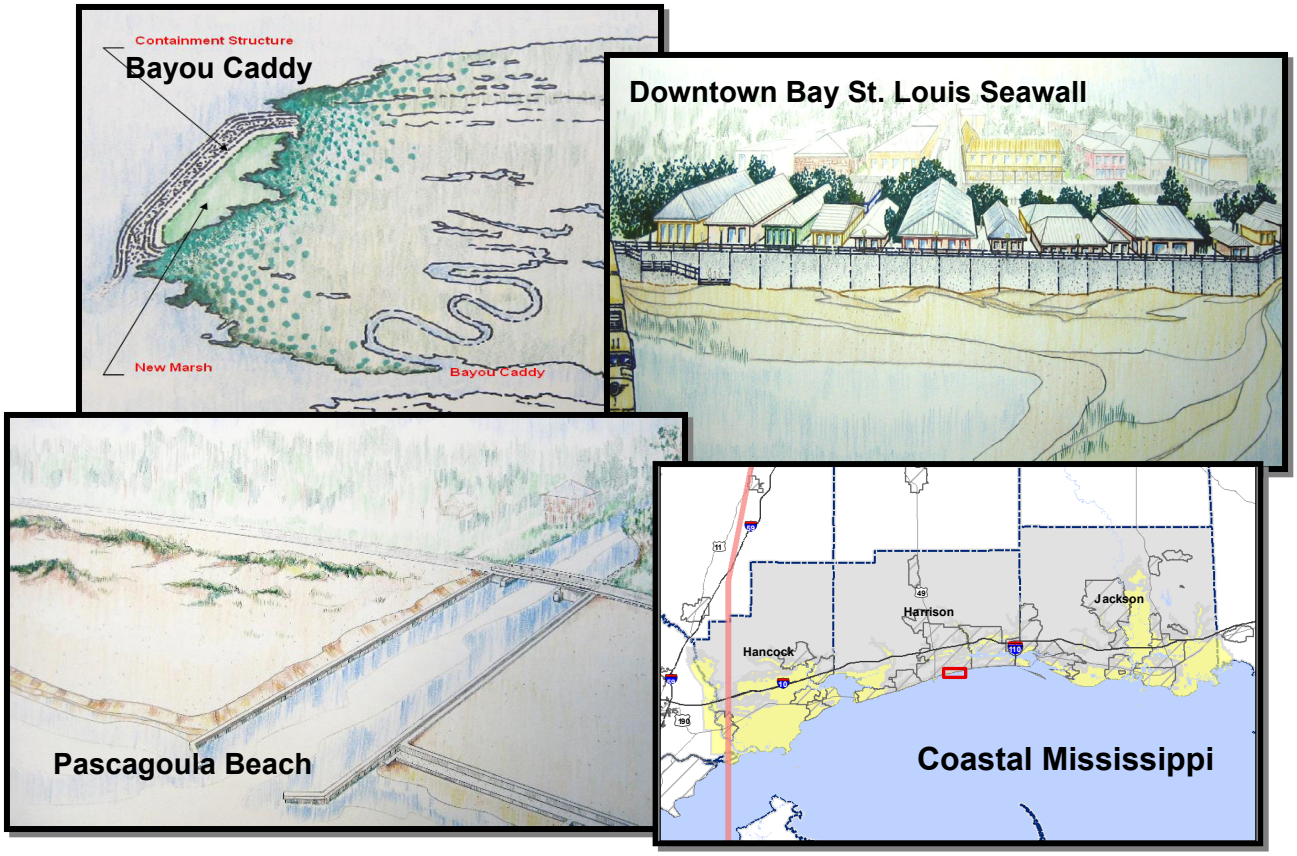
US Army Corps
of Engineers

June 2006

Environmental Assessment
and
Finding of No Significant Impact

Mississippi Coastal Improvements Program (MsCIP)
Near Term Improvements
Hancock, Harrison, and Jackson Counties, Mississippi



FINDING OF NO SIGNIFICANT IMPACT
MISSISSIPPI COASTAL IMPROVEMENTS PROGRAM (MSCIP)
NEAR TERM IMPROVEMENTS

Hancock, Harrison, and Jackson Counties, Mississippi

A. Description of the Proposed Action.

The Hurricanes of 2005 created unprecedented destruction within the Gulf Region. Coastal Mississippi was the point of impact of the greatest tidal surge that has hit the mainland in its recorded history. As a group, the hurricanes of 2005 caused extensive damage to fish and wildlife, the shrimp and oyster industries, shore protection, jetties, groins, seawalls, navigation channels, barrier island ecosystems, public infrastructure, commercial and recreational vessels, roads, bridges, aquatic and terrestrial habitat, commercial and industrial development, marshes, forests, and most devastating to individuals and families, destroyed the homes, businesses, and livelihoods of tens of thousands of individuals.

The mission of the U.S. Army Corps of Engineers was provided by the Department of Defense Appropriations Act, 2006 (P.L. 109-148) December 30, 2005. This mission requires an interim report to facilitate “near term improvements” recommendations by the Chief of Engineers and the Assistant Secretary of the Army (Civil Works) to be delivered to Congress on June 30, 2006. A final report on December 30, 2007 will provide recommendations for “comprehensive” improvements and modifications for the coastal area of Mississippi. These studies were required to address hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes.

The Mississippi Coastal Improvements Program (MsCIP) Near Term Improvements Environmental Assessment (EA) presents environmental impacts that would potentially result from constructing 15 projects in coastal Mississippi (See Table 1 for list). Each of the projects has been fully discussed to address any potential impacts associated with their implementation. All of these sites are located in coastal Mississippi, either in Hancock, Harrison, or Jackson County.

B. Description of Alternatives.

Alternatives to the proposed MsCIP Near Term Improvements are presented. In some cases the alternatives were limited to the “No Action” alternative or a limited number of other alternatives. This situation was unavoidable; contributed to by the evaluation criteria used to identify MsCIP Near Term Improvements. As discussed previously, these projects had to be related to the hurricanes of 2005, contribute to the recovery of the coastal Mississippi, be easily implemented, and be consistent with the recovery efforts and goals of other agencies and groups. As a result of these criteria, the Near Term Improvements are often limited in scope and the alternatives to those projects are limited. Projects that required significant design and analysis including perceived significant environmental review requirements were eliminated as MsCIP Near Term Improvements and will be evaluated in the MsCIP Final Report (Comprehensive Plan).

C. Potential Environmental Impacts.

The environmental impacts associated with the proposed actions are fully described in the EA. The EA concludes that the proposed projects would not have a significant adverse impact on the existing environment. Most of the proposed MsCIP Near Term Improvements would have beneficial impacts to the coastal environment such as those associated with providing or restoring wetland functions, improving coastal stream circulation or connectivity with Mississippi Sound, or providing vegetated dune systems on the beaches.

Table 1.
Mississippi Coastal Improvements Program – Near Term Improvements

Project #	Project name	Mission	County
2.3.1	Bayou Caddy	Ecosystem Restoration	Hancock
2.3.2	Hancock County Beaches	Ecosystem Restoration	Hancock
2.3.3	Hancock County Streams	Flood Damage Reduction & Ecosystem Restoration	Hancock
2.3.4	Jackson Marsh	Ecosystem Restoration	Hancock
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2.3.7	Cowand Point	Hurricane & Storm Damage Reduction	Hancock
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2.3.12	Gautier Coastal Streams	Flood Damage Reduction & Ecosystem Restoration	Jackson
2.3.13	Pascagoula Beach Boulevard	Hurricane & Storm Damage Reduction & Ecosystem Restoration	Jackson
2.3.14	Upper Bayou Casotte	Flood Damage Reduction	Jackson
2.3.15	Franklin Creek Floodway	Flood Damage Reduction	Jackson

Note: The Project # refers to the section in this EA which describes the project.

D. Mitigation.

No mitigation will be required as a result of implementing the proposed actions.

E. Public Involvement

An extensive public involvement process was conducted during the preparation of the EA. Soon after Katrina struck coastal Mississippi, the Corps made and received contacts with local government officials, agencies, and the public regarding the impacts of the storm and conditions on the coast. After the MsCIP authorization, the Corps sent multi-discipline project teams to each coastal Mississippi county and municipal area to assess damages and needs first hand and to discuss needs with local constituents. To further solicit public input and collaborate with State, Federal, and local officials in gathering ideas, a facilitated two-step agency and public involvement process was used. Ten involvement workshop opportunities were held for public input between April 7 and May 4, 2006 including two public involvement workshops in each of the coastal Mississippi counties. A web-site, www.MSCIP.usace.army.mil was maintained as a repository of information and a vehicle to allow input to those who were displaced from there homes or could not attend the workshop opportunities. In addition, webcasts were provided as an online alternative for participating in the project.

The Environmental Assessment, Mississippi Coastal Improvements Program (MsCIP), Near Term Improvements, Hancock, Harrison, and Jackson Counties, Mississippi, dated May, 2006 was mailed to Federal, State, local governments, and the interested public on May 19 for a 30-day review and comment period. The distribution of the EA to the public also included the MsCIP Interim Report, Project Implementation Reports for each Near Term Improvement, and Engineering, Economics, Cost, and Real Estate Appendices.

Written comments on the EA and other MsCIP report documents were received from the agencies and public and used in the preparation of this FONSI. The comments and our responses can be found in Appendix B of the Environmental Assessment and Finding of No Significant Impact.

F. Finding of No Significant Impact (FONSI).

A careful review of the EA and comments received following public circulation of the EA supports the finding that the proposed actions would not have a significant adverse impact on the natural and human environment. The requirements of the National Environmental Policy Act and the Council of Environmental Quality regulation have been satisfied and the preparation of an Environmental Impact Statement is not necessary.

G. Document Availability and FONSI Comments.

The EA and FONSI are available for public review at U.S. Army Corps of Engineers, Mobile District by contacting Dr. Susan I. Rees at (251)694-4141.

DATE 28 Jun 06

Peter F. Taylor, Jr.
Colonel, Corps of Engineers
District Commander

EXECUTIVE SUMMARY

The Hurricanes of 2005 created unprecedented destruction within the Gulf Region of the United States of America. Beginning with Hurricane Cindy on July 6th 2005, which made landfall near Waveland, Mississippi, peaking with Hurricane Katrina, which made landfall on the 25th of August on the Louisiana-Mississippi border, and ending with Hurricane Rita on the 24th of September, which also caused additional damage to coastal Mississippi, this series of tremendous storms caused unparalleled damage on numerous fronts. Coastal Mississippi was the point of impact of the greatest tidal surge that has hit the mainland of the United States in its recorded history. Hurricane Katrina caused almost complete destruction of several large coastal communities, and seriously damaged numerous others. As a group, the hurricanes of 2005 caused extensive and repeated damage to fish and wildlife, the shrimp and oyster industries, shore protection, jetties, groins, seawalls, navigation channels, barrier island ecosystems, public infrastructure, commercial and recreational vessels, roads, bridges, aquatic and terrestrial habitats, commercial and industrial development, marshes, forests, and most devastating to individuals and families, destroyed the homes, businesses, and livelihoods of tens of thousands of individuals. The destruction was on a scale unmatched by any natural disaster in U.S. history. Hurricane Katrina virtually obliterated portions of the natural and human environment of coastal Mississippi, an event from which Mississippi will be recovering for a lifetime.

The mission of the Corps of Engineers was provided by the Department of Defense Appropriations Act, 2006 (P.L. 109-148) 30 December 2005, which states:

> *"…the Secretary shall conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes at full Federal expense; Provided further, that the Secretary shall recommend a cost-effective project, but shall not perform an incremental benefit-cost analysis to identify the recommended project, and shall not make project recommendations based upon maximizing net national economic development benefits; Provided further, that interim recommendations for near term improvements shall be provided within 6 months of enactment of this act with final recommendations within 24 months of this enactment."*

This mission requires an interim report to facilitate recommendations by the Chief of Engineers and the Assistant Secretary of the Army (Civil Works) to be delivered to Congress on 30 June 2006. The Interim Report is to provide recommendations for "near term improvements." A final report on December 30, 2007 will provide recommendations for "comprehensive" improvements and modifications for the coastal area of Mississippi.

The U.S. Army Corps of Engineers (Corps) began expedited studies of flood and storm damage reduction related to the consequences of hurricanes in the Gulf of Mexico in 2005. These studies were required to address hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes. As required by the authorization, the Corps has prepared a Mississippi Coastal Improvements Program (MsCIP) Draft Interim Report. This Environmental Assessment (EA) is part of the MsCIP Draft Interim Report.

Soon after Katrina struck coastal Mississippi, the Corps made and received contacts with local government officials, agencies, and the public regarding the impacts of the storm and conditions on the coast. These contacts were fostered by the working relationships established during the normal water resources activities conducted by Corps and the state and local governments. After the

MSCIP authorization, the Corps sent multi-discipline project teams to each coastal Mississippi county and municipal area to assess damages and needs first hand and to discuss needs with local constituents. This coordination was a productive means for identifying needs and the brainstorming of ideas and opportunities. To further solicit public input and collaborate with State, Federal, and local officials in gathering ideas, a facilitated multi-step public involvement process was used. Ten involvement workshop opportunities for public input into the MsCIP planning process were held between April 7 and May 4, 2006. In addition a web-site, www.MSCIP.usace.army.mil was maintained as a repository of information and a vehicle to allow input to those who were displaced from there homes or could not attend the workshop opportunities. The web-site was continually up and running for public information during the short project planning period.

