, Appendix F. The holes were apparently dredged for fill material and they cover an area of about 53 acres. The holes have existing depths around 12 feet below mlw. The plan is to fill the holes to a depth of 1 foot below mlw using material from both 3D and Big Bend. Filling the holes will require about 950,000 CY of material. To help reduce the level of impact, several measures would be taken in the discharge area. Double silt curtains will be required to keep unacceptable levels of turbidity from entering the surrounding bay area. The discharge pipe would be positioned near the bottom of the holes to minimize the volume of fines in suspension. Pumping rates would be reduced to provide more time for fines to settle and consolidate. A spreader head would be attached to the end of the discharge pipe to help distribute the capping material more uniformly over the fines, minimizing the heaving effect. Pumping rates would be reduced to provide more time for fines in the material to settle and consolidate. A small channel 2 to 6 feet in depth, located south of the holes, would remain to permit shallow draft vessel access.

2.4. ALTERNATIVE COMPARISON.

Figure 1, Alternative Comparison

Resources	No Action Alternative	Alternative Plan C1- Dredging and CMDA-3D Disposal	Alternative Plan C4 - Dredging and Sunken Island Disposal	Alternative Plan C3 - Dredging and Whiskey Stump Key Disposal
Water quality	No adverse impacts.	Minor short-term increase in turbidity levels at the dredging site. No impact from disposal area return water.	Minor short-term increase in turbidity levels at the dredging site. Major short-term increases in turbidity levels at disposal site. Will require turbidity screens to minimize impacts.	Minor short-term increase in turbidity levels at the dredging site. Major short-term increases in turbidity levels at disposal site. Will require turbidity screens to minimize impacts. Moderate long-term benefit to water quality from the elimination of oxygen-poor water quality in man-made dredged holes in the Bay bottom
Navigation	Moderate long-term adverse impact on vessel safety and long-term size and tonnage capacity limitation of the channel.	Moderate short-term adverse impact from dredging equipment hampering commercial navigation. Moderate long-term benefit from increased vessel capabilities using the port and from safer navigability of the channel.	Moderate short-term adverse impact from dredging equipment hampering commercial navigation. Moderate long-term benefit from increased vessel capabilities using the port and from safer navigability of the channel.	Moderate short-term adverse impact from dredging equipment hampering commercial navigation. Moderate long-term benefit from increased vessel capabilities using the port and from safer navigability of the channel. Minor long-term adverse impact on recreational navigation by reducing navigable capacity of Whiskey Stump Key area.
Manatees	No adverse impacts.	There would be no impacts on manatees if the State manatee protection conditions are adhered to.	There would be no impacts on manatees if the State manatee protection conditions are adhered to.	There would be no impacts on manatees if the State manatee protection conditions are adhered to.

Resources	No Action Alternative	Alternative Plan C1- Dredging and CMDA-3D Disposal	Alternative Plan C4 - Dredging and Sunken Island Disposal	Alternative Plan C3 - Dredging and Whiskey Stump Key Disposal
Seagrasses	No adverse impacts.	No adverse impacts.	No adverse impacts.	Long-term benefit by providing suitable habitat for seagrass growth provided water quality improves.
Migratory birds	No adverse impacts.	Moderate adverse impact on nesting during 1 April-31 August nesting window. No adverse impact if work is conducted outside window. Moderate long-term benefit from the revitalization of nesting habitat.	Moderate adverse impact on nesting during 1 April-31 August nesting window. No adverse impact if work is conducted outside window. Moderate long-term benefit from the revitalization of nesting habitat.	No adverse impacts.
Historic, Archeological, and Cultural Resources	No adverse impacts.	No adverse impacts on known cultural resources.	No adverse impacts on known cultural resources.	No adverse impacts on known cultural resources.
Recreation	No adverse impacts.	Minimal temporary adverse impacts from dredging operation.	Minimal temporary adverse impacts from dredging operation.	Minimal temporary adverse impacts from dredging operation.
Aesthetics	No adverse impacts.	Minimal temporary adverse impacts from dredging operation.	Minimal temporary adverse impacts from dredging operation.	Minimal temporary adverse impacts from dredging operation.
Economics	Minor long-term adverse impact on the economy of the area from the reduced port capabilities.	Minor short-term stimulus from sale of goods and service during construction. Moderate long-term benefit to the local economy from the increased port capabilities.	Minor short-term stimulus from sale of goods and service during construction. Moderate long-term benefit to the local economy from the increased port capabilities.	Minor short-term stimulus from sale of goods and service during construction. Moderate long-term benefit to the local economy from the increased port capabilities.

