6. ALTERNATIVES.

6.01 General. The alternatives available to the U.S. Army Corps of Engineers for action on permit applications are more limited than those for Federal projects undertaken directly. The Corps of Engineers may only deny, grant, or grant with conditions, the applications before them. A Federal agency does not have the latitude on permit applications which it has on its own projects to develop alternatives. Also, an understanding of the basis for the project as submitted is important to determine the relative impacts of possible alternatives so that a decision regarding the Federal action to be taken is made with knowledge of reasonable alternatives. Therefore, this section discusses the alternatives available to the Federal government, and to the Nueces County Navigation District No. 1.

6.02 Alternatives Available to the Federal Government. The only alternatives available to the Corps of Engineers are to simply grant the Nueces County Navigation District No. 1 its permit as requested, deny the permit, or grant it with conditions. By granting the permit, the applicant would be allowed to construct the project as described in Section 1 of the statement. Denial of the permit would essentially be adoption of the no action alternative.

6.03 No Action. This alternative would be to deny the permit application and allow no action to be taken on construction of the deep port facilities by the applicant.

6.04 In the absence of a deeper channel that would allow an increase in the efficiency of ocean-going cargo movements through Harbor Island, cargo movements would continue in smaller, shallower-draft vessels, the size of which would be limited by the existing Federally authorized project depth of 45 feet. As the commerce through the port continues to increase and the average size of ocean-going vessels increases through obsolescence and attrition, an increasing number of ships would have to either light load or call at other ports. Beyond a certain size, highly loaded vessels would be restricted from the Port of Corpus Christi either because of width, draft, or height. The economic growth of the area would probably be slow and the lack of the transport benefits of a deep channel might discourage long-range industrial growth and cause a decline in the local refinery industry if it became less competitive with other areas. This competitive posture is particularly significant since greater than 85 percent of the production of local refineries is consumed outside of the state of Texas.

6.05 The no action alternative would result in a savings in resources (labor, material, and money) needed to construct the project. Additionally, potentially adverse environmental effects (discussed in Section 4) associated with the construction of the project would be avoided.

6.06 Granting the Permit with Conditions. Another alternative available to the Federal government is to grant the permit with conditions or restrictions. This action would essentially serve to modify the project so that it would be more socially and environmentally acceptable. These modifications could include alternate methods of dredging and disposal, and other structural and non-structural changes to the project including operational constraints. Such action may make the project no longer economically attractive.

6.07 Some structural and non-structural changes may negatively affect navigational safety. For example, the channel, turning basin or docking basin could be realigned to avoid a particularly environmentally sensitive area. Location and arrangement of surge tankage, levees, docks, and other facilities associated with the project could be modified if it were believed the project would be more environmentally sound. Other requirements which could be imposed including operational changes and more strict environmental monitoring requirements.

6.08 Various Types of Dredges Available. Dredges are generally divided into two categories--mechanical and hydraulic. The major types of mechanical dredges are dipper dredges, ladder dredges, and bucket dredges. Hydraulic dredges include hopper dredges, pipeline (or cutter suction) dredges, and side casting dredges.

6.09 Environmentally, hopper and pipeline dredges are the least hazardous since dredged material is taken up by pumps, producing only limited turbidity, and deposited in a controlled manner onto prearranged disposal sites. Dipper and bucket dredges have a dragging or scooping motion which causes high turbidity and scatters dredged material.

6.10 Dipper Dredge. The dipper dredge is basically a power shovel, such as is used for earth excavation, which has been mounted on a barge. It has the advantage of being capable of excavating hard materials such as blasted rock or loose boulders that cannot easily be removed by other types of dredges. Most such dredges do not excavate more than 60 feet in depth. The barge, which serves as the work platform for the power shovel, has spuds to anchor it in the work area while operating. Two spuds are used at the forward end to stabilize the dredge, and a single spud is centered at the stern of the barge.