As a result of the public and agency process described, over 190 potential recovery and restoration projects or ideas for coastal Mississippi were identified. As a management tool, projects were divided in terms of near term (otherwise known as 'low hanging fruit') and long-term projects. The near term projects are those which contribute to the recovery of coastal Mississippi and can be implemented in the near term without significant engineering, economic, and environmental impacts and controversy. There are 15 recommended MsCIP Near Term Improvements included in the MsCIP Draft Interim Report. These Near Term Improvements are listed in Table 1 and categorized in the following groups:

- Seawalls and Bulkheads
- Beach Nourishment
- Marsh Creation/Restoration
- Dredging
- Purchase and Relocation of Floodway Properties

These projects are included in the MsCIP Interim Report as recommendations to Congress for near term improvements to coastal Mississippi. These proposed near term improvements are addressed in this EA. Other projects or actions not recommended for the June 30th Interim Report to Congress will be reviewed for potential inclusion in the Final Report to Congress which will be submitted on December 30, 2007. An Environmental Impact Statement (EIS) will accompany the MsCIP Final Report. Further opportunity for public and agency review will occur during the environmental compliance process for the Final Report projects.

This MsCIP Near Term Improvements EA discusses environmental impacts that would potentially result from implementing the recommended 15 Near Term Improvements in coastal Mississippi (See Table 1 for list). Each of the projects has been fully discussed to address any potential impacts associated with their implementation. All of these sites are located in the coastal Mississippi either in Hancock, Harrison, or Jackson County.

Alternatives to the proposed MsCIP Near Term Improvements are presented. In some cases the alternatives were limited to the "No Action" alternative or a limited number of other alternatives. This situation was unavoidable; contributed to by the constraints placed on the MsCIP Near Term Improvements. As discussed previously, these projects had to be related to the hurricanes of 2005, contribute to the recovery of the coastal Mississippi, be easily implemented, and be consistent with the recovery efforts and goals of other agencies and groups. As a result of those constraints, the Near Term Improvements are often limited in scope and the alternatives to those projects are limited. Projects that required significant design and analysis including perceived significant environmental review requirements were deferred to a longer term comprehensive analysis and possible inclusion in the MsCIP Final Report.

Table 1.
Mississippi Coastal Improvements Program – Near Term Improvements

Project #	Project Name	Mission	County
2.3.1	Bayou Caddy	Ecosystem Restoration	Hancock
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2.3.15	Franklin Creek Floodway	Flood Damage Reduction	Jackson

Note: The Project # refers to the section in this EA which describes the project.

The purpose of this EA is to determine whether or not the proposed actions have the potential for creating significant impacts to the environment and would thereby warrant a more detailed study on possible impacts, mitigation, and alternative courses of action.

The EA discusses each proposed project and alternatives considered including the no action alternative. The environmental effects on important resources of the coastal Mississippi project area are discussed. The Relationship of the proposed action to environmental requirements such Environmental Justice, Protection of Children, Endangered and Threatened Species, Coastal Area Management and others are described.

The proposed actions presented in this EA are not expected to have any significant cumulative or secondary adverse impacts. The implementation of the proposed action would not have a significant adverse impact on the quality of the environment and an EIS is not required.

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1.0 INTRODUCTION

Hurricane Katrina made landfall on August 29, 2005 as a Category 4 hurricane with sustained winds of 145 miles per hour (mph) with higher gusts, at 6:10 a.m. central time near Buras-Triumph, Louisiana. Hurricane force winds extended outward 120 statute miles; pressure was 918 millibar and forward speed 15 mph. Unfortunately, landfall of this storm placed coastal Mississippi in the northeast quadrant, the most destructive quadrant. Destruction spans along all three coastal counties—Hancock, Harrison, and Jackson. Most, if not all, of the infrastructure was destroyed by the hurricane south of Highway 90. South of Interstate-10 had massive flooding and infrastructure damage. Hurricane Katrina destroyed coastal regions of Louisiana, Mississippi, and Alabama making it the most destructive and costliest natural disaster in the history of the United States.

The U.S. Army Corps of Engineers (Corps), has been authorized by Congress to investigate expedited studies of flood and storm damage reduction related to the consequences of hurricanes in the Gulf of Mexico in 2005. These studies must address hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes. As a result, the Corps has prepared a Mississippi Coastal Improvements Program (MsCIP) Interim Report for Congress. This Environmental Assessment (EA) is part of the MsCIP Interim Report. The Corps will submit a Final Report recommending a Comprehensive Plan for Improvements in coastal Mississippi to Congress in December 2007.

Soon after Katrina struck coastal Mississippi, the Corps made and received contacts with local government officials, agencies, and the public regarding the impacts of the storm and conditions on the coast. These contacts were fostered by the existing working relationships established during the normal water resources activities conducted by Corps and the state and local governments. After the MsCIP authorization, the Corps sent multi-discipline project teams to each coastal Mississippi county and municipal area to assess damages and needs first hand and to discuss needs with local constituents. This coordination was a productive means for identifying needs and the brainstorming of ideas and opportunities. To further solicit public input and collaborate with State, Federal, and local officials in gathering ideas, a facilitated multi-step public involvement process was used. Ten involvement workshop opportunities for public input into the MsCIP planning process were held between April 7 and May 4, 2006. In addition a web-site, www.MSCIP.usace.army.mil was maintained as a repository of information and a vehicle to allow input to those who were displaced from their homes or could not attend the workshop opportunities. The web-site was continually up and running for public information during the project planning period.

As a result of the public and agency process described, over 190 potential recovery and restoration improvements or ideas for coastal Mississippi were identified. As a management tool, the improvements were divided in terms of near term (otherwise known as ‘low hanging fruit’) and long-term improvements. The near term improvements are those activities which contribute to the recovery of coastal Mississippi and can be implemented in the near term without significant engineering, economic, and environmental impacts and controversy. The Near Term Improvements and those to be evaluated and recommended in the Final Report are all part of the same MsCIP authorization. Accordingly, proposed Near Term Improvements have been screened using criteria that they would not preclude other future options that may have a higher level of contribution, and/or that would take a longer timeframe to study and construct. MsCIP Near Term Improvements should contribute to both the short-term and longer-term recovery of coastal Mississippi. Near Term Improvements should contribute to an overall comprehensive plan for hurricane storm damage reduction of the coast of Mississippi as identified in the State’s long-term recovery plan.

There are 15 projects included in the MsCIP Interim Report as recommendations to Congress for Near Term Improvements to coastal Mississippi. They are listed in Table 1.1. These Near Term Improvements can be categorized in the following groups:

- Seawalls and Bulkheads
- Beach Nourishment
- Marsh Creation/Restoration
- Dredging
- Purchase and Relocation of Floodway Properties

These near term projects are addressed in this EA. Other projects or actions not recommended for the June 30th Interim Report to Congress will be reviewed for potential inclusion in the Final Report to Congress which will be submitted on December 30, 2007. An Environmental Impact Statement (EIS) will accompany the MsCIP Final Report. Further opportunity for public and agency review will occur during the environmental compliance process for the Final Report projects.

This MsCIP Near Term Improvements EA presents environmental impacts that would potentially result from constructing 15 projects in coastal Mississippi (See Table 1-1 for list). Each of the projects has been fully discussed to address any potential impacts associated with their implementation. All of these sites are located in the coastal Mississippi either in Hancock, Harrison, or Jackson County.

Alternatives to the proposed MsCIP Near Term Improvements are presented. In some cases the alternatives were limited to the "No Action" alternative or a limited number of other alternatives. This situation was unavoidable; contributed to by the constraints placed on the MsCIP Near Term Improvements. As discussed previously, these projects had to be related to the hurricanes of 2005, contribute to the recovery of the coastal Mississippi, be easily implemented, and be consistent with the recovery efforts and goals of other agencies and groups. As a result of those constraints, the Near Term Improvements are often limited in scope and the alternatives to those projects are limited. Projects that required significant design and analysis including perceived significant environmental review requirements were eliminated as MsCIP Near Term Improvements.

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Note: The Project # refers to the section in this EA which describes the project.

The purpose of this EA is to determine whether or not the proposed actions have the potential for creating significant impacts to the environment and would thereby warrant a more detailed study on possible impacts, mitigation, and alternative courses of action. The project area addressed in this EA, the three coastal Mississippi counties, is shown in Figure 1-1.

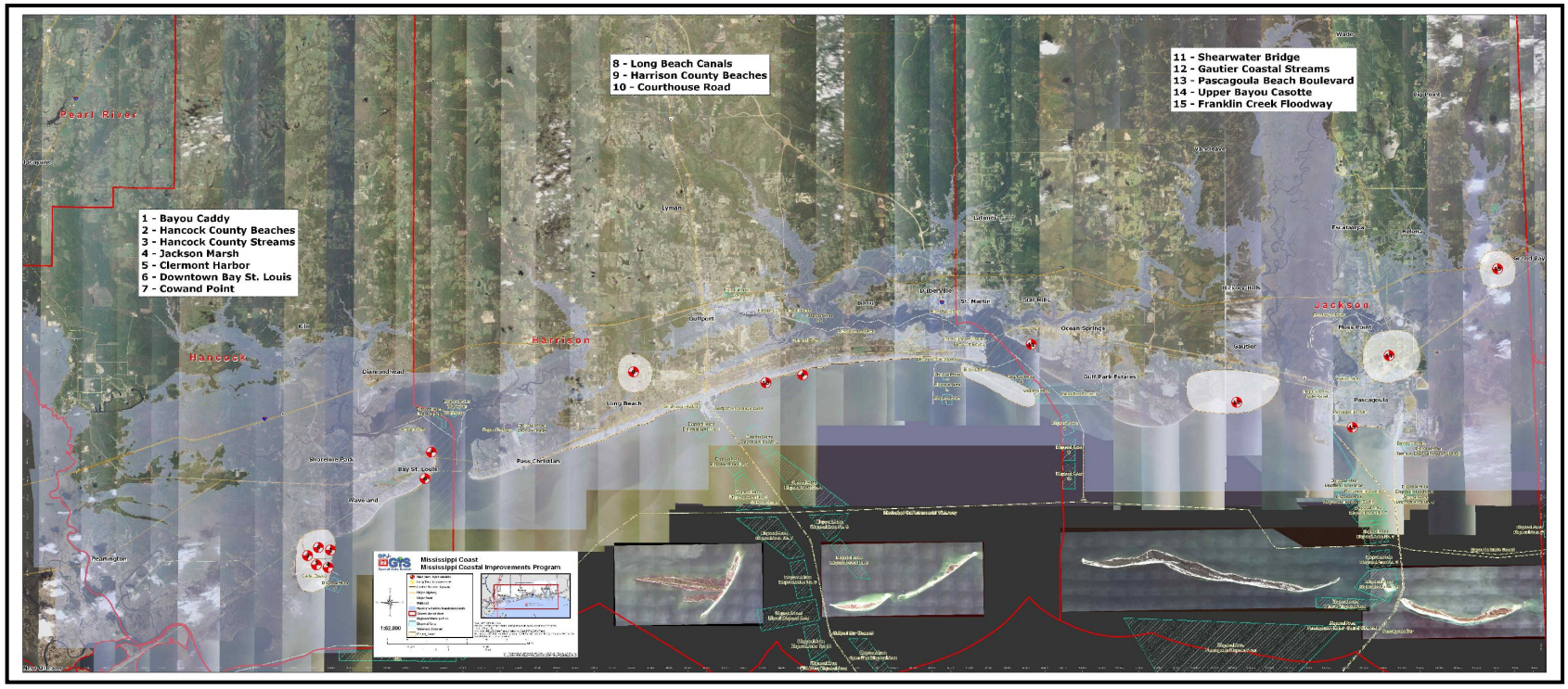


Figure 1-1. MsCIP Project Area, Jackson, Harrison, and Hancock Counties. Near Term Improvements Shown as Red Circles and White Shaded Areas. The areas inundated by storm surge are shown in light shading.

2.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

2.1 Authority and Scope

The Mississippi Coastal Improvement Project, Mississippi was authorized by Congress in the Department of Defense Appropriations Act, 2006 (Public Law 109-359) 30 December 2005. A description of the analysis and design authority contained in the aforementioned act reads as follows:

> *For an additional amount for "investigations" to expedite studies of flood and storm damage reduction related to the consequences of hurricanes in the Gulf of Mexico and Atlantic Ocean in 2005, $37,300,000, to remain available until expended: Provided, That using $10,000,000 of the funds provided, the Secretary shall conduct an* ***analysis and design*** *for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion, and other related water resource purposes* ***at full Federal expense:*** *Provided further, That the Secretary shall recommend a cost-effective project, but* ***shall not perform an incremental benefit-cost analysis*** *to identify the recommended project, and shall not make project recommendations based upon maximizing net national economic development benefits: Provided further, That interim* ***recommendations for near term improvements shall be provided within 6 months*** *of enactment of this Act* ***with final recommendations within 24 months of enactment: (emphasis added).***

The National Environmental Policy Act (NEPA) of 1969 excuses or excludes the Corps from the preparation of any formal environmental analysis with respect to actions that result in minor or no environmental effects, which are known as "categorical exclusions." For an action that is not categorically excluded the Corps must prepare an EA (see 33 CFR § 230.6-7, 9)[40 Code of Federal Regulations (CFR) §1501.3 (a) and (b)]. Based on the EA, the Corps either prepares an EIS, if one appears warranted, or issues a "Finding of No Significant Impact" (FONSI), which satisfies the NEPA requirement. This EA is prepared according to the Engineer Regulation (ER) 200-2, *Procedures for Implementing NEPA, and the Council on Environmental Quality (CEQ) Regulations (40 CFR § 1508.27) for Implementing the Procedural Provisions of NEPA (40 CFR § 1500-1508).*

2.2 Non-Federal Sponsor

Congressional language states that the MsCIP analysis and design for coastal Mississippi improvements shall be at 100% Federal cost. The MsCIP will result in Interim and Final Reports containing recommendations to Congress. No construction authorizations have been made by Congress. Under current Administration policy on comprehensive, multi-purpose programs of this nature, including the Everglades Restoration Programs, are cost shared 50 percent Federal and 50 percent non-Federal.