2.5. **PREFERRED ALTERNATIVE**. The preferred alternative would be the construct alternative with any combination of the disposal alternatives.

3.0. AFFECTED ENVIRONMENT.

3.1. **INTRODUCTION**. The Affected Environment section succinctly describes the existing environmental resources of the areas that would be affected if any of the alternatives were implemented. This section describes only those environmental resources that are relevant to the decision to be made. It does not describe the entire existing environment, but only those environmental resources that would affect or that would be affected by the alternatives if they were implemented. This section, in conjunction with the description of the "no-action" alternative forms the base line conditions for determining the environmental impacts of the proposed action and reasonable alternatives. The environmental issues that are relevant to the decision to be made are the following:

a. Water quality.
b. Navigation.
c. Manatees.
d. Seagrasses.
e. Migratory birds.
f. Historic, archeological, and cultural resources.
g. Recreation.
h. Aesthetics.
i. Economics.

3.2. **GENERAL DESCRIPTION**. Tampa Bay is the largest estuary on the west coast of Florida (USFWS,1984). As man developed the Bay, the resources have been impacted. The Bay has been excavated for navigation purposes; islands and fast land have been created from the dredged material; ports and residential development have encroached on the aquatic environment; and numerous effluents have been discharged into the Bay.

3.2.1. Aquatic Resources: The Bay supports a wide variety of aquatic life including the American oyster which is harvested from the lower Tampa Bay, three species of clams, blue crab, and numerous species of fish: the red drum, spotted seatrout, snook, sheepshead, southern flounder, Florida pompano, striped mullet, Gulf menhaden, and the black drum (USFWS, 1984). Many offshore fish spend their juvenile stages in the Bay estuary. These include the red and gag groupers, jewfish, scamp, and the red and mangrove snappers.

3.2.2 Avian Resources: Development has reduced the nesting areas available for birds. However, this same development (including dredging and the creation of dredged material disposal areas) has recreated suitable areas for nesting, contributing to the increased carrying capacity of the Bay area. Gulls, terns, sandpipers, plovers, stilts, skimmers and oystercatchers are known to inhabit the Bay. Other wading birds such as herons, egrets and ibises use the interior wetland areas. Disposal Site CMDA-3D provides nesting for Caspian

terns, laughing gulls, American oystercatchers, black skimmers, and royal, least and sandwich terns (Paul, 1991). Nesting by these species is protected by the Migratory Bird Treaty Act.

3.2.3. Seagrass Beds: Five species of seagrasses are found in the Bay; turtlegrass, shoalgrass, manateegrass, widgeon grass, and six-leaved dwarf seagrass (Lewis, 1984). The City of Tampa also has conducted seagrass surveys in Hillsborough Bay area (1996). The return of seagrasses also indicates an improvement in water quality in the Bay.

3.2.4. Wetlands. Tampa Bay has mangrove and emergent wetlands along the fringe of the bay where development has not occurred. These wetland areas provide cover and spawning areas for fish and shrimp. The mature mangroves provide nesting areas for birds such as the pelican. These wetlands improve water quality of the Bay by trapping sediments and nutrient uptake.

3.2.5. Threatened and Endangered Species. The work may affect the following species listed as threatened or endangered by U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) pursuant to the Endangered Species Act (USFWS, 1987):

green sea turtle . . . . . *Chelonia mydas*
hawksbill sea turtle . . . . . *Eretmochelys imbricata*
Kemp's Ridley sea turtle . . . . . *Lepidochelys kempii*
leatherback sea turtle . . . . . *Dermochelys doriacea*
loggerhead sea turtle . . . . . *Caretta caretta*
West Indian manatee . . . . . *Trichechus manatus*

Species considered threatened or endangered by the State of Florida, exclusive of the above, include osprey, magnificent frigate-bird, roseate tern, and least tern.

3.2.6. Water Quality. Tampa Bay receives storm runoff from agricultural and residential areas of Pinellas, Hillsborough and Manatee Counties as well as discharges from sewage treatment plants and other facilities. As a result bay waters are high in nitrogen and phosphorous and turbidity has reduced light penetration to 8 feet or less in many areas. The water quality tends to improve as the entrance to the bay is approached. West of the Skyway bridge water quality improves markedly as the bay meets the Gulf of Mexico.