6.11 Ladder Dredge. The ladder dredge is so named because of its chain of buckets passing over and under a long steel frame or ladder. This ladder is usually mounted in the middle of the dredge and extends toward the front of the barge. The operating depth of the ladder can be altered to suit the channel depth being excavated but is limited by design considerations. Larger dredges in this class use buckets of approximately 2 cubic yard capacity and can operate at depths of 100 feet. Dredging with the ladder dredge is accomplished by forcing the teeth of the buckets into the material to be excavated. The dredge is set up over the cut with an anchored cable set out ahead to pull on and side cables placed to either side to stabilize the barge while working. The ladder dredge is advantageous for dredging varied types of material at greater depths in a comparatively confined location. Disposal of the material from such a dredge presents a problem. No large marine ladder dredges are available in the United States.

6.12 Bucket Dredge. The bucket dredge is so named because it utilizes a bucket to excavate material to be dredged. The type bucket utilized (clamshell, orangepeel, or dragline) often can be changed to suit the job conditions and material to be removed. Different size buckets can be employed by the same dredge, again dependent on the character of the dredged material. Buckets holding up to 15 cubic yards are currently in use. The bucket dredge is mostly used to remove material in confined areas, such as around docks and piers, or where small amounts of material are to be dredged and placed on nearby areas. It is generally not economical for large scale excavation projects unless nearby disposal areas are available.

6.13 Side Casting Dredge. The side casting dredge evolved from modification of hopper dredges to provide overboard discharge of dredged material. Under certain conditions this type of dredging is feasible and by far the most economical means of providing and maintaining channel depths. These dredges can be designed for side casting only, or the conventional hopper dredge can be equipped to provide the capability for side cast dredging. All of this equipment is self-propelled with the discharge of the dredged material usually accomplished through a boom pipeline alongside the dredged channel. Side casting dredges are particularly effective in locations where the littoral currents do not return a significant amount of the dredged material to the navigation channel. The side caster can handle the same range of material that a hopper dredge can. Its ability to maneuver in the channel makes this dredge particularly useful in opening shallow inlets to the ocean. Side casting dredges range in discharge pipeline size from 12 inches to 26 inches.

6.14 Hopper Dredge. The use of hopper dredges to construct the entire project and dispose of the material at sea is a possible consideration. However, the economic use of hopper dredging requires disposal areas in reasonable proximity to the area to be dredged and the ability of the dredge to move fully over the dredging site. Hopper dredges are not designed for, nor can they be operated, so as to remove emergent land masses efficiently nor can they operate in small confined areas or dredge in corners or alongside docks.

6.15 Because of the time involved in transporting the dredged material to an offshore disposal site, the time required construct the entire project by hopper dredge would be considerably longer than by the proposed methods. Disturbance or removal of the bottom dwelling organisms would be the same as would occur with pipeline dredging. Localized turbidity and water quality problems in the immediate area of dredging would also occur with hopper dredging but would be prolonged because of the longer time required. The minor effects on air quality caused by hopper dredge exhaust would be comparable to those caused by a pipeline dredge. Use of a hopper dredge would eliminate the adverse environmental effects of disposing the dredged material in bay and wetland areas, but would require more disposal offshore. Use of a hopper dredge would not permit the restoration of the southern end of San Jose Island.

6.16 Alternatives Available to the Applicant. Several alternatives are available to the applicant which would provide the same end result of importing large quantities of petroleum at a cheaper price. These include offshore facilities and alternate modes of importing crude oil. The development of deep draft tanker loading and unloading facilities in some offshore waters may be subject to the legal constraints imposed by the Deepwater Port Act of 1974, which governs the construction and operation of oil terminal facilities located beyond the territorial sea. Such facilities constructed outside the seaward boundary of Texas would be subject to this Act.

6.17 Offshore facilities. Offshore terminals have been developed in many parts of the world for loading and unloading crude oil and other bulk materials. Pipeline transshipment to shore is generally more economical than dredging close to shore, and reduces harbor congestion.