2.3 Proposed Project Descriptions

2.3.1 Bayou Caddy

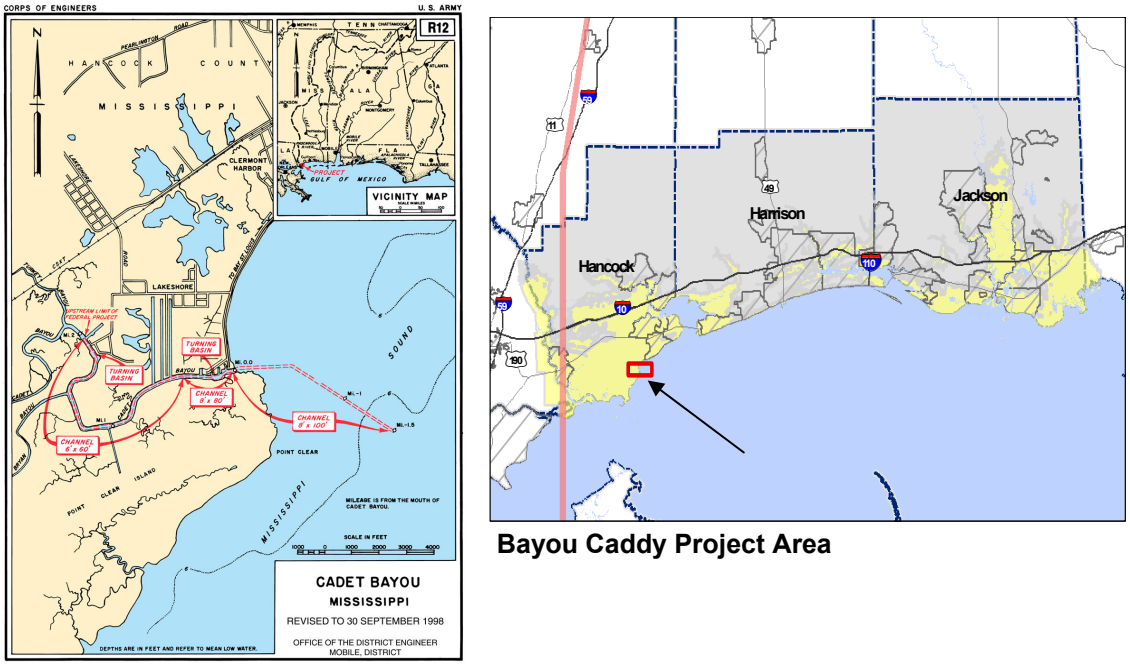
The proposed project site is located along the shoreline of Mississippi Sound in Hancock County, Mississippi, south and west of the federally authorized Cadet Bayou navigation project. Cadet Bayou

(otherwise known as Bayou Caddy) is a small coastal stream draining most of southwest Hancock County south of Interstate-10. It empties into Mississippi Sound. The Cadet Bayou Federal navigation project provides for an approximately 3.5 mile channel from 8-foot depth contour in Mississippi Sound to a turning basin just south of the confluence of Turkey and Cadet Bayous. Currently, only the 1.5 mile portion of the channel within Mississippi Sound is maintained. Historically, material dredged from the channel has been placed in open-water adjacent to the channel. Recently, a Section 204 [Water Resources and Development Act (WRDA)1996] project was initiated that would utilize this dredged material to help restore wetlands along the critically eroding Point Clear shoreline. This material and possibly material from the inner portion of the project is highly suitable for wetland/shoreline restoration as long as the material is initially confined.

The Bayou Caddy area is an exposed shoreline facing to the north and east. The north terminus of the project site is the entrance channel to Bayou Caddy. The entrance channel extends from the -8 feet MLLW contour in the Sound for a distance of about 7,800 feet to the mouth of the bayou. The shoreline and adjacent area of Bayou Caddy consists mostly of marshland. A map of the Federal project is shown as Figure 2.3.1-1. A photograph and artist rendering of the proposed project site area is shown as Figure 2.3.1-2.

Erosion from wave attack under average conditions and hurricanes and other storms have undermined and eroded the marsh habitat at the proposed project site. Concrete seawalls armor the shoreline further to the north and east, and a large section of the Mississippi mainland. Sediment budgets are supplemented in these areas by periodic replenishment projects. Extensive areas of coastal wetlands in western Hancock County are experiencing land losses due to erosion. Average rates of erosion in the Hancock County marshes are on the order of 12 to 13 feet per year over the past 70 years. The erosion of marsh habitat in Mississippi has exposed shorelines along the mainland of Mississippi and its barrier island system to wave energy and additional erosion.

Commercial and recreational fishermen also frequently use Bayou Caddy. As a result of this high level of boat activity and other natural erosive forces, the mouth and western face of the bayou are eroding and losing marsh making the shore more prone to disturbance from waves and erosion.



Bayou Caddy Project Area

Figure 2.3.1-1. Cadet Bayou (Bayou Caddy)

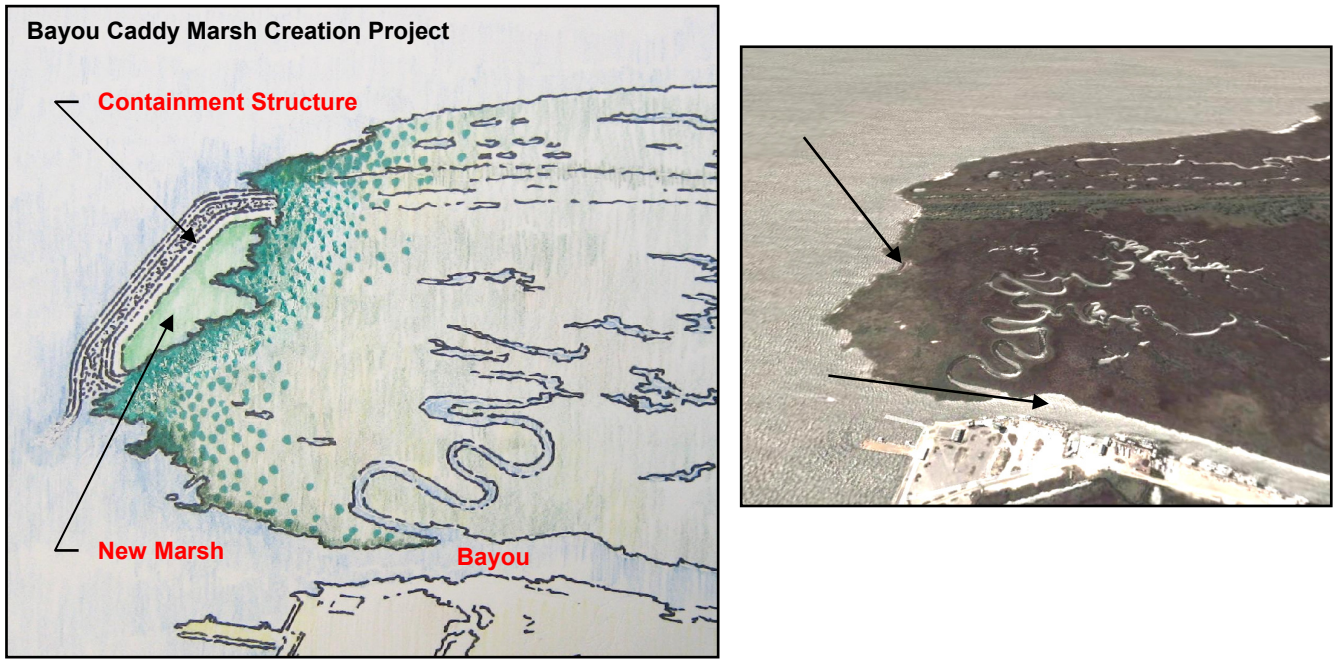


Figure 2.3.1-2. Proposed Bayou Caddy Project

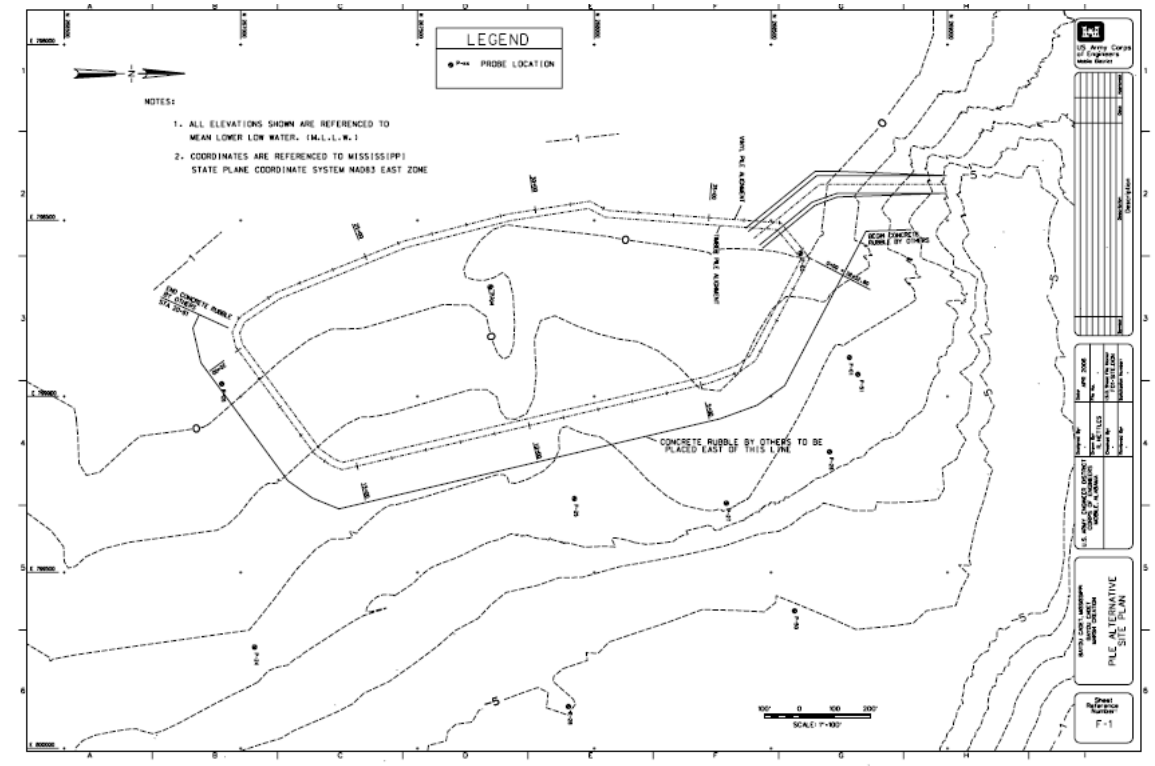


Figure 2.3.1-3. Proposed Bayou Caddy Containment/Breakwater

2.3.1.1 Coastal and Hydraulic Conditions

Circulation patterns within the vicinity of the project site are controlled by astronomical tides, winds, and freshwater discharges. The mean diurnal tide range in Mississippi Sound is 1.6 feet, and the extreme (except during storms) is about 3.5 feet. The magnitude of normal tidal currents ranges from 0.5 to 1.0 Feet per second (fps) and their direction is generally east to west. Predominant winds average 8 mph from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the Sound causing current velocities of several knots in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline. Wave heights in Mississippi Sound exceed 5 feet more than 20 percent of the time in winter, but only 5 percent of the time in summer. The study area has been impacted by several tropical storms and hurricanes, most recently from Hurricane Katrina in 2005.

2.3.1.2 Geotechnical Conditions

A subsurface investigation that included the project site was made in November, 2001. The subsurface investigation consisted primarily of 51 probes made using ½" steel pipes with capped ends. The depth of investigation was typically to refusal of the manually pushed probe. The soil penetration depth varied from 0.5 to 14 feet.

The ground surface is underwater, so all soils are saturated. The soil at the generally shallow depths consists of silty clay (CL), sandy silt (ML), and silty and clayey sand (SM-SC and SP-SM). The thickness of this stratum varied from 0.5 to 14 feet, averaging 5.1 feet. The top stratum generally appears to be underlain by fine sand (SP) of unknown thickness. However, other materials could also be present. Generally, the foundation at the site is very soft and consists of fine-grained sands, silts and clays, and presents some engineering challenges for construction of any recommended plan.

2.3.1.3 Preferred Project. Combination of Marsh Restoration and Breakwater

A 120,000 cubic yard earthen containment structure placed along a 3900 linear foot semi-circular alignment. The earth dike would have a crest that is 8 feet wide and would rise 6 feet above the lowest low water tide. The berm would slope upwards 1 foot for every 3 feet of horizontal width. Approximately 50,000 cubic yards of clean concrete rubble would be placed (possibly by the Mississippi Department of Marine Resources) on an alignment just outside the earthen berm. This will function as a protective breakwater for the inner earthen containment structure. The inner containment would be a 3900 linear foot semi-circular cutoff wall that would tie into the existing shoreline and enclose an approximately 18-acre site. The earthen berm would be constructed of approximately 120,000 cubic yards of material from an upland site (provided dredged material is unsuitable). Construction of a weir would also be included as part of the containment structure (earthen dike). One of the objectives of restoration along the Mississippi coast is to create as natural of an environment as is possible. Once the newly created marsh has been established, the earthen berm can be reduced to create a more natural environment.