3.3. RELEVANT ISSUES.

3.3.1. Physical.

a. Water quality. Tampa Bay, is classified as a class III Florida water, suitable for recreation, propagation and maintenance of a healthy and well-balanced population of fish and wildlife. The Bay has suffered impacts from wetland and seagrass destruction and coastline alteration; severe stormwater pollution from residential and commercial sources; dredging and harbor activities; litter; fertilizer, food processing, and other industrial discharges; and a heavy load of domestic wastewater from power and sewage treatment utilities. The bay has extremely high phosphorus levels and is nitrogen limited. Recent trends in water quality show improving conditions in the bay and the overall water quality is fair in the areas north of the Little Manatee River to good in the lower bay.

b. Navigation. The commercial cargo fleet currently calling at Big Bend is diverse. Tug/barge combinations exported an average of 4,663,000 short tons of phosphate rock and 197,000 short tons of phosphate products (Granulated Triple Super Phosphate) to Louisiana during 1988 and 1989. The same tug/barge fleet imported an average of 4,343,000 short tons of coal from Louisiana during the same period. During 1988 and 1989, ocean going bulk carriers and general cargo vessels exported an annual average of 297,000 short tons of phosphate chemical. Ocean going tankers exported an average of 321,000 short tons of phosphoric acid during the same period. Local interest dredged the current channel in 1994 to a depth of 34 feet mean low water. The annual shoaling rate for the project is approximately 45,000 cubic yards per year. The shoaling rate is based on a dredging history for the channel since initial construction in 1962. Assuming a uniform shoal over the entire project, the loss in depth is approximately 4 inches per year. The shoaling rate equates to one foot every three years.

c. Aesthetics. Visual aesthetic resources in the Tampa Bay Harbor can be classified as low to medium in scenic value. As the seventh largest port in the country (based on tonnage), Tampa Harbor is very busy with shipping traffic to many of the commercial industries located at the harbor. The Tampa area's three coal-fired power plants are located on the east side of the bay. The surrounding land is very flat and sparsely vegetated with much of the lands being developed for residential, commercial, or agricultural purposes. The panoramic view is through air quality diminished by the pollution from the industries associated with the harbor area. The odor of the air is better some days than others.

3.3.2. Biological.

a. Manatees. Manatees are found in the vicinity of the Big Bend Channel. During periods of cold weather, they congregate at the outfall of the Big Bend Power Plant

which is located 3/4 mile south of the eastern end of the channel. It is estimated that up to sixty (60) manatees have been observed congregating at the site (FWCAR).

b. Seagrasses. No seagrasses are located immediately adjacent to the work areas. Seagrass beds are located along the shoreline on shoals north of the dredging site. Shoalgrass has been located in the areas north of the project area and along the spoil islands south of the channel (City of Tampa, 1996). A small band has been identified as being just west of the inner channel and north of the spoil island located north of the TECO discharge channel. There are also areas of shoalgrass along the southeast side of Sunken Island. Shoalgrass has also been found in the shallows around Whiskey Stump Key area outside the former borrow pit areas known as the "kitchen".

c. Migratory birds. In 1991, it was estimated that there were between 10,000 and 20,000 laughing gull nests on CMDA-3D. In addition, the American oystercatcher (10 nests), Caspian tern (65), Royal tern (20) and the Black skimmer (110) were also observed nesting on CMDA-3D.

3.3.3. **Social.**

a. Recreation. Recreation resources consist of water-borne activities, birdwatching, and sunbathing within the Tampa Harbor area. Pleasure boating and some fishing take place within Tampa Harbor also. Sunbathing on CMDA-3D island and swimming near its shore has been noted in the past.

b. Historic, Archeological, and Cultural Resources. An archival and literature search has been conducted for the proposed navigation improvements at Big Bend Channel, Tampa Bay, Hillsborough County, Florida. No significant cultural resources are recorded for the vicinity of Big Bend Channel, existing disposal island CMDA-3D, or for any of the dredge holes which may be considered as disposal areas for material dredged from the navigation channel.

3.3.4. **Economic Issues.**

a. Two private phosphate product terminals and a coal fueled power generating plant, owned by Tampa Electric Company (TECO), are located at the Big Bend Channel project. Total usable wharf length in the harbor is approximately 3,600 feet at 34 foot depths. Storage facilities in the harbor include six phosphoric acid tanks with a total capacity of 60,000 short tons and a phosphate chemical storage (Granulated Triple Super Phosphate) area with 32,000 short tons of capacity. Phosphate rock is stored in an uncovered area with a capacity of 2,200,000 short tons.

b. The two primary commodities to be considered in the benefit analysis are phosphate products and coal. The phosphate is an export commodity and the coal is

an import commodity. The wet phosphate rock is exported by barge to Donaldsonville and Uncle Sam, Louisiana. Phosphate chemical (Granulated Triple Super Phosphate) is exported by barge to Davant, Louisiana and by ocean going vessel to ports world wide. Phosphoric acid is exported to ports primarily in the Far East, Central America, and South America by ocean going vessels. The coal, being an import from a distribution point at Davant Louisiana, would be distributed throughout the Bureau of Economic Analysis (BEA) regional area (Tampa-St. Petersburg) which includes Hillsborough, Pinellas, Polk, Pasco, and 10 other adjoining counties in the form of electricity by TECO. The phosphate ore is mined primarily from reserves in Polk County.

c. Direct service is available to Big Bend terminal via pipeline, rail, and highway. The major import is coal. Major exports include phosphate rock and chemicals.