6.18 Five alternate systems in use today are the conventional multiple-point buoy mooring, single point buoy mooring, single anchor leg mooring, sea islands, and trestle or causeway-connected piers. The acceptability of these systems depends on engineering considerations at a particular site. Where offshore storage is preferred, construction of an artificial island may, under certain conditions, be desirable. The criteria for these types of facilities are discussed separately below. In addition, there are many variations of these facilities including floating breakwaters which could provide for integral storage within the breakwater structure itself, and enclosed harbor and terminal complexes.

6.19 Conventional Buoy Mooring. This mooring system uses a number of mooring buoys to maintain the tanker in a given position and orientation. Flexible hoses connect the vessel to an underwater pipeline which is used to carry the crude oil from tanker to a tank farm on land. Multiple point mooring facilities have been in operation for years in many parts of the world. However, because tankers are essentially restricted to two orientations (180° apart), this system is limited to sites where prevailing winds are longitudinal to the berth or, at least, to locations where strong winds are not expected broadside to the berth.

6.20 This facility can become untenable in beam or quartering winds greater than 25-35 miles per hour. Limiting current conditions are normally one knot for beam or quartering currents and two knots or more for head currents. In addition, 100,000 DWT appears to be the limiting size for multi-CBM moorings.

6.21 Single Point Mooring Buoy (SPM). This mooring system consists of a flat cylindrical floating buoy with its vertical axis held in position by a multi-leg system of anchors and chains. The buoy has a central piping manifold topped by a single or multiple-product swivel and mooring ties, the former connected by under-buoy hoses to a submarine pipeline. A turntable on top carries pipes from the central swivel to the side of the buoy where they connect to floating hoses and then to the tanker manifold. The tanker is usually moored to two nylon hawsers running from the buoy turntable to the bow of the ship. This permits the tanker to berth into prevailing winds and to move with changes in wind and/or current direction while at berth. Such mooring operations usually require a launch for line running and hose handling. When launch operations are required, berthing is generally halted by six-foot seas. There is presently no way of controlling or containing a spill which occurs at an SPM in the open sea such as the Gulf of Mexico. Unloading operations take place in the open, unprotected sea, in contrast to the sheltered condition of an inshore port.

6.22 Due to the vessel approach requirements, for the same required water depth as for the proposed inshore facility the SPM would have to be located farther offshore from Corpus Christi, thereby probably requiring a permit from DOT for its construction.

6.23 Despite some drawback SPM's have been employed at offshore locations where sea and weather conditions may be severe. Currently proposed practices for SPM's suggest ceasing of offloading in 12-foot seas and berth abandonment in 15-foot seas. Berthing operations have limitations similar to CBM's and require a 4,000-to 5,000-foot clear radius around the buoys for approval, and for vessel survey. As the tanker unloads, ballast water is taken on to maintain a safe and stable draft.

6.24 One problem experienced with SPM's is a tendency of tankers to creep towards the buoy during calm weather and slack tide. This can lead to possible overrunning of the buoy and fouling of the buoy mooring chanins or submarine hoses by the tankers' bulbous bows. Floating hoses are particularly susceptible to vessel damage, particularly at night, and to wave damage in heavy seas. Turntable sticking and subsequent wrapping of hoses around the buoy can also cause damage. Further, in spite of the fact that pressure drop sensitive devices and volume flow measurement can be employed to detect leaks of sufficient magnitude, potential exists for fairly substantial leaks and spills to be undetected if they occur in the underwater portion of the system, particularly if unloading is being done at night. SPM's require a high degree of maintenance, particularly in the hose systems.

6.25 Single Anchor Leg Moorings (SALM). The single anchor leg mooring is a modification of the SPM system. The hose and product swivel mechanism of the SALM is located on the sea bed. The buoy floats on the water and is anchored to the bottom by a single chain. Should the bow of the vessel strike the SALM while berthing or drift while berthed, the buoy would be pushed aside and submerged without materially affecting the hose and product swivel mechanisms. However the system still suffers from the vulnerability of the floating hoses the potential for unobserved leakage, and the inability to contain spills should they occur. This system has been installed at two locations in depths of 85 and 140 feet and can be designed for mooring tankers exceeding 500,000 DWT. Mooring and berthing limitations with this system are similar to the SPM.