Approximately 120,000 cubic yards of dredged material, beneficially used from the maintenance of the federally authorized navigation channel, will be pumped into the containment structure. After consolidation, this newly developed 18-acre site will be planted to create a saltwater marsh habitat that will also protect the existing marsh from further erosion. The landward side of the containment structure would be filled with dredged material from the next maintenance and/or new work dredging of the Bayou Caddy navigation channel. The material would be allowed to settle, and appropriate vegetation would be planted, resulting in restoration of an 18-acre tidal marsh wetland site. Emergent aquatic vegetation would be planted at the site following adequate draining time and the

re-working, if necessary, of dredged material at the site. *Spartina alterniflora* (saltmarsh cordgrass), a low marsh species, would be planted, as well as a middle marsh species, *Juncus roemerianus* (black needlerush), and a high marsh species, *Spartina patens* (saltmeadow cordgrass). These plants would be placed about 18 inches apart from one another. While monitoring for the contract performance of planted materials will be part of this plan, long-term monitoring of the marsh will be provided by the Mississippi Department of Marine Resources. The key elements of the plan could be implemented in approximately one year, including development of plans and specifications.

Since water depths at the proposed project site are shallow, dredging of an access channel may be required for construction of the inner containment structure. The trapezoidal channel would have a 50-foot bottom width at elevation -4' mean lower low water (MLLW), and 1V(vertical):3H(horizontal) side slopes. The channel would extend about 600 feet from the -4 feet contour at the Bayou Caddy channel to the interior of the north part of the site. This route is the shortest suitable path relative to the rubble to be placed. The Contractor would have the option on how to move around within and construct the site (i.e., either excavate more barge canal inside the area and/or construct a haul road on the earth dike).

Maintenance dredging of the Bayou Caddy navigation channel occurs approximately every 5 to 6 years. The amount of material dredged has varied from 123,739 cubic yards (cys) to 234,877 cys. Under the proposed restoration project, maintenance dredging of the navigation project would be accomplished as scheduled in one maintenance dredging cycle. The proposed restoration site is immediately adjacent to the navigation channel and is within the typical pumping distances to the open water disposal areas normally used for maintenance.

2.3.1.4 Other Alternatives

Alternative 1— 'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with continued shoreline erosion. Without corrective action, shoreline erosion would continue with the resultant loss of valuable fishery habitat. This alternative was not selected because it would not correct the erosion problem experienced on the western side of Bayou Caddy.

Alternative 2—Breakwaters. This alternative consists of placing material offshore to reduce wave erosion to the existing marsh. It would also provide minor accretion of sediment which would restore some of the lost habitat. The plan involves the placement of approximately 50,000 cubic yards of "clean" concrete rubble along a 3900 foot alignment. The material would come from sites around Hancock County as a result of local construction projects (i.e. – Hwy 90 bridge demolition). This alternative would provide protection to existing tidal marsh shoreline but would not restore the tidal marsh historically lost. This alternative was not selected by itself. However, it was included as a component of the preferred alternative.

It is possible that the State of Mississippi would pay for this effort to coincide with ongoing local projects. At this time, however, it is included as a federal cost.

Alternative 3—Marsh Restoration. This alternative consists of constructing a containment structure which would be beneficially filled with approximately 120,000 cubic yards of dredged material from future maintenance of the Bayou Caddy channel. Once the dredged material has settled, low, medium, and high marsh plantings will restore the habitat to its previous state. This alternative also includes restoring habitat connectivity to the Mississippi Sound and adjacent marsh areas through the creation of tidal creeks and a weir in the containment structure. Three options for construction of the containment structure were evaluated for this alternative:

a. Steel Sheetpile Containment Structure. The steel sheetpile alternative would consist of placing a 3900 linear foot semi-circular cutoff wall that would tie into the existing shoreline and enclose an approximately 18-acre site.

b. Vinyl Sheetpile Containment Structure. The vinyl sheetpile alternative would consist of placing a 3900 linear foot semi-circular cutoff wall that would tie into the existing shoreline and enclose an approximately 18-acre site.

c. Earthen Containment Structure. This alternative is similar to the sheetpile cutoff walls but would consist of an earthen berm that would tie into the existing shoreline to enclose the 18-acre site. The earthen berm would be constructed of approximately 120,000 cubic yards of material from an upland site (provided dredged material is unsuitable). One of the objectives of restoration along the Mississippi coast is to create as natural of an environment as is possible. Once the newly created marsh has been established, the earthen berm can be modified to create a more natural environment. For this reason, the earthen berm option was selected in combination with the breakwaters alternative. The breakwaters provide additional protection to the restored shore and as well as hard substrate and additional habitat complexity themselves.

Alternative 4—Armoring Existing Shoreline. This alternative consists of armoring the existing shoreline with rip-rap to impede erosion from future storms. While this would be a cost effective alternative, it would not have the benefits of restoring wetlands lost from erosion due to Hurricane Katrina. As a result, this alternative was eliminated from further consideration.

2.3.1.5 Environmental Effects

Environmental effects associated with using dredged material to create marsh and aquatic habitat along the western shoreline of Bayou Caddy include:

- Restoration of emergent tidal wetland habitat;
- Prevention of future erosion;
- Protection from future storm and hurricane wave energy; and
- Restoration of additional aquatic resource and upland habitats (i.e., hard substrate attached organisms, upland chenier).

The adverse environmental effects would be temporary environmental impacts principally associated with construction. There would be temporary disruption of the aquatic habitat and benthic habitats as material is placed to construct the earthen containment and marsh substrate material. Measures will be taken to minimize these unavoidable impacts. The restoration of 18 acres of marsh habitat and placement of the hard substrate is expected to offset these adverse impacts.

2.3.2 Hancock County Beaches

The study shoreline areas are located in Hancock County, the eastern-most coastal county in Mississippi, between Bay St. Louis and Bayou Cadet. It is located on Mississippi Sound about 95 miles west of Mobile, Alabama and about 50 miles east of New Orleans, Louisiana as shown in Figure 2.3.1-1.

The Hancock County shoreline running between Bayou Caddy and Waveland is fronted by Beach Boulevard, which is protected by a concrete seawall and existing beach. The project sites are seaward of Beach Boulevard existing seawalls some 50 feet, creating a 2 foot high sand berm with 1 vertical to 3 horizontal side slopes and supplemented by sand fencing and plantings.

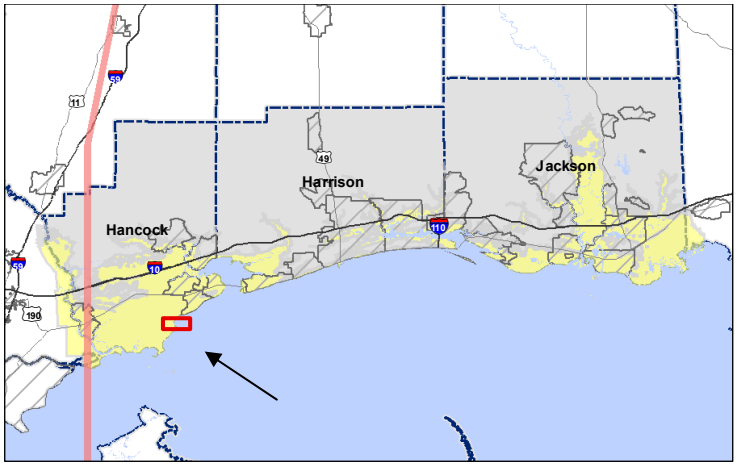


Figure 2.3.2-1. Hancock County Beaches Project Area.

The existing Mississippi Sound shoreline in the area is protected by a concrete stepped-face structure about 8 miles long. The seawall was constructed by local interests at various times between 1915 and 1928. Hydrographic and topographic survey data was obtained by the Mobile District under contract in September, 2003. The top elevation of the seawall varies between +3.8 to +5.0 feet National Geodetic Vertical Datum (NGVD). A sand beach was pumped into place on the along about six miles of this seawall in early 1967 as part of the emergency repair and protection following Hurricane Betsy (September 1965). There is another beach extending for about a mile south of the U.S. Highway 90 Bridge crossing the mouth of St. Louis Bay that was placed by the Mississippi Highway Department during the bridge construction. An additional one-mile-long segment of beach was constructed in the summer of 2005 from Cadet Bayou eastward.

South Beach Boulevard is the main thoroughfare along the entire length of the existing seawall. Historical as well as current wave attack against the shoreline of Hancock County has caused migration of soil through or under the seawall and scour of soil below the seawall in various locations, resulting in damages to South Beach Boulevard and other infrastructure. Sections of the highway have collapsed from time to time, disrupting and damaging utilities, and causing hazards and delays for residents and vehicular traffic. Hancock County has frequently repaired the seawall and road because of the loss of material from beneath the highway. Damaged utilities which have required repairs include water, sewer, natural gas, electric power, and electronic communications. The Mobile District has constructed a number of new seawall segments along various reaches of the existing seawall to alleviate this soil migration and scour problems in the study area under Sections 14 and 103 authorities.

Prior to the 2005 hurricane season, the Hancock County shoreline eastward of Buccaneer Park was characterized by wide and well established beach with dunes as constructed just before the hurricane season (Figure 2.3.2-2). The beaches survived the storm without major damages: however, the dunes and associated vegetation were destroyed. The dunes provided a line of defense to the roadway and properties landward of the road. The absence of the dune leaves the area particularly vulnerable to future storm events.

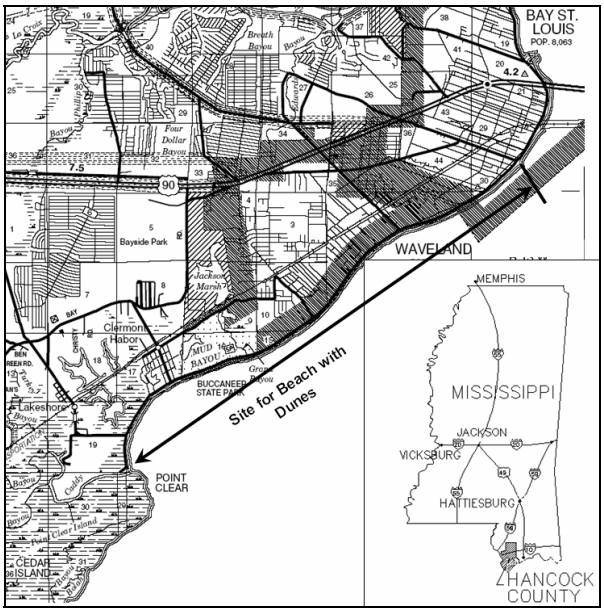


Figure 2.3.2-2. Hancock County Beaches Proposed Location and Photograph of Typical Dune That Existed Prior to 2005 Hurricane Season

2.3.2.1 Coastal and Hydraulic Conditions

The climate in the project area is subtropical, characterized by warm summers and short, mild winters. Average temperatures are 82 degrees Fahrenheit for the summer months and 53 degrees Fahrenheit for the winter months. The average annual rainfall is about 60 inches, and is fairly evenly distributed throughout the year. Precipitation records also indicate July as the wettest month, while October is the driest.

Mississippi Sound is a shallow coastal lagoon extending 80 miles along the coast of the Gulf of Mexico from Mobile Bay, Alabama westward to Lake Borgne, Louisiana. The average depth in the sound is 10 feet, and 99 percent of the sound is less than 29 feet deep.

Circulation patterns within the vicinity of the study area are controlled by astronomical tides, winds, and freshwater discharges. The mean diurnal tide range in St. Louis Bay is 1.6 feet, and the extreme (except during storms) is about 3.5 feet. The velocity of normal tidal currents ranges from 0.5 to 1.0 foot per second (fps) and their direction is generally east to west. Predominant winds average eight miles per hour (mph) from the south during the summer and from the northeast during the winter.

Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Winds from the southeast can produce high tides, piling water up against the shoreline. The Wolf and Jordan Rivers discharge fresh water into opposite sides of the upper portion of St. Louis Bay, with average flows of about 830 and 710 cubic feet per second, respectively. The study area has been impacted by several tropical storms and hurricanes, most recently from Hurricane Katrina in 2005. Post-Katrina recovery of high water marks in the area suggest storm surges on the order of 20 to 25 feet or more. Frequency estimates of historic storm tide elevations are shown in Table 2.3.2-1, suggesting surges from Katrina far exceeded the 100-year surge elevation.

Table 2.3.2-1.
Storm Tide Frequency (feet, NGVD)

Return Interval	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
Height (FT)	3.7	5.1	6.6	9.1	11.7	15.1

2.3.2.2 Geotechnical Conditions

Materials used for the dune construction will have 90% passing the #40 sieve and only 10% will pass the #200 sieve. The sand fill shall not have noticeable amounts of shell and/or gravel. The sand will be trucked to the sites form upland sources within 10 miles of the work area, dumped and reshaped in place.

2.3.2.3 Preferred Alternative. Dune Restoration (2-foot height) with Vegetation and Fencing

The preferred plan involves constructing a dune associated with the existing beach and adding stabilizing fencing and dune vegetation. The finished stable dune will be 2 feet high with a crest width of 10 feet and side slopes of one vertical to three horizontal. The dune material will come from the established upland borrow areas within 10 miles of the work area. The plantings will have a density of 1 plant per 4 square feet and the fence will include the entire linear length of the project. The dune alone project will require replacement within 10 years and the dune with plantings and fence will require replacement within 15 years.