4.0. ENVIRONMENTAL CONSEQUENCES.

4.1. **INTRODUCTION.** This section describes the probable consequences of implementing each alternative on selected environmental resources. These resources are directly linked to the relevant issues listed in Section 1.4 that have driven and focus the environmental analysis. The following includes anticipated changes to the existing environment including direct and indirect impacts, irreversible and irretrievable commitment of resources, unavoidable effects and cumulative impacts.

4.1.1. Cumulative Impacts. Cumulative impact is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7).

4.1.2. Irreversible and Irretrievable Commitment of Resources.

a. Irreversible. An irreversible commitment of resources is one in which the ability to use and/or enjoy the resource is lost forever. One example of an irreversible commitment might be the mining of a mineral resource.

b. Irretrievable. An irretrievable commitment of resources is one in which, due to decisions to manage the resource for another purpose, opportunities to use or enjoy the resource as they presently exist are lost for a period of time. An example of an irretrievable loss might be where a type of vegetation is lost due to road construction.

4.2. NO ACTION ALTERNATIVE.

4.2.1. Physical

a. Water quality. There would be no water quality impacts from the implementation of this alternative.

b. Navigation. There would be a long-term moderate adverse impact on navigation from the continued use of the channel in its existing condition. Impacts on navigation would include decreased vessel safety and a limitation on the size of the vessel using the port and the quantity of material being transported.

c. Aesthetics. No impacts are anticipated to the project's existing aesthetic resources with the no action alternative.

4.2.2. Biological

a. Manatees. There would be no impacts from the implementation of this alternative.

b. Seagrasses. There would be no impact on seagrasses from implementation of

this alternative.

c. Migratory birds. There would be no impact on migratory birds from the implementation of this alternative.

4.2.3. **Social**

a. Recreation. No impacts are anticipated to the project's existing recreation resources with the no action alternative.

b. Historic, Archeological, and Cultural Resources. This alternative will not affect cultural resources included in or eligible for inclusion in the National Register of Historic Places.

4.2.4. **Economic impacts**. There would be a long-term minor impact on the port and Tampa area from the navigable limitations of this channel for use by certain size vessels or the quantity of materials being able to be transported through the channel.

4.2.5. **Cumulative effects**. There would be no cumulative effects from the selection of this alternative.

4.2.6. **Unavoidable effects**. There would be no unavoidable effects from the selection of this alternative.

4.2.7. **Irreversible and Irretrievable Resource Commitments**. There would be no irreversible or irretrievable commitment of resources from the selection of this alternative.

4.3. **ALTERNATIVE Plan C1 - CMDA-3D Disposal.**

4.3.1. **Physical**

a. Water quality. There would be a short-term minor increase in turbidity levels at the dredging site from the suspension of material in the water column. However, these turbidity levels would be within State standards.

b. Navigation. There would be a moderate short-term adverse impact on navigation of vessels entering and leaving the port during construction. There would be a long-term moderate benefit to vessels entering this port area from safer operations and from increased vessel size handling capabilities.

c. Aesthetics. Aesthetic resources of Tampa Harbor could be minimally impacted with the deposit of the project's dredged material on CMDA-3D. The dikes on the island would be raised to accommodate the dredging of the Big Bend Channel. Air pollution, water turbidity, and noise pollution increases can be expected during project construction. Temporary construction impacts will not adversely affect the existing aesthetics found in the Tampa Harbor area.

4.3.2. **Biological**

a. Manatees. There would be no impact on manatees anticipated provided the Federal and State manatee protection conditions are adhered to.

b. Seagrasses. There would be no impact on seagrasses from the dredging and the subsequent turbidity if State water quality standards are met.

c. Migratory birds. There would be a short-term moderate impact on migratory nesting should the construction occur during the 1 April through the 31 August timeframe. However, this impact will be minimized by implementing the District's Migratory Bird Protection Policy. If the work occurs outside this timeframe, there would be no adverse impact on these birds. There would be a long-term moderate benefit to nesting by providing additional suitable habitat for nesting.