6.26 Single Point Mooring Pier. This facility consists of a pylon or tower fixed to the sea floor with a long swivel-mounted semi-submersible floating arm, which has a floating tower at its end. The tanker moors at the bow to the tower, permitting it to feather into the wind, seas, and current and to assume a line of least resistance. The oil moves from the vessel's manifold through a short hose to the floating structure and into the submarine pipeline. This facility is relatively expensive to install, costing two to five times as much as a monobuoy. The floating arm may be vulnerable to sea conditions. However, it has a much higher capacity than a monobuoy, as its hoses are shorter and they flex only where connected to the tanker manifold. In addition, single pile moorings endeavor to eliminate the monobuoy's major disadvantages (i.e. hose vulnerability and system maintenance) by replacing flexible elements with a rigid truss structure.

6.27 Piers. Piers, like sea islands, are fixed structures. This type of docking facility is usually placed close to an existing shore or artificial island. Cargo is carried ashore either by a trestle-or causeway-supported pipeline for liquid or by conveyor for dry material from the mooring facility. Since the ship is moored at a fixed berth, tugs are required for safe berthing. Waves which prevent tugs from completely controlling the operation will stop berthing at the facility. Construction of a breakwater to shelter the docking area permits the facilities to be used in much higher seas. The cost of a breakwater must be weighed against the cost of shut-down during adverse sea conditions. This type of system does not appear feasible inasmuch as a pier would have to extend in the Gulf approximately 11 miles to accomodate the same size vessels as the proposed project. If the pier were shorter, dredging would be required. Also, in all cases a breakwater would, in all probability, be required.

6.28 Sea Island. A sea island is a fixed structure to which a vessel is moored and which keeps the ship restrained in position and orientation. Fixed structures are usually used where prevailing winds are parallel to the berth or where strong broadside winds are expected infrequently.

This system permits installation of several all metal loading arms allowing high oil transfer rates. Ships may dock at both sides of the sea island concurrently, and can easily be fueled or bunkered. Surveillance of the oil transfer can easily be conducted by trained personnel. For other mooring systems, these personnel would have to operate either from aboard the tanker or from special launches, an inconvenience if the facility is some distance from shore. The oil is transferred to shore via a submarine pipeline. Fixed berths require tugs to berth tankers safely and require more shelter from waves than do SPM's or CBM's. Therefore, wave conditions that preclude tugs from maintaining complete control of the operation will stop berthing. Similarly, wave height and direction will affect the vessel when moored. A tanker can remain moored in higher waves from the bow and stern than it can from the quarter or beam. Beam and quartering currents, along with or apart from beam and quartering winds, will also have an affect on a berthing tanker and a moored tanker.

6.29 Impacts of Monobuoy Systems. Monobuoys or floating-type structures will normally have little direct impact on the marine environment. Of the alternatives considered, these structures offer the least potential damage to the environment. Since monobuoys displace only a small area, they will not significantly affect current or circulation patterns other than in the immediate area. Since only a very small area is needed for anchorage of a monobuoy, there will be little impact upon the bottom habitat and its associated biotic communities. Like artificial islands, monobuoys will probably attract finfishes, but in much smaller numbers. In general, impacts of monobuoys on the marine environment and its associated biota will not be of great importance. However, the loading hoses require frequent replacement and since part of the hoses and the submarine pipeline are not visible from the surface, the possibility of a large and undetected oil spill during unloading is greater than with a system which is fully exposed to view and in which oil spills could be contained. It is not practical with the present state of the art to contain a spill at an open sea monobuoy.