The construction plan will be to install the new dune 50 feet seaward of the existing seawall at the edge of Beach Boulevard from the Washing Street Pier (Waveland, MS) to Bayou Caddy. The beach road is established at an elevation of $\pm$ 5.0 feet NGVD and the existing beach extends about 150 feet to the water's edge. Construction surveys will be necessary to lay out the design beach template and to confirm as-built grading meets design intents. This alternative will require replacement within 15 years and will require periodic removal of wind-blown sand from Beach Road by street sweeping equipment, and transferal of wind-blown sand from the lee of the dunes to the front. Severe storms, such as hurricanes, could severely damage the project regardless of the presence or absence of fencing and vegetation and require replacement of the dunes. The base of the dune is at elevation +5.5 ft NGVD. If the still-water elevation at the base of the dune is the elevation at which storm surge, with additional wave action, would begin to erode the dune, an approximately 10-year recurrence interval surge corresponds to this elevation based on frequency analysis of annual maximum water surface elevations at Biloxi.

Dune plants will be planted to cover 60-80% of the total dune area. The vegetation will consist of local dominant species that populate nearby natural dune systems. The selection of the dune vegetation will consist of species that are most widely used for dune restoration and are readily available from local nurseries and suppliers. The selection will be coordinated with local environmental experts familiar with dune ecosystems in the immediate area. Dune plant species being considered are:

- sea oats (*Uniola paniculata*)
- bitter panic grass *(Panicum ararum)*
- sea rocket *(Cakile constricta)*
- beach morning glory *(Ipomoea imperati)*
- railroad vine *(Ipmea pes-caprae)*

- blue stem *(Schizachyrium scoparium)*
- blanket flower *(Gaillardi pulchella)*

2.3.2.4 Other Alternative

Altenative 1— 'No Action'. The 'No Action' alternative includes not placing a dune system in association with the already planned beach nourishment project. Dunes provide a valuable level of protection from minimal storm surges and waves. Dunes also provide beneficial habitat for a variety of wildlife. Without a dune system, the shorelines will remain particularly vulnerable to storm damages and will not contribute to the benefits resulting from increased wildlife habitat. Accordingly, this alternative was not selected.

Alternative 2—Placement of Dune Without Vegetation. Vegetated, stable dunes are considered a valuable coastal resource. Restoring dunes without associated vegetation will not contribute to the well being of various flora and fauna that once existed within the proposed project area. Achieving these goals will allow greater sustainability of a coastal environment contributing benefits to various indigenous wildlife species. Because of the reduced environmental benefits as compared to the preferred alternative, the dune without vegetation was not selected.

2.3.2.5 Environmental Effects

The proposed dune restoration at the Hancock County Beaches will produce numerous ecological benefits associated with the shoreline restoration. Vegetated dunes provide foraging and roosting habitats for various shore and migratory birds including least terns and the federally-listed (threatened) piping plover. The proposed shoreline feature will provide additional resting and wintering areas for these birds. The creation of a dune would allow the establishment of multiple vegetation types associated with local dune habitats. The proposed project would also provide general benefits by creating opportunities for the production of food sources; thus, contributing to the general well being of waterfowl, raptors, nearshore fish and other wildlife associated with the coastal environment. A beach-dune system will be advantageous for increased overall stability of the entire beach ecosystem by providing reserves of sand acting as a buffer to resist erosive events. The increased beach stability will directly contribute to the sustainability of the dune system habitats.

The placement of beach compatible sand on the existing beach to create the proposed dunes will have minimal environmental effects. Activities during the construction period may displace shorebirds. Water impacts should be minimal as the sand will be placed using trucks and shaped with earth moving equipment. Beach visitors may be required to move from a specific location to another beach location. The equipment operation may present a temporary noise disturbance. The se environmental impacts will be minor and temporary.

2.3.3 Hancock County Streams

The hurricanes of 2005 caused damage to drainage ways by blowing trees, and other debris into these areas and by depositing sediment in many areas of Hancock County, Mississippi. There were many canals and drainage ways for low-lying areas near the coast that were affected by sedimentation. The canals are numerous in the county. Tidal water extends throughout the canals. Although the work could reduce the rainfall flooding to some degree, the tidal effects mean that removal of sediment may not reduce flooding significantly. However there are specific canals that are crossed by hurricane evacuation routes, or are used by commercial fishing vessels, or have sediment impaired tidal exchange that would benefit from removal of storm carried sediment. These include drainage ways near Cowan Bayou, and Hancock County Fishing Center. A general location map of the study areas is shown below in Figures 2.3.3-1 and 2.3.3-2.

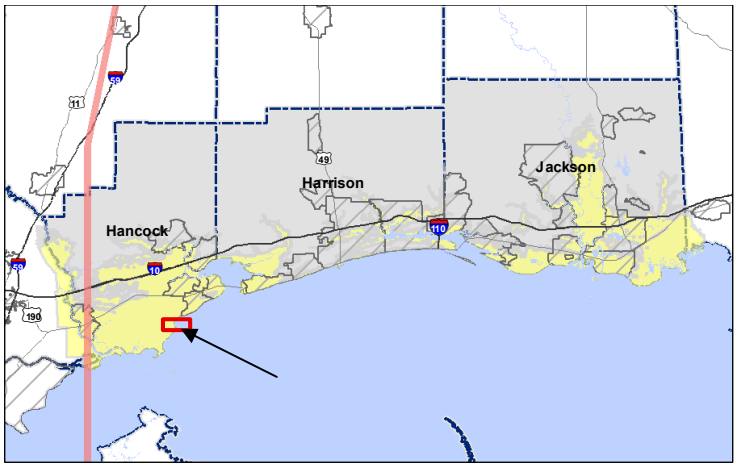


Figure 2.3.3-1. Hancock County Streams Project Area

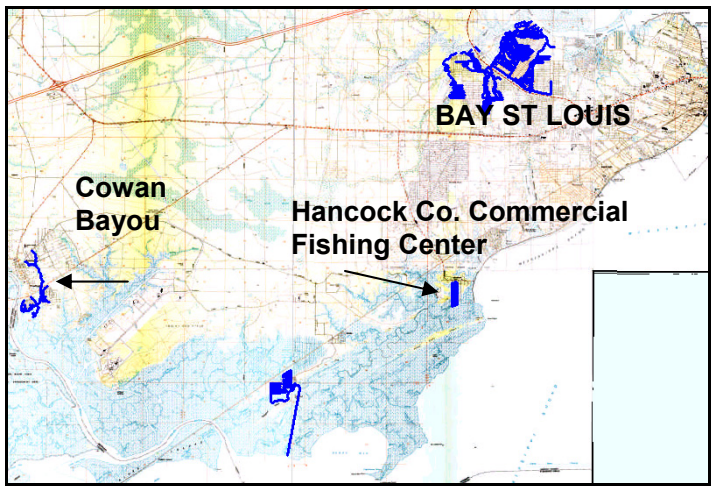


Figure 2.3.3-2. Hancock County Streams Project Vicinity Map

2.3.3.1 Coastal and Hydraulic Conditions

Drainage canals and small navigation canals were severely damaged by the hurricanes of 2005. Debris and sediment were placed in the canals. Hydraulic flows within the canals have become severely restricted. Water quality may deteriorate as a result of impeded flows and without removal this could continue. In addition, impediment of water flow and navigation traffic (recreational) would continue to occur.

2.3.3.2 Geotechnical Conditions

The hurricane storm surge which flooded much of the county brought in large amounts of sediment which was deposited in the canals when the waters receded. In addition, debris from adjacent areas was carried to the canals as a result of the storm surge. The sediment has not been sampled but likely consists of coastal sediments common to the area. These include mixtures of predominately silts and clays and lesser amounts of sands.

2.3.3.3 Preferred Alternative. Sediment Removal (2ft) within Cowan Bayou and Hancock County Commercial Fishing Center

The preferred alternative project involves improvement of drainage in order to reduce flooding of a hurricane evacuation route (White's Road) adjacent to Cowan Bayou by removal of debris and sediment from within the drainage way and to restore small vessel commercial navigation at Hancock County Commercial Fishing Center, adjacent to Bayou Caddy. The preferred alternative would consist of removing approximately 2 feet of sediment over an average width of 45 feet for a length of 6.6 miles, as shown in Figures 2.3.3-3 and 2.3.3-4. The specific projects are discussed in the following paragraphs. There appears to be a minor amount of debris in the canals which would also have to be removed to facilitate removal of the sediment. Mechanical excavation of the debris and sediments would be accomplished by using a marsh buggy type back-hoe or other mechanical excavation equipment and dump trucks. Dredged material would be stockpiled. Large debris would be removed and hauled to an appropriate disposal facility. The sediment would be made available for appropriate beneficial use.

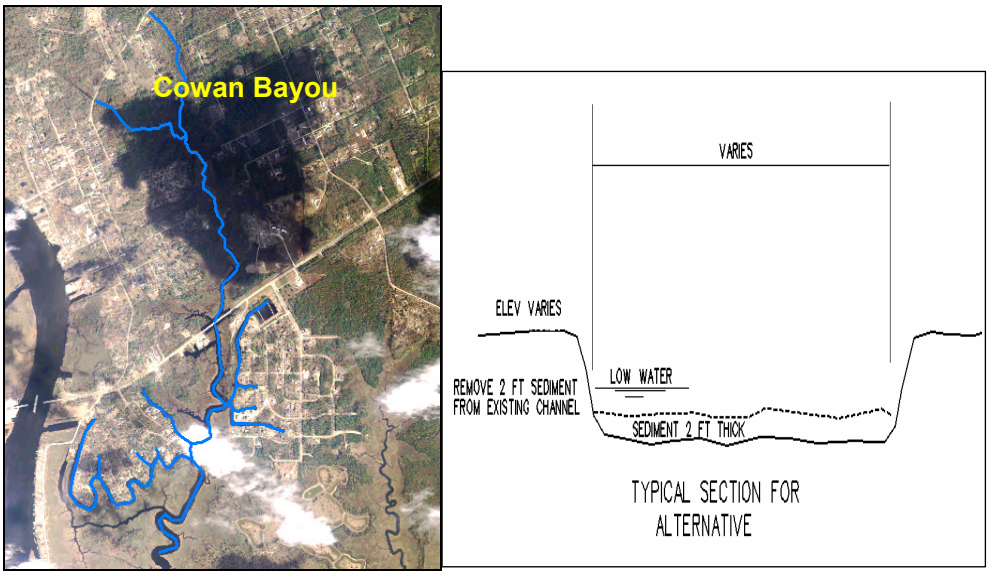


Figure 2.3.3-3. Cowan Bayou

Figure 2.3.3-4. Hancock County Commercial Fishing Center

Cowan Bayou. This area consists of the drainage at Whites Road, the subdivisions of Oak Harbor and Belle Isle, and the drainage ways connecting these areas. These areas are shown in Figure 2.3.3-3. The drainage canals in these subdivisions vary in width from approximately 15 feet – 75 feet with an average of approximately 45 feet wide. The Cowan Bayou canals total approximately 4.7 miles in length. Although it could not be verified, an engineer representing Hancock County states that the canals shoaled approximately 2 feet from the 2005 hurricanes, from an elevation of -4 feet NGVD to -2 feet NGVD. High water marks by FEMA indicate water reached elevations near 20 feet NGVD on Cowan Bayou at Pearlington, Mississippi.

The project involves improvement of drainage in order to reduce flooding by removing approximately 2 feet of sediment over an average width of 45 feet and a length of 4.7 miles.

The work could reduce the rainfall flooding to some degree, although tidal water extends throughout the canals below Highway 90. Flooding at Whites Road from high water on the Pearl River would not be reduced. The work in the reach of the bayou above Highway 90 would probably have more impact than work below Highway 90.

Hancock County Commercial Fishing Center. This area consists of the development at the Hancock County Commercial Fishing Center and the canals ways connecting these areas. The project area is shown in Figure 2.3.3-4. The canals in this area are approximately 100 feet wide and 300 feet apart. The canals total approximately 1.9 miles in length. An engineer representing Hancock County states that the canals shoaled approximately 2 feet from the 2005 hurricanes. Several larger boats were in the canal at the time which would typically draw approximately 6 feet. The upper end of the eastern canal was clogged with sediment and debris. USGS quad sheets indicate that the elevation of the subdivisions is less than 5 feet above NGVD. High water contours by FEMA indicate water reached elevations near 23 feet NGVD at the Hancock County Commercial Fishing Center.

The Hancock County Commercial Fishing Center portion of the preferred alternative involves removing approximately 2 feet of sediment over an average width of 100 feet and length of 1.9 miles. There is debris in the canals which would also have to be removed to facilitate removal of the sediment.

2.3.3.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with the removal process. Without correction action, increased flooding would occur with the resultant loss of and damage to existing infrastructure, public lands, and residences. This alternative was not selected because it would not address the problem of flooding and sediment in theses coastal streams.

Alternative 2—Minimal Sediment Removal (1ft) within Cowan Bayou and Hancock County Commercial Fishing Center. This alternative involved removal of 1-foot of sediment from the Cowan Bayou and Hancock County Commercial Fishing Center area. This results in slightly less benefits that the preferred 2-foot alternative but with similar costs. This alternative was not selected because of the environmental impacts would be basically indistinguishable compared with the preferred alternative while the benefits would be slightly reduced.