4.3.3. **Social**

a. Recreation. Recreation resources could be minimally impacted by the deposit of dredged material from the proposed Big Bend Channel Navigation project onto CMDA-3D. The proposed project widening and deepening would require CMDA-3D dikes to be raised. The steep sides of the dikes would further adversely impact recreation activities using the shoreline of the disposal area.

b. Historic, Archeological, and Cultural Resources. As previously described in this document, no significant cultural resources are recorded in the area of impact for this study. Based on coordination for the reconnaissance report, the SHPO concurred with the Jacksonville District's determination that significant cultural resources are not likely to be affected by the proposed channel improvements. Formal coordination with the SHPO for the feasibility phase of this study has been completed.

4.3.4. **Economic Impacts**. There would be a minor short-term stimulus to the local economy from the sale of goods and services in support of the construction. There would be a long-term minor impact on the regional economy from the increased safe passage of all types of commercial vessels into this port area.

4.3.5. **Cumulative effects**. There would be no cumulative effects from the selection of this alternative.

4.3.6. **Unavoidable effects**. There would be local temporary increases in turbidity levels around the dredging operations and a minor impact on navigation from the presence and operation of the dredging equipment.

4.3.7. **Irreversible and Irretrievable Resource Commitments**. There would be no irreversible or irretrievable commitment of resources except for the expenditure of fuels for the dredging equipment.

4.4. ALTERNATIVE Plan C4 - Sunken Island Disposal.

4.4.1. Physical

a. Water quality. There would be a short-term minor increase in turbidity levels at the dredging site from the suspension of material in the water column. However, these turbidity levels would be within State standards.

b. Navigation. There would be a moderate short-term adverse impact on navigation of vessels entering and leaving the port during construction. There would be a long-term moderate benefit to vessels entering this port area from safer operations and from increased vessel size handling capabilities.

c. Aesthetics. Aesthetic resources of Tampa Harbor could be minimally impacted with the deposit of the project's dredged material on CMDA-3D. The dikes on the island would be raised to accommodate the dredging of the Big Bend Channel. Air pollution, water turbidity, and noise pollution increases can be expected during project construction. Temporary construction impacts will not adversely affect the existing aesthetics found in the Tampa Harbor area.

4.4.2. Biological

a. Manatees. There would be no impact on manatees anticipated provided the Federal and State manatee protection conditions are adhered to.

b. Seagrasses. There would be no impact on seagrass beds located adjacent to the island from the placement of material if State water quality standards are met. This would be accomplished by the use of turbidity curtains around the area and avoiding the seagrass beds. If the beds cannot be avoided the loss would be mitigated.

c. Migratory birds. There would be a short-term moderate impact on migratory nesting should the construction occur during the 1 April through the 31 August timeframe. However, this impact will be minimized by implementing the District's Migratory Bird Protection Policy. If the work occurs outside this timeframe, there would be no adverse impact on these birds. There would be a long-term moderate benefit to nesting by providing additional suitable habitat for nesting.

4.4.3. Social

a. Recreation. Recreation resources could be minimally impacted by the deposit of dredged material from the proposed Big Bend Channel Navigation project onto CMDA-3D. The proposed project widening and deepening would require CMDA-3D dikes to be raised. The steep sides of the dikes would further adversely impact recreation activities using the shoreline of the disposal area.

b. **Historic, Archeological, and Cultural Resources**. As previously described in

this document, no significant cultural resources are recorded in the area of impact for this study. Based on coordination for the reconnaissance report, the SHPO concurred with the Jacksonville District's determination that significant cultural resources are not likely to be affected by the proposed channel improvements. Formal coordination with the SHPO for the feasibility phase of this study has been completed.

4.4.4. **Economic Impacts**. There would be a minor short-term stimulus to the local economy from the sale of goods and services in support of the construction. There would be a long-term minor impact on the regional economy from the increased safe passage of all types of commercial vessels into this port area.

4.4.5. **Cumulative effects**. There would be no cumulative effects from the selection of this alternative.

4.4.6. **Unavoidable effects**. There would be local temporary increases in turbidity levels around the dredging operations and a minor impact on navigation from the presence and operation of the dredging equipment.

4.4.7. **Irreversible and Irretrievable Resource Commitments**. There would be no irreversible or irretrievable commitment of resources except for the expenditure of fuels for the dredging equipment.