6.30 Artificial Island. This is probably the most expensive type of deep water port facility. However, its versatility is practically unlimited. An island would probably be built by placing a rock fill dike around its perimeter; hydraulic fill would then be pumped in and compacted to form the island. Simultaneously, a stone revetment would be built around the outside perimeter of the dike. The revetment would be protected with precast concrete armor units massive enough to remain stable under severe sea conditions. The island size would be determined by the types of material shipped through the facility. A marginal pier or sea island to handle the actual berthing would be attached to the island. The island could be used for the unloading, storage, and transshipment of both liquid and solid commodities. Limitations of the artificial island are similar to those of the marginal pier.

6.31 The impacts of artificial islands with breakwaters are primarily related to water movement; however, certain segments of biota will definitely be impacted. The exact nature of impacts on water movement will depend upon the size and shape of an island and its location in the Gulf. A structure, such as the typical artificial island and breakwater, will act as a barrier to waves and will alter current and water circulation. The exact mechanisms of change to these parameters is not known. Several factors, such as water depth, location within the Gulf, and tidal influences, determine how circulation patterns will be influenced.

6.32 The direct impacts of an artificial island in the Gulf on marine organisms would primarily be related to destruction of bottom habitat. Benthic organisms existing at the site will be destroyed by dredge and fill operations. Removal of materials, such as sand for island construction, will affect the resident biota of the borrow area.

6.33 Some benefits may be derived from the construction of an artificial island. In the case of finfishes, an artificial island may create a desirable habitat where none existed before, increasing the concentration of certain species. The face of such a structure, often constructed of rock with holes and irregular surfaces, provides shelter and feeding areas unlike those of the surrounding marine habitat.

6.34 Floating Islands. Floating superports are impracticable because of their high cost (investment and maintenance) and sensitivity to sea conditions. Breakwaters can be built around these facilities to increase utilization but only with significant investment cost increases. Additionally, the floating superport concept has never been employed, even though extensive design studies have been performed. In general, these studies indicate the feasibility of modular concrete, or prestressed concrete, construction with offshore assembly and the applicability of the islands for offshore use. Moorings would be massive, and some sort of flexible connection still would be required in the cargo connection between island and submarine pipeline. Articulated mechanical arms, however, could provide for fluid cargo transfer to the island from a ship moored alongside. The impacts of such as system would probably be similar to those resulting from an SPM.

6.35 Submarine Pipeline Impacts Which Would Result from Any Offshore System. Submarine pipeline impacts in open water areas consist primarily of disruption of bottoms and alteration of water quality from construction activities. Benthic organisms in the area where the pipeline is laid will be destroyed or displaced. However, after the line is laid and covered with soil, benthic organisms will recolonize the area.

6.36 Water quality problems associated with pipeline construction are similar for those described for dredging; however, due to the much smaller amount of bottom disruption required for a pipeline, these problems are much less severe. The primary water quality problem associated with pipeline construction is increased turbidity in the immediate construction areas. These impacts are temporary, lasting only during the actual construction period.

6.37 Pipeline construction impacts in bay-estuary systems are similar to those discussed for the open Gulf area; however, since bay-estuary systems are more productive than open Gulf areas, the magnitude of impact would be greater. Also, impacts on water quality in bays and estuaries during pipeline construction Would generally be more severe due to lower flushing rates. Of particular importance in bay systems are grass flats. Pipeline construction through these areas can seriously affect the vegetation and associated faunal assemblages by physical destruction and smothering from siltation. Pipeline construction through highly productive marsh ecosystems poses the most serious environmental threat related to pipeline construction. Some of the most serious impacts include (1) disruption of drainage in the marsh system, (2) physical and physiological destruction of marsh vegetation, and (3) loss of habitat for wildlife. These impacts can be minimized if the pipelines are covered with soil and the area allowed to revegetate. Some of the less serious impacts of pipeline construction through marshes include increased turbidities and BOD loading in surrounding water areas; however, these conditions are temporary, lasting only during the construction period.