Alternative 3—Removal of Sediment from Other Hancock County Canal Systems. The removal of sediment from drainage ways many drainage ways of other Hancock County communities was considered. These included drainage ways for Shoreline Park, Bayou Phillip, and Heron Bay. These populated subdivisions are shown on Figure 2.3.3. These subdivision drainage canals vary in width from approximately 30 feet – 75 feet with an average of approximately 45 feet wide and are

approximately 300 feet apart. The Shoreline Park canals total approximately 22 miles in length, the Bayou Phillips canals total approximately 12.8 miles in length, and Heron Bay total approximately 6.8 miles in length. The U.S. Geological Survey (USGS) quad sheets indicate that the elevation of the subdivisions is less than 5 feet above NGVD.

Removal of sediment from these drainage ways could reduce the rainfall flooding to some degree. However, tidal water extends throughout the canals and the reductions are not anticipated to be significant. Further analysis is required to determine more effective measures to reduce flooding damages are available.

2.3.3.5 Environmental Effects

Overall aesthetic quality would be improved, since the unsightly debris would be removed. Removal of the sediment would provide flushing of the system and improvement to tidal exchange resulting in less stagnant water. Removal of the large obstructions would allow fish to migrate up the systems by the sub-adult and larvae for use as a forage area. The improved habitat would also improve foraging areas for shorebird use. Removal of the non-biodegradable foreign material and deposition of sediments would improve overall water quality by improving circulation and enhanced drainage in the area resulting in an overall reduction of flooding to nearby residences.

Localized, minor, and temporary adverse impacts will take place during the removal of the sediment. Temporary increases in turbidity in the immediate area of sediment removal will unavoidably occur. Bottom living organisms will be displaced or lost. Recolonization is expected to occur quickly. The sediments to be removed were likely deposited over a short period during the storm covering the existing bottom organisms. Mobile organisms may just leave the area until construction activity is over.

2.3.4 Jackson Marsh

The study shoreline areas are located in Hancock County in Mississippi, between Bay St. Louis and Bayou Caddy (Figure 2.3.4-1).

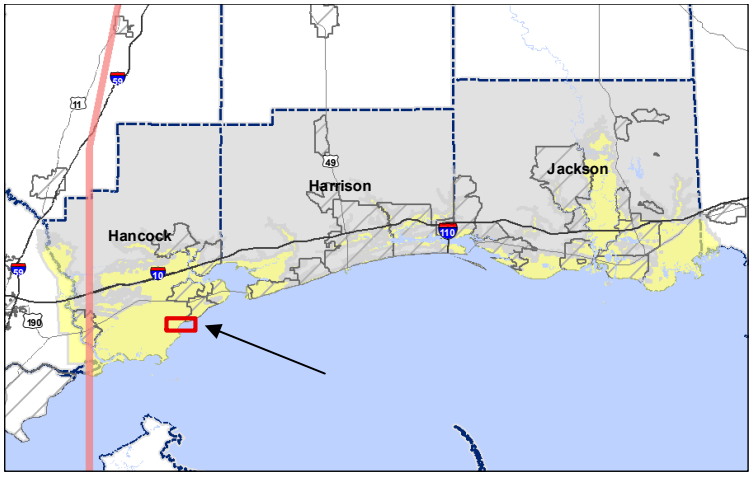


Figure 2.3.4-1. Jackson Marsh Project Area

The site location is shown on Figures 2.3.4-2 and 2.3.4-3. The Hancock County shoreline running between Bayou Caddy and Waveland is fronted by Beach Boulevard, which is protected by a concrete seawall and existing beach. The project sites are seaward of Beach Boulevard at the

culvert outlets, replacing existing damaged guide walls that extend some 150 feet to the water's edge.

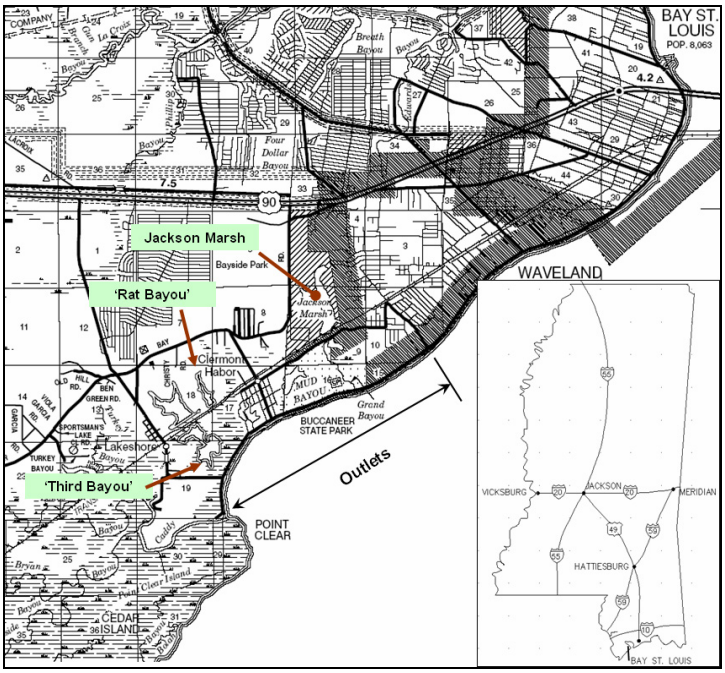


Figure 2.3.4-2. Jackson Marsh Project Location

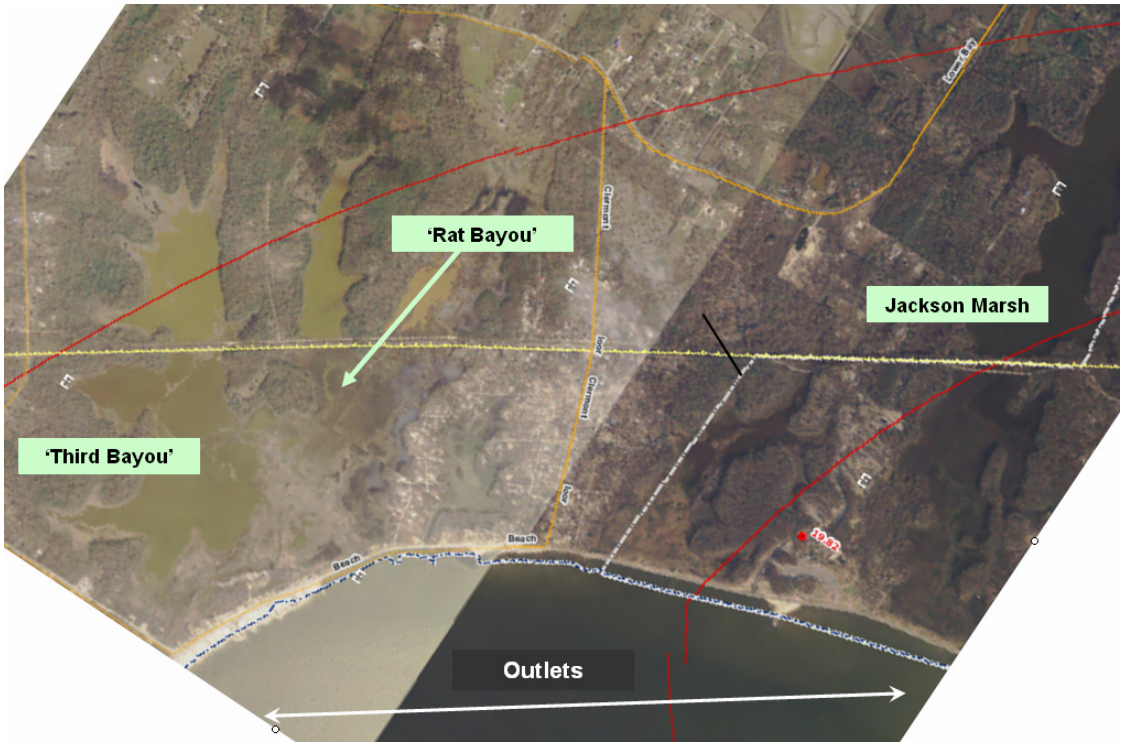


Figure 2.3.4-3. Aerial Photograph of Jackson Marsh Area. Shoreline from 'Third Bayou' to Jackson Marsh

The existing Mississippi Sound shoreline in the area is protected by a concrete stepped-face structure about 8 miles long. The seawall was constructed by local interests at various times between 1915 and 1928. The top elevation of the seawall varies between +3.8 to +5.0 feet NGVD. A sand beach was pumped into place along about six miles of this seawall in early 1967 as part of the emergency repair and protection following Hurricane Betsy (September 1965). There is another beach extending for about a mile south of the Highway 90 Bridge crossing the mouth of St. Louis Bay that was placed by the Mississippi Highway Department during the bridge construction. An additional one-mile-long segment of beach was constructed in the summer of 2005 from Cadet Bayou eastward.

South Beach Boulevard is the main thoroughfare along the entire length of the existing seawall. Historical as well as current wave attack against the shoreline of Hancock County has caused migration of soil through or under the seawall and scour of soil below the seawall in various locations, resulting in damages to South Beach Boulevard and other infrastructure. Sections of the highway have collapsed from time to time, disrupting and damaging utilities, and causing hazards and delays for residents and vehicular traffic. Hancock County has frequently repaired the seawall and road because of the loss of material from beneath the highway. The Corps has constructed a number of new seawall segments along various reaches of the existing seawall to alleviate this soil migration and scour problems in the study area under Sections 14 and 103 authorities.

The seawall is penetrated in a number of locations by open drainage channels. Typically, the components of these drainage channels at their crossings of South Beach Boulevard include concrete headwalls, concrete box culverts beneath the boulevard, and channel extension guide-walls extending out into Mississippi Sound. Many of these were severely damaged by Hurricane Katrina. Typical damages included breaching of the extension guide walls, failure of the guide walls, and destruction of the outlet end of the box culverts (see Figure 2.3.4-4).

Figure 2.3.4-4. Damaged Pathway, Drainage Channel Outlet, and Outlet Bridge, Near Waveland

Several tidal marshes (over 977 acres) exist on the landward side of the roadway on the southwestern end of Hancock County around the Waveland area. The existence of these expansive and contiguous tidal marshlands are maintained through tidal conduits (outfalls) built into the existing seawall at regular intervals. The twelve outlets provided drainage and tidal exchange between the Mississippi Sound and the freshwater marshes located inland from the beach. The beach road is established at elevation 5.0 ±, with the beach extending some 150 feet to the water's edge. The outfalls require training walls to maintain the channel integrity from the outlet to the beach water. The

existing training walls are in a state of failure and will choke off these outlets if they fail completely. The walls will run from the edge of the outlet headwalls to the water's edge. The top of the wall will be placed at elevation 5.0 with about 5.0 feet of unsupported length and embedded some 10 feet. Many of the tidal conduits supporting these marsh areas are in a state of severe deterioration. It is also believed that much of the tidal flow between Mississippi Sound and the marshes has been critically restricted from sedimentation as a result of Hurricane Katrina. The existence of these valuable marshlands is dependent upon the continuation of the tidal exchange provided by the outfalls.

Without the tidal exchange, the marshes would drastically deteriorate and cease to function as a tidal salt marsh. In the short-term, clearing and/or reconstruction of tidal outfalls would maintain a minimum tidal flow necessary to sustain salt marshes providing vital stabilization. The overall health of the marshes is likely constrained by the limited water exchange allowed by the tidal conduit system. Reconstruction in a manner that would increase tidal flow may also result in the expansion and restoration of marsh areas that may have been restricted due to the present tidal exchange allowed by the old seawall and tidal conduits. Restoring a greater tidal flow will provide for the restoration, protection, stabilization, and continued existence of the present ecological resources.

2.3.4.1 Coastal and Hydraulic Conditions

Circulation patterns within the vicinity of the study area are controlled by astronomical tides, winds, and freshwater discharges. The mean diurnal tide range in St. Louis Bay is 1.6 feet, and the extreme (except during storms) is about 3.5 feet. Predominant winds average 8 mph from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the Sound causing current velocities of several knots in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline. The Wolf and Jordan Rivers discharge freshwater into opposite sides of the upper portion of St. Louis Bay. The study area has been impacted by several tropical storms and hurricanes, most recently from Hurricane Katrina in 2005. Post-Katrina recovery of high water marks in the area suggests storm surges on the order of 20 to 25 feet or more.

2.3.4.2 Geotechnical Conditions

The wall should be capable of supporting the backfill without the aid of tiebacks since erosion of the backfill is likely during a storm event. The existing beach subgrade for the support of the walls can be assumed to be poorly graded sands and silty sands from elevation 5.0 to elevation -15. Medium to dense poorly graded sands and silty sands can be expected below elevation 5.0 with more silty sands and possible organic content beyond elevation -10.0, becoming less silty beyond elevation -15.

2.3.4.3 Preferred Alternative. Sediment Removal and Guide Wall Replacement

This alternative consists of removing the sediment that clogs the drainage channels to the Mississippi Sound. This alternative would accelerate tidal exchange between the adjacent wetlands and Mississippi Sound.

There are 16 outlets along Beach Boulevard with 12 identified outlets that the guide walls require replacement. That means that there are 24 walls, each 155 feet in length and a pile length of 15 feet. This should give a total of 55,800 square feet of piling in place. The pile section should be of sufficient stiffness to not require tiebacks. There will be an average of 5 feet in unsupported length and 10 feet of embedment. Thus, install 55,800 square feet of new sheetpile walls using vinyl sheets

at 12 locations. Excavate 1,000 cys of sand materials from within the channel and deposit it behind the new walls.

2.3.4.4 Other Alternatives

Alternative 1— 'No Action'. This alternative does nothing to address the lack of water influx into Jackson Marsh; thus, the marsh will continue to deteriorate. Because of the deterioration, this alternative was not acceptable.