4.5. ALTERNATIVE Plan C3 - Whiskey Stump Key Disposal

4.5.1. Physical

a. Water quality. There would be a short-term minor increase in turbidity levels at the dredging site from the suspension of material in the water column. However, these turbidity levels would be within State standards.

b. Navigation. There would be a moderate short-term adverse impact on navigation of vessels entering and leaving the port during construction. There would be a long-term moderate benefit to vessels entering this port area from safer operations and from increased vessel size handling capabilities.

c. Aesthetics. Aesthetic resources of Tampa Harbor could be minimally impacted with the deposit of the project's dredged material on CMDA-3D. The dikes on the island would be raised to accommodate the dredging of the Big Bend Channel. Air pollution, water turbidity, and noise pollution increases can be expected during project construction. Temporary construction impacts will not adversely affect the existing aesthetics found in the Tampa Harbor area.

4.5.2. Biological

a. Manatees. There would be no impact on manatees anticipated provided the

Federal and State manatee protection conditions are adhered to.

b. Seagrasses. There would be no impacts on seagrasses from dredging and placing material in disposal areas if State water quality standards are met. This would be accomplished by the use of turbidity curtains around the placement area.

c. Migratory birds. There would be a short-term moderate impact on migratory nesting should the construction occur during the 1 April through the 31 August timeframe. However, this impact will be minimized by implementing the District's Migratory Bird Protection Policy. If the work occurs outside this timeframe, there would be no adverse impact on these birds. There would be a long-term moderate benefit to nesting by providing additional suitable habitat for nesting.

4.5.3. **Social**

a. Recreation. Recreation resources could be minimally impacted by the deposit of dredged material from the proposed Big Bend Channel Navigation project onto CMDA-3D. The proposed project widening and deepening would require CMDA-3D dikes to be raised. The steep sides of the dikes would further adversely impact recreation activities using the shoreline of the disposal area.

b. Historic, Archeological, and Cultural Resources. As previously described in this document, no significant cultural resources are recorded in the area of impact for this study. Based on coordination for the reconnaissance report, the SHPO concurred with the Jacksonville District's determination that significant cultural resources are not likely to be affected by the proposed channel improvements. Formal coordination with the SHPO for the feasibility phase of this study has been completed.

4.5.4. **Economic Impacts**. There would be a minor short-term stimulus to the local economy from the sale of goods and services in support of the construction. There would be a long-term minor impact on the regional economy from the increased safe passage of all types of commercial vessels into this port area.

4.5.5. **Cumulative effects**. There would be no cumulative effects from the selection of this alternative.

4.5.6. **Unavoidable effects**. There would be local temporary increases in turbidity levels around the dredging operations and a minor impact on navigation from the presence and operation of the dredging equipment.

4.5.7. **Irreversible and Irretrievable Resource Commitments**. There would be no irreversible or irretrievable commitment of resources except for the expenditure of fuels for the dredging equipment.

5.0. **LIST OF PREPARERS**. The following professionals prepared the draft Environmental Assessment for the Tampa Harbor Big Bend Navigation Study Project.

NAME	DISCIPLINE	EXPERIENCE	ROLE IN PREPARING EIS
William J. Fonferek	Biologist	18 years environmental impacts assessment	Environmental Study Manager, Biological Impact Assessment, Endangered Species Coordination
Tim Murphy	Hydraulic Engineer	6 years planning experience	Technical Manager
Paul Stevenson	Landscape Architect	14 years experience recreation design, construction and development	Recreation Resources Analysis
Janice Adams	Archeologist	16 years cultural resources assessment	Cultural Resources
Matt Miller	Environmental Engineer	5 years	HTRW and Water Quality Investigations and Impact Assessment

6.0. CONSULTATION WITH OTHERS - PUBLIC INVOLVEMENT PROCESS.

6.1. Scoping was conducted by letter dated 26 November 1990 to develop issues, concerns, and ideas about the project. The comments received expressed concerns for impacts on migratory birds and manatees (Exhibit III).

6.2. The draft EA was circulated to all interested parties for comment by cover letter dated 28 June 1996. The following comments were received (Exhibit III):

6.2.1. The Florida Division of Historical Resources responded to the request for comments by letter dated 7 August 1996, stating that no archeological or historical sites are recorded for or likely to be present in the project area and it is unlikely that such sites would be affected. Therefore, it is the opinion of this office that the proposed work would not affect historic properties listed on or eligible for the *National Register of Historic Places.*

6.2.2. The Tampa Bay Regional Planning Council responded by letter dated 1 August 1996, stated it would submit its comments following the receipt of additional information.

6.2.3. The National Marine Fisheries Service responded by letter dated 23 July 1996 stating that the proposed work is consistent with previous comments and they offer no additional comments.

6.2.4. The Clearwater Power Squadron, Inc., responded by letter dated 15 July 1996 noted no serious environmental problems and offered their assistance.

6.2.5. The US Department of Housing and Urban Development responded by letter dated 10 July 1996, stating that the review indicates no significant adverse impacts on any HUD programs.