6.38 Impacts of pipeline construction through upland areas consist primarily of destruction of vegetation and associated wildlife habitat along rights-of-way and disruption and erosion of soils. Impacts of denudation of the vegetative coverage in pipeline rights-of-way vary with the particular plant coverage in the area. For example, destruction of high quality bottomland hardwood vegetation would have a much greater impact than destruction of pasture vegetation along a pipeline right-of-way. Problems associated with soil erosion often occur most extensively during pipeline construction and the period required for establishment of vegetation.

6.39 Direct Shipment by Small Vessels. The use of small tankers (less than 65,000 DWT) and light loading of medium sized tankers is currently the primary mode of importing crude oil into the Gulf of Mexico. Harbor Island on the Corpus Christi Ship Channel is the only U.S. Port on the Gulf of Mexico that can accommodate vessels with draft up to 44 feet. Medium sized tankers of the 80,000 DWT class can be partially loaded to stay within draft limits of 44 feet. Although some of the benefits of the larger ship size are obtained, partial or light loading larger tankers cannot be a long-term solution to the problem of draft limitations in ports. The obvious disadvantage of continuing usage of small vessels is the higher cost of transportation. With the scrapping of the older vessels, fewer tankers will be available to transport the needed volumes of curde oil.

6.40 Congestion at the principal oil ports is expected to increase as more small tankers are used to deliver the expected increase in U.S. oil import requirements. If larger vessels are used, one tanker of the 150,000 DWT class would be required each day or a VLCC of the 300,000 DWT class every other day for every one million barrels per day of imports. Vessels of the 50,000 DWT class would require three tankers each day. The increase in small vessel traffic would increase the probability of collisions and other vessel casualities and associated oil spills.

6.41 Lightering. Lightering is a method whereby crude oil from VLCC's is transferred at sea directly to smaller vessels for delivery into existing ports. The technique was developed several years ago by major oil companies for deliveries to ports with insufficient draft and has become common practice. It requires good seamanship and good weather and wave conditions and is a relatively high risk operation. However, no major oil spills associated with lightering are known to have occurred. A bill is presently being considered by the U.S. Congress to regulate ocean lightering. Lightering is presently being used to some extent to import oil to Gulf Coast and other U.S. ports. In the Gulf, lightering requires off loading the entire tanker at sea because present docks and/or channel widths are inadequate to serve such vessels. Occasionally, tankers less than 120,000 DWT are offloaded only to the point where the draft of the larger vessel will allow it to enter port and complete unloading.

6.42 The primary advantage associated with lightering results from the economic utilization of VLCC's for the majority of the ocean journey. The major disadvantages of lightering are that it is unsafe to conduct this operation in rough seas, it would tend to cause congestion near approaches to existing harbors if used on a large scale, and the double handling of the cargo is more expensive than direct shipment. Delays will result primarily when seas are too rough to conduct the transfer operation. Also, it will increase the potential for an oil spill and will not avoid the problem of port congestion by small ships. Environmentally, lightering a VLCC by offloading part of its cargo into a lighter vessels is somewhat similar to the offshore buoy systems discussed in previous sections since the two vessels are secured to each other and transfer is by hose. However, weather conditions do affect this type of operation. The volume movement, or traffic, of the smaller lightering vessels, however, has greater potential for environmental impact than the project or offshore systems because of the increased traffic and potential harbor congestion. If the volume of crude oil projected to be imported in 1985 actually results, the movement of this much oil will require the equivalent of 2000 tankers of an average 70,000 dwt or 200 VLCC's of 200,000 dwt. (Texas A&M, 1972)

6.43 Transshipment. Transshipment is a method whereby crude oil from ULCC's(Ultra Large Crude Carriers) is first transferred to a land based facility and then later transferred to shallower draft vessels for delivery. Transshipment has some of the advantages of lightering at sea, such as partial usage of VLCC economy, but it avoids the environmental hazards of vessel to vessel exchange of oil at sea and the scheduling problems associated with large-scale lightering-at-sea operations. However transshipment does not alter the congestion problem associated with the use of a large fleet of small vessels at the final destination port.