Alternative 2—Sediment Removal and Guide Wall Replacement with Aluminum Sheetpile. Install 55,800 square feet of new sheetpile walls using aluminum sheets at 12 locations. Excavate 1,000 cys of sand materials from within the channel and deposit it behind the new walls. This alternative is the similar to the preferred alternative except the structure would be made of aluminum instead of vinyl. This alternative would provide the same level of protection as vinyl sheetpile, but is not as cost-effective as vinyl, therefore no longer considered as an alternative.

Alternative 3—Sediment Removal – Without Replacement of Guide Walls. This alternative consists of removing the sediment that clogs the drainage channels to the Mississippi Sound. This alternative would restore tidal exchange between the adjacent wetlands and Mississippi Sound, but would not be sustainable without repairing the culvert walls**.** Because it would not be sustainable and have high, recurring maintenance costs. Because of this impaired sustainability, this alternative was not selected.

2.3.4.5 Environmental Effects

The tidal connection of several tidal marshes that occur on the landward side of the roadway on the southwestern end of Hancock County around the Waveland area would be restored to the Mississippi Sound. The existence of these expansive and contiguous tidal marshlands are maintained through tidal conduits (outfalls) built into the existing seawall at regular intervals. The existence of these valuable marshlands is dependent upon the continuation of the tidal exchange provided by the outfalls. Without the tidal exchange, the marshes would drastically deteriorate and cease to function as a tidal salt marsh. Reconstruction in a manner that would increase tidal flow may also result in the expansion and restoration of marsh areas that may have been restricted due to the present tidal exchange allowed by the old seawall and tidal conduits. Restoring and increasing tidal flow will provide for the restoration, protection, stabilization of the present ecological resources. Water quality in the marsh areas will be improved as compared to the restricted flow condition.

Overall aesthetic quality would be improved, since the existing structure is crumbling in places. Implementation of the proposed action would reduce sediment movement and turbidity.

Adverse environmental effects will be very limited to the very short construction period. Excavation of the sand and repair of the drainageways will have very localized and minor effects on water column and benthic habitat. The scale of this construction is very small. Shorebirds will move to adjacent areas where construction is not taking place. Fish and aquatic organisms are not expected to be adversely affected. The restoration of the tidal exchange of the marshes with Mississippi Sound clearly outweighs the minor adverse impacts that would occur.

2.3.5 Clermont Harbor

Clermont Harbor is a small community along the shore of Mississippi Sound in southern Hancock County as shown in Figure 2.3.5-1. The existing seawall fronting Mississippi Sound is a concrete stepped-face structure about 8 miles long and was constructed by local interests at various times between 1915 and 1928, as shown in Figure 2.3.5-2.

2.3.5.1 Coastal and Hydraulic Conditions

Hydrographic and topographic survey data obtained by the Corps in September, 2003, determined the top elevation of the seawall varying between +3.8 to +5.0 feet NGVD.

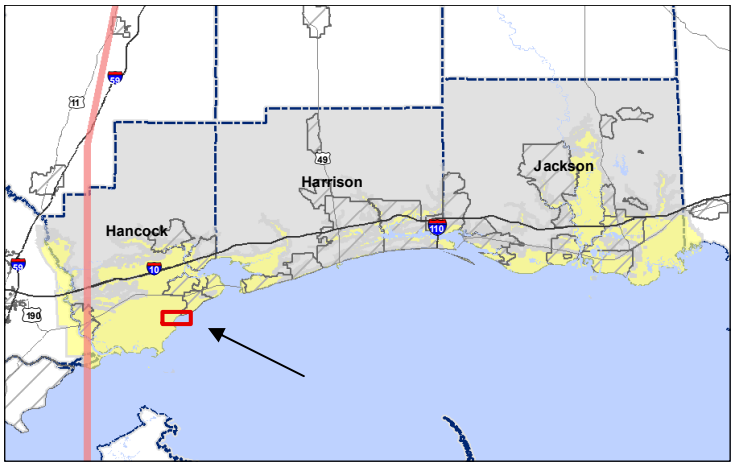


Figure 2.3.5-1. Clermont Harbor Project Area

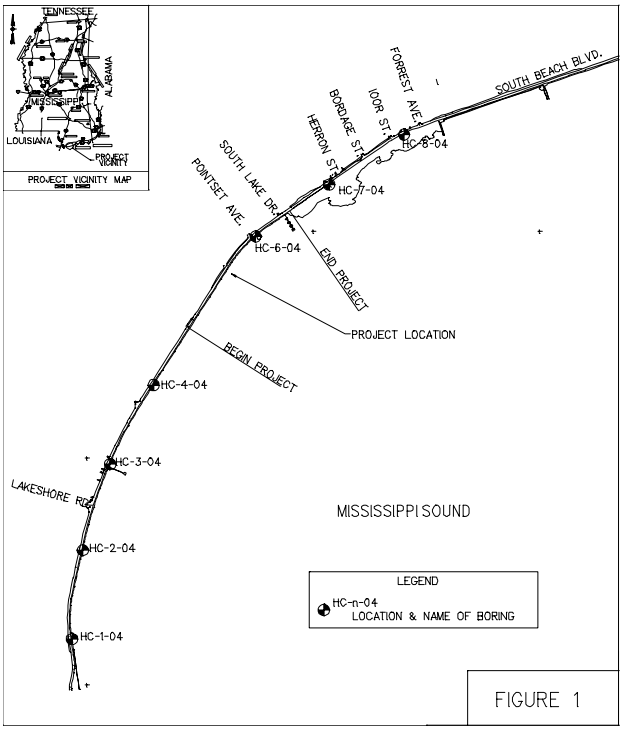


Figure 2.3.5-2. Clermont Harbor Seawall and Proposed Rehab Locations

2.3.5.2 Geotechnical Conditions

Historical as well as current wave attack against the shoreline of Hancock County has caused migration of soil through or under the seawall and scour of soil below the seawall in various locations, resulting in damages to South Beach Boulevard and other infrastructure. Sections of the

roadway have collapsed from time to time, disrupting and damaging utilities, and causing hazards and delays for residents and vehicular traffic. Hancock County has frequently repaired the seawall and road because of the loss of material from beneath the highway. Damaged utilities, which have required repairs, include water, sewer, natural gas, electric power, and electronic communications. Figure 2.3.5-3 depicts a typical cross section of the existing seawall condition.

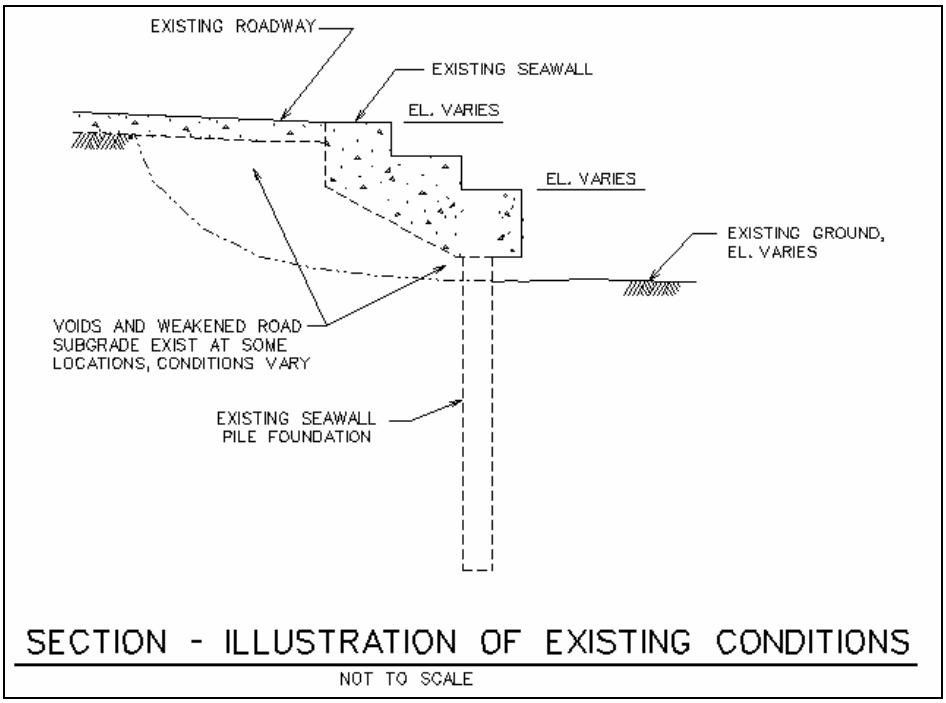


Figure 2.3.5-3. Typical Cross-Section of Existing Clermont Harbor Seawall

2.3.5.3 Preferred Project. Rehabilitation of Existing Seawall With Vinyl Sheetpile

The preferred alternative involves the rehabilitation of the existing Clermont Harbor seawall using a vinyl sheet piling bulkhead attached to the face of the seawall, with a cast-in-place reinforced concrete cap, The project involves the stabilization of approximately 2,000 feet of the Hancock County seawall along South Beach Boulevard in Hancock County. The project will provide protection for South Beach Boulevard through the rehabilitation of the deteriorating seawall by constructing an erosion protection system consisting of the placement of vinyl sheetpile in front of the existing seawall. Vinyl material is the most inexpensive and effective material for use in this application as it is extremely resistant to the saltwater environment and is strong enough to resist the minimal loads imposed on the walls. The vinyl sheetpile should serve almost indefinitely in providing toe protection for the existing seawall. The sheetpile will be anchored to the seawall face using steel rock anchors. The void behind the bulkhead will be backfilled with gravel and sealed at the top with a reinforced concrete cap. Figure 2.3.5-4 gives a representative cross-section of the work to be performed.

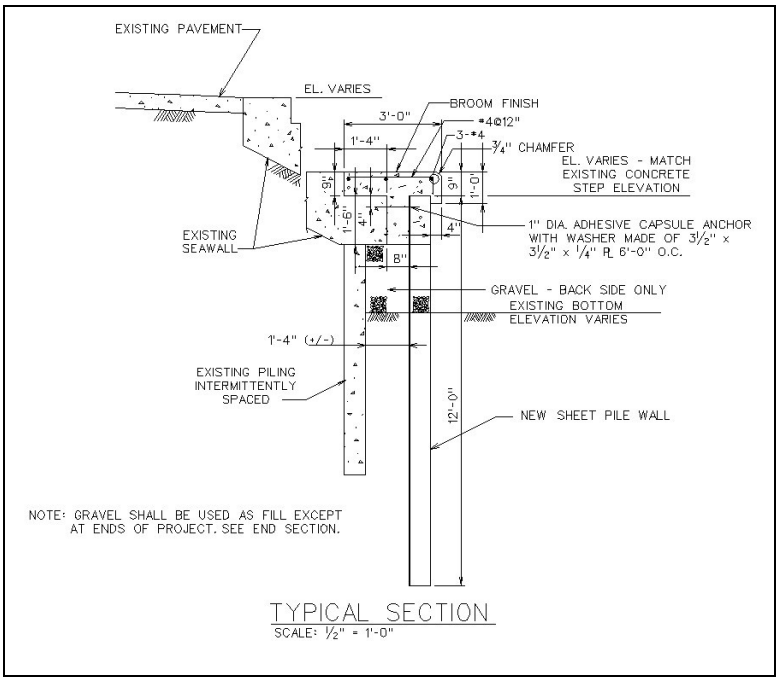


Figure 2.3.5-4. Cross-Section of Proposed Clermont Harbor Work

2.3.5.4 Other Alternatives

Alternative 1— 'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with structural improvements. Without corrective action, roadside erosion and seawall instability would continue with the resultant loss of valuable public land and facilities. This alternative was not selected because it would not correct the existing erosive conditions presently experienced along the highway.

Alternative 2—Rehabilitation of Existing Seawall With Steel Sheetpile. This alternative would consist of the installation of continuous interlocked steel sheetpiling along the face of the lower-most step of the existing stepped seawall for the entire project length of approximately 2,000 feet. The sheetpile bulkhead would be anchored to the seawall face using steel rock anchors; the void behind the bulkhead would be backfilled with gravel and sealed at the top with a reinforced concrete cap. This alternative was not selected because the vinyl sheetpile is less expensive and considered best for this application.

Alternative 3—Riprap Revetment Protection. This alternative is a structural protection plan consisting predominantly of riprap revetment protection for the existing seawall sections. The riprap revetment protection would consist of graded stone placed over bedding material, which would be placed over a layer of filter fabric and granular fill. Top elevation will be the same as the bottom step of the existing seawall. The base of the revetment would extend from the base of the existing seawall to a point 15.5 feet out in Mississippi Sound. This alternative will require a variance to the Mississippi Coastal Program [Chapter 8 – Rules, Regulations, Guidelines and Procedures, Section 2 (Wetlands Management), Part III. D. (Guidelines for Regulated Activities – Bulkheads and Seawalls)]. This alternative was not selected because it would increase the environmental impacts to the Mississippi Sound water bottoms and the final costs for the project.

2.3.5.5 Environmental Effects

The project will provide protection for North Beach Boulevard through the rehabilitation of the deteriorating seawall by constructing an erosion protection system consisting of the placement of vinyl sheetpile in front of the existing seawall. Overall aesthetic quality would be improved, since the existing seawall is crumbling in places. Implementation of the proposed action would reduce sediment movement and turbidity resulting from the failure of the seawall. The potential for wave-induced erosion in the vicinity of the project after construction was examined and a reduction is expected as a result of the project. Sheetpile will also serve as substrate for attached aquatic organisms (epifauna) such as barnacles.