6.2.6. The US Environmental Protection Agency responded by letter dated 12 August 1996 stating that the proposals impacts appear relatively straight forward and mitigation should compensate for significant alterations. We believe that the best management measures would be implemented during construction and any changes directed by monitoring should lessen short-term adverse effects. The environmental features proposed appear to be excellent and should establish a precedent for future development.

6.2.7. The US Department of Interior responded by letter dated 22 August 1996 based on comments received from the US Fish and Wildlife Service (Service). The Service stated that it had concerns even with the manatee protection conditions. While no dredge has ever taken a manatee, it has been documented that associated boat traffic has caused injury or death. They also stated that seagrasses, an attractant to manatees, have been located in recent year north of the project area in an area referred to as the "kitchen". The Service agrees that the bulkhead should keep manatees out of the turning basin. The Service requests that we reconsider the decision to dredge during the winter months (15 November-31 March) because the project is adjacent to a state-designated manatee sanctuary. It recommended an alternative solution would be to dredge the inner channel first and the

outer channel during the colder months. If this were not possible, then, a Service-approved biologist be used as an observer at the project and that all service boats with propellers be fitted with guards. They recommend disposal at CMDA-3D be done outside the bird nesting season and that any nourishment of Sites C-3 or C-4 avoid impacting seagrass beds.

RESPONSE: We responded by letter dated 3 September 1996 stating we plan to implement the Districts' Migratory Bird Protection Policy and avoid impacting bird nesting season. We do agree that manatees could be impacted by the dredging project and plan to implement the standard manatee conditions, add a special manatee observer to the operation, require fitting of guards on propellers and restrict boats speeds to no wake. We disagree with the use of any window because no deaths or injuries have been ever attributed to Corps dredging or auxiliary equipment, the dredging is segregated from the power plant outfall by a bulkhead, and no seagrasses are located within the project area. The window would significantly limit our ability to construct the project. If limited construction to daylight hours, the project would cost three times as much and take twice as long. Since we are trying to avoid the bird nesting season and the manatee window, there would not be enough time to construct the channel. We believe the impacts to nesting are almost certain and the impacts to manatees unlikely if we follow the precautions outlined above.

6.2.8. The Florida Department of Community Affairs acting as the State Clearing house for comments responded by letter dated 29 August 1996, requesting an extension until 17 September to provide their comments.

RESPONSE: Based on the regulations published by the Department of Commerce for Coastal Zone Consistency, we are giving the State an additional 15 days to respond.

6.2.9. We have been in constant contact with the DEP and Clearinghouse regarding a response and any problems associated with their response. A conference telephone call was conducted with Florida DEP, Tampa Port Authority, Florida Game and Freshwater Fish Commission and the Clearinghouse on 9 September 1996. On 10 September we conducted a second conference call with DEP and the Clearinghouse regarding a modification to the manatee protection conditions. By letter dated 10 September 1996, we agreed to the additional conditions recommended by DEP. Based on this resolution, DEP provided the Clearinghouse with a concurrence in our Coastal Zone Consistency Determination.

6.2.10. Mr. Roger Johansson, representing the City of Tampa, Bay Study Group, responded by letter dated 21 August 1996 stating concerns for seagrasses in the project area and provided information concerning their location.

RESPONSE: We will incorporate the seagrass information provided.

6.2.11. The Florida Department of Community Affairs, acting as the State Clearinghouse for review of federal project responded by letter dated 13 September 1996 stating that proposal had been coordinated the Environmental Assessment in accordance with Executive Order 12372 and the Coastal Zone Management Act (CZMA). They received comments

from the Department of Environmental Protection stating concerns for the large number of manatees that congregate in the area. It found that as initially proposed the project was unacceptable. However, with the modifications agreed upon with DEP and the Corps (See Section 6.2.9) the project is consistent with the CZMA. The DEP also recommended the use of a hydraulic dredge instead of a clamshell. It also recommended taking precautions from impacting submerged aquatic vegetation. The DEP also stated that an Environmental Resources Permit would be required for construction. The Southwest Florida Water Management District recommended additional analysis of filling the holes and restoration proposed for the Whiskey Stump Key area. The Florida Game and Freshwater Fish Commission indicates that several listed species occur in the area and recommends measures to protect nesting birds and seagrass beds in the area.