6.44 In spite of the latter, transshipment is currently used from terminals in the Caribbean with deepwater, such as Aruba, Bonaire, Curacao, and the Bahamas, directly to U.S. ports on the East Coast and in the Gulf of Mexico.

6.45 Since ULCC or VLCC economy is used only for part of the trip, and since unloading, storage and reloading are expensive, transshipment is inherently more costly per ton of crude oil delivered, than direct ULCC or VLCC delivery to destination. It has been estimated that transshipment may add as much as $0.40 to the cost of a barrel of oil transported from the Persian Gulf to Texas, as compared with direct shipment in VLCCs. An added disadvantage of transshipment is the location of terminals in a third party country, a situation that may entail a security risk for the United States.

6.46 Alternatives Developed in the Federal Study. As part of the ongoing federally authorized study, two alternate plans have been developed which would satisfy most of the requirements of the applicant and be much more environmentally acceptable. One plan calls for the same harbor configuration as that requested by the applicant; however, disposal of dredged materials would be on San Jose Island and offshore Gulf areas. There would be no disposal in wetland areas except that needed for construction of the docking basin. Materials dredged during maintenance of the channel could be deposited on San Jose Island and in the Gulf disposal areas. This plan would result in the loss of only approximately 167 acres of wetlands as compared to 3,077 acres in the proposed project. Some minor terrestrial habitat of value to wildlife would also be lost. Surge tanks would be located on high ground or mainland areas. This plan would reduce most of the impacts that would result from the physical construction of the proposed project such as filling wetland areas and loss of terrestrial habitat. Most of the other impacts associated with the proposed project as discussed in Section 4 would be applicable to this alternative. The other plan which is being considered in the federal study calls for the same harbor configuration as that requested by the applicant except that it has been relocated southwestward such that the Tributary channel to Aransas Pass would not require relocation. Environmentally, this plan would be the preferred inshore plan since no wetland area would be affected and the terrestrial habitat that would be lost has already been disturbed and is of little value to wildlife. This plan would also utilize San Jose Island and the Gulf for disposal of dredged material for both construction and maintenance dredging. Surge tankage would be located on mainland areas. This plan would, however, require the relocation or loss of 31 oil storage tanks, 3 crude oil receiving docks, and other facilities associated with the unloading process. Such a configuration may increase navigation problems and affect the safety of vessels while docking and turning. There would be no physical loss of any wetlands or loss to the biological community associated with these wetlands. Most of the other impacts of the proposed project (as discussed in section 4) such as turbidities from dredging and disposal activities and removal of benthic organisms in the dredged acres would be the same for this alternative.

6.47 Modification of the Proposed Plan. The applicant could modify the proposed project in other ways to make it more environmentally acceptable. For example, reducing the channel depth from 80 to 60 feet would reduce the amount of dredged material to be removed and disposed by about 50 percent. While this type of plan has several advantages environmentally over the proposed plan, most of the economic benefit of transporting in large tankers would be lost and the remaining economic benefit would not provide sufficient incentive for the commitment to throughtput agreements by the oil companies. The project then could not be financed with non-Federal funds. Reducing the channel depth would slightly reduce the amount of water exchanged through Aransas Pass as compared to the 80 foot channel and lessen the change in the overall salinity in the bays. Since less dredged material would need to be disposed of, less wetland area would be lost by filling. It may also be possible to dispose of all the dredged material offshore, depending on compliance with EPA's Ocean Dumping regulation (40CFR220-228). Locating the surge tankage on the mainland would preclude the filling of additional wetlands on Harbor Island. Reduction of channel depth would, however, decrease the per barrel savings which would be gained by an 80 foot channel. Modifications to the proposed disposal plans could significantly affect the environmental consequences resulting from the proposed plan. Generally, disposal of dredged material in areas other than wetlands would be an improvement and hopper dredging and offshore disposal in other areas of the Coast have been shown to improve Gulf bottom as habitat.