2.3.6 Downtown Bay St. Louis

The City of Bay St. Louis (see Figure 2.3.6-1) was heavily damaged by the hurricanes of 2005, particularly by the storm surge generated by Hurricane Katrina on August 29, 2005. The initial Hurricane Cindy (6 July), which hit southwest of Waveland, MS near Ansley, caused some loss of beach sediments, but Hurricane Katrina caused extensive erosion of the beach and the natural bluff landward of the beach (shown below), damage to an existing shore protection bulkhead; South Beach Boulevard was the main thoroughfare along the entire length of the project area. Wave attack from the surge elevation of Hurricane Katrina destroyed South Beach Boulevard and the commercial and residential structures on both sides of the boulevard. Utilities located beneath the pavement and adjacent to the street were also lost, including water, sewer, natural gas, electric power, and electronic communications. Hancock County plans to rebuild South Beach Boulevard, the commercial and residential structures on both sides of the boulevard, and repair the utility infrastructure lost during the storm. Figures 2.3.6-2 and 2.3.6-7 give an illustration of current damaged existing conditions.

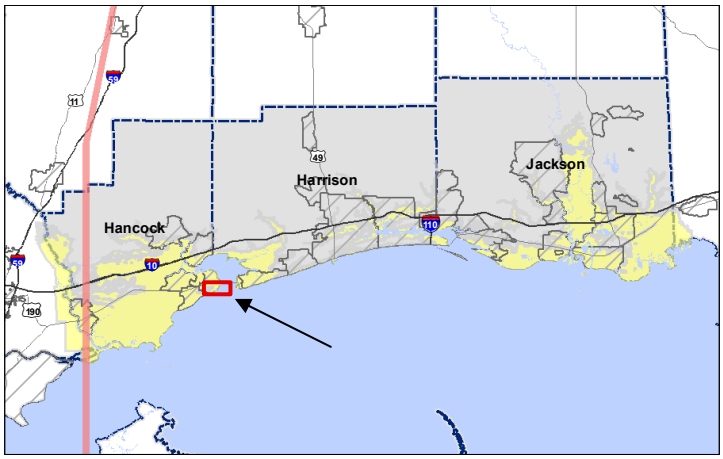


Figure 2.3.6-1. Downtown Bay St. Louis Project Area

Figure 2.3.6-2. Downtown Bay St. Louis, After Hurricane Katrina

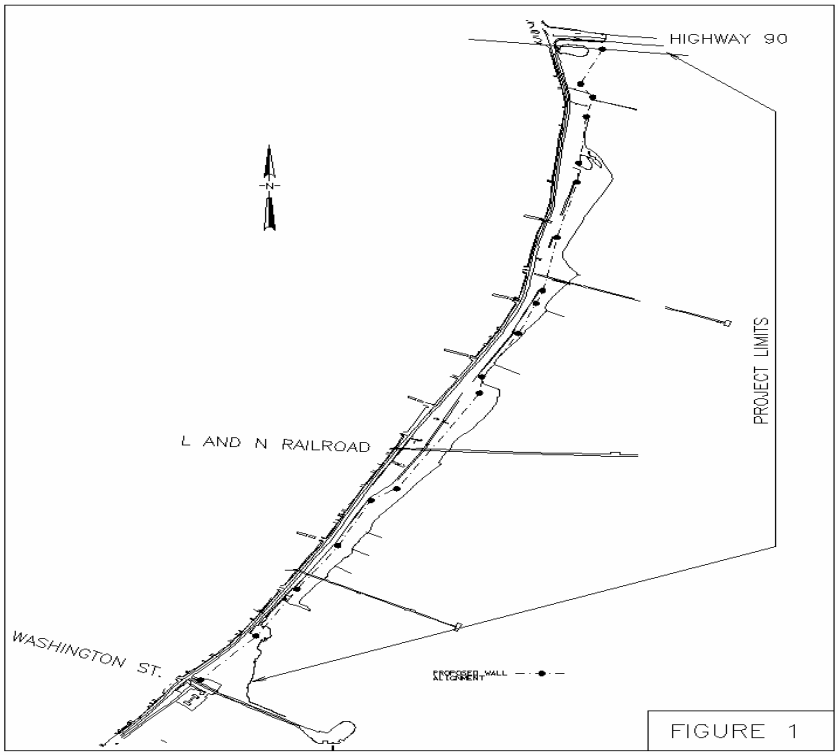


Figure 2.3.6-3. Downtown Bay St. Louis, Existing Seawall

Existing protective structures fronting the project area include an interlocking concrete paved revetment with a top elevation of about 7 feet at the north end, adjoined by a timber bulkhead with top elevation of about 10 feet to the south, then a section of stepped concrete seawall with top elevation of about 10 feet, and a length of vertical-faced concrete seawall with a top elevation of 10 feet (see Figure 2.3.4-3). The seawall was constructed by local interests at various times between 1915 and 1928. Hancock County has frequently repaired the seawall and road because of the loss of material from beneath the highway as a result of wave attack against the shoreline.

The project is located in Downtown Bay St Louis, in Hancock County, which is the westernmost coastal county in Mississippi, on Mississippi Sound. The Downtown Bay St Louis project area extends along a paved road (South Beach Boulevard) in the City of Bay St. Louis for about 1 mile south from Highway

90. The shoreline and associated infrastructure was protected by existing seawalls and bulkheads, and South Beach Boulevard ran parallel along the seawall for its entire length.

2.3.6.1 Coastal and Hydraulic Conditions

The study area is bordered on the east by Mississippi Sound. Hancock County has no coastline on the Gulf of Mexico. Mississippi Sound is a shallow coastal lagoon extending 80 miles along the coast of the Gulf of Mexico from Mobile Bay, Alabama westward to Lake Borgne, Louisiana. The average depth in the sound is 10 feet, and 99 percent of the sound is less than 29 feet deep. Circulation patterns in the vicinity of the project area are controlled by astronomical tides, winds, and freshwater discharges. The mean diurnal tide range in St. Louis Bay is 1.6 feet, and the extreme (except during storms) is about 3.5 feet. The velocity of normal tidal currents ranges from 0.5 to 1.0 foot per second (fps) and their direction is generally east to west. The mainland shoreline, on Mississippi Sound, is protected by Cat Island, in Harrison County, and by the islands of the Louisiana marshes. Most of the eastern half of the coast, from near the mouth of Jourdan River to the mouth of Bayou Caddy, is afforded some protection by 11.5 miles of seawall built by local interests at various times between 1915 and 1928.

The coastal region of Hancock County has its eastern boundary near the center of St. Louis Bay, one of the two inland bays on the Mississippi Coast. The north shore of the bay, from the Harrison-Hancock County line to the mouth of Jourdan River, north of the City of Bay St. Louis, is entirely marsh. A paved road (Beach Boulevard) runs behind the seawall and connects the various shoreline communities. At Bayou Caddy, there is an abrupt change in topography. From Bayou Caddy westward the coastal area is flat, drainage is poor, and the shoreline is virtually all-low salt marsh broken by numerous bayous and streams. Hancock County has approximately 32 miles of bay/estuary shoreline of which about 7 miles is beach, all of which is man-made, and about 26 miles of non-beach shoreline, of which about 20 miles are marsh. Most of the area behind the seawall is developed for residential purposes including the downtown area of Bay St. Louis.

2.3.6.2 Geotechnical Conditions

Soils encountered during recent geotechnical investigations of the project area were classified mostly as poorly graded sand (SP), but also included inorganic silt (ML), clayey sand (SC), and organic silt (OL). Some of soil classified in the field as inorganic silt (ML) was classified in the laboratory as highly plastic clay (CH). Soils at approximately elevations -10 to -20 feet were indicated to be mostly soft to medium ML, SC, and OL soils. The soil overlying and underlying this layer to the elevation investigated was predominately dense to hard poorly graded sand (SP).

2.3.6.3 Preferred Alternative. Replacement of Seawall with a Concrete Gravity Seawall

This alternative would involve the replacement of the seawalls and other in-place shore protection features with a new seawall of extended height and length (consisting of a mass concrete structure), approximately 6,500 feet in length, incorporating 20” and 14” pre-stressed foundation piles, vinyl sheet pile, cast in-place concrete, scour protection stone, and new storm drains. The maximum top elevation would be of +20.0 feet NGVD. A cross section of this wall configuration is shown in Figure 2.3.6-4. This structure would be constructed approximately along the alignment of the existing seawall structure and above Mean High Water. County and local government officials are considering an alignment more seaward of the existing shore protection features, to meet utility placement requirements and Federal Highway Administration standards, and to position projected development further from the seawall. However, the alternative alignments have not been determined. Additional environmental coordination and appropriate documentation would be required for a change in the proposed alignment.

Construction of the preferred alternative would begin with installation of the concrete foundation piling and the sheet pile cutoff wall, followed by placement of the gravity concrete seawall. It is anticipated that conditions will allow all construction to be accomplished “in the dry” and require no special control measures for groundwater or surface runoff.

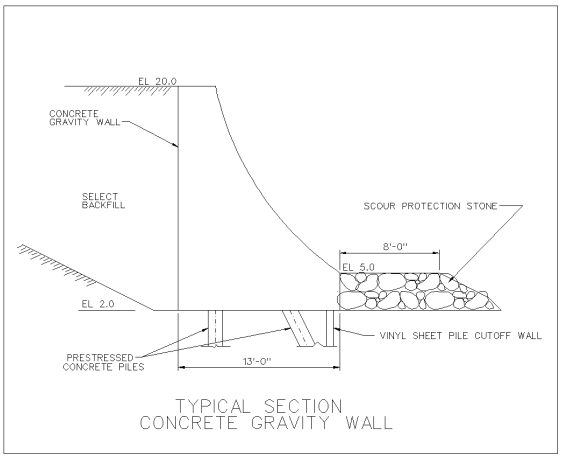
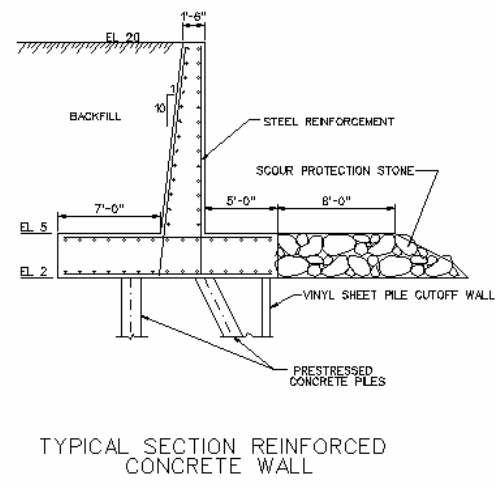


Figure 2.3.6-4. Downtown Bay St. Louis, Concrete Gravity Seawall Cross-Section

2.3.6.4 Other Alternatives

Alternative 1— ‘No Action’. The ‘No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with structural improvements. Without corrective action, roadside erosion and seawall instability would continue with the continued loss of valuable public land and facilities. This alternative was not selected because the reconstructed roadway, utilities, and commercial and residential property in the area would continue to be extremely vulnerable to existing erosive conditions and future storm events.



Alternative 2—Inverted Reinforced Concrete T-Wall. This alternative would involve the replacement of the seawalls and other in-place shore protection features with a new seawall. The new wall would be an inverted reinforced concrete T-wall built on a concrete pile foundation (Figure 2.3.6-5). The performance and expected environmental benefits and effects of this alternative are the same as the preferred alternative. The inverted T-Wall has a higher estimated cost than the preferred alternative concrete gravity wall. Accordingly the T-wall alternative was not selected.

Figure 2.3.6-5. Typical Section of Inverted Reinforced Concrete T-Wall

2.3.6.5 Environmental Effects

Implementation of the proposed action would reduce sediment movement and turbidity resulting from the failure of the seawall. Changes in substrate are not expected nor will any deleterious materials be added to the sediment. The potential for wave-induced erosion in the vicinity of the project after construction was examined and a reduction is expected as a result of the project. The littoral movement of sand will continue and will not be impacted by implementation of the project. The environmental impacts are expected to be minor and temporary mainly during the construction period. The construction will be in the dry which will reduce water impacts.

Figure 2.3.6-6. Downtown Bay St Louis before and after Hurricane Katrina

2.3.7 Cowand Point

The existing seawall fronting St. Louis Bay in Hancock County is a concrete stepped-face structure about 3 miles long and was constructed by local interests at various times between 1915 and 1928, as shown in Figures 2.3.7-1 and 2.3.7-2.

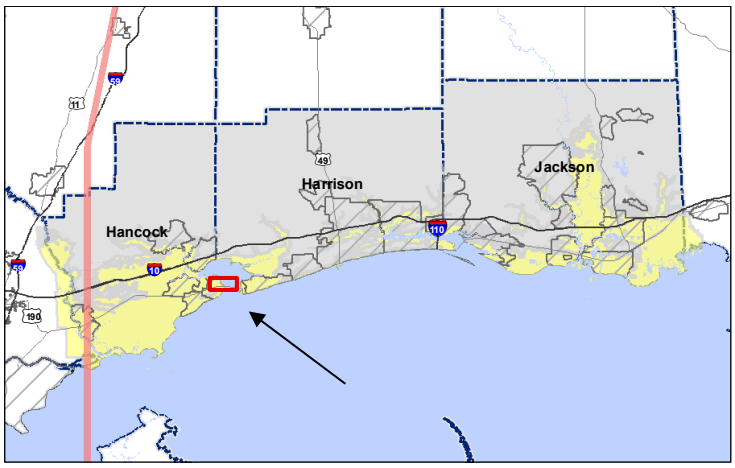


Figure 2.3.7-1. Cowand Point Project Area