RESPONSE: We have incorporated into our manatee protection conditions (Exhibit I) additional measures to insure that manatees are protected. We cannot exclude certain types of equipment from bidding on our contracts unless it is restricted through other legal means such as the Endangered Species Act or Water Quality Certifications. The hydraulic dredge has been determined to be the most economical method for this project for cost estimating purposes. We have surveyed the area and the dredging would not directly affect seagrasses. Seagrass are found adjacent to the beneficial use sites at Whiskey Stump Key area and impacts would be minimized by the use of silt curtains. A water quality permit would be sought for the work in accordance with the Memorandum of Agreement between the Corps and DEP even though dredging does not require a permit in accordance with Section 301 of the Clean Water Act. The Corps currently has results of various studies conducted by the Waterways Experiment Station (WES) concerning open-water filling and capping of silt materials. During the preparation of Plans and Specifications for the filling of these holes, we will consult with the experts at the WES. We have always recognized the impacts on migratory bird nesting in the area and because of our concerns have developed the Districts Migratory Bird Protection Policy which will be implemented for this project.

6.3. A notice of a public meeting was sent to of all interested parties by letter dated 10 July 1996. The public meeting was conducted in Tampa at the Tampa Port Authority Office on 29 July 1996. A list of attendees is attached.

6.4. A public presentation was given to the Tampa Bay Regional Planning Council, Agency on Bay Management by Mr. Tim Murphy (CESAJ-DP-I) on 12 August 1996.

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8.0. REFERENCES

City of Tampa, Department of Sanitary Sewers, Bay Study Group. 1 March 1996. *Seagrass and Caulerpa Monitoring in Hillsborough Bay, Seventh Annual Report.*

Springer and Woodburn. January 1960. An Ecological Study of the Fishes of the Tampa Bay Area.

Tampa Bay Management Study Commission, Tampa Bay Regional Planning Council. The Future of Tampa Bay.

Taylor Biological Company. July 1973. Biological Studies and Inventory Tampa harbor - Florida Project.

U.S. Army Corps of Engineers, Jacksonville District. April 1980. Navigation Study for Tampa Harbor, Big Bend Channel, and Alafia River, Florida. Reconnaissance

Report - 10128 (Stage I).

U.S. Army Corps of Engineers, Jacksonville District. September 1984. Tampa Harbor - Alafia River and Big Bend Channel Florida. Feasibility Report and Environmental Impact Statement.

U.S. Army Corps of Engineers, Jacksonville District. July 1986. Tampa Harbor, Florida. General Design Memorandum. Branch Channels.

U.S. Army Engineer Waterways Experiment Station. April 1978. Dredged Material Research Program Technical Report D-78-14. Colonial Bird Use and Plant Succession of Dredged Material Islands in Florida. Vol. II: Patterns of Plant Succession.

U.S. Army Engineer Waterways Experiment Station. April 1978. Dredged Material Research Program Technical Report D-78-14. Colonial Bird Use and Plant Succession of Dredged Material Islands in Florida. Vol. I: Sea and Wading Bird Colonies.

U.S. Army Engineer Waterways Experiment Station. December 1978. Dredged Material Research Program. Development and Management of Avian Habitat on Dredged Material Islands.

U.S. Army Engineer Waterways Experiment Station. December 1978. Dredged Material Research Program. An Introduction to Habitat Development on Dredged Material.

U.S. Army Engineer Waterways Experiment Station. October 1983. Tampa Bay Dredged Material Disposal Site Analysis.

U.S. Army Engineer Waterways Experiment Station. 1994. Letter Report. Final Findings on Big Bend Channel Navigation Study, Tampa Bay, Florida.

U.S. Department of Commerce, National Oceanic and Atmospheric Administration, NOAA Estuarine Programs Office. February 1989. NOAA Estuary-of-the-Month Seminar Series NO. 11. Tampa and Sarasota Bays: Issues, Resources, Status, and Management.

U.S. Department of the Interior Fish and Wildlife Service. Fishery Bulletin, Volume 65 No. 2.

U.S. Department of the Interior Fish and Wildlife Service. June 1986. Mitigation Options for Fish and Wildlife Resources Affected by Port and Other Water-Dependent Developments in Tampa Bay, Florida.

U.S. Department of the Interior Fish and Wildlife Service. December 1984. Tampa Bay Environmental Atlas.

U.S. Department of the Interior Fish and Wildlife Service. September 1988. The Ecology of Tampa Bay, Florida: An Estuarine Profile.

U.S. Department of the Interior Geological Survey. 1980. Preliminary Simulated Tidal Flow and Circulation Patterns in Hillsborough Bay, Florida.

U.S. Environmental Protection Agency. April 1995. Final Environmental Impact Statement. Designation of the Tampa Ocean Dredged Material Disposal Site.

U.S. Geological Survey Water-Supply Paper 2282. 1987. Tidal-Flow, Circulation, and Flushing Changes Caused by Dredge and Fill in Tampa Bay, Florida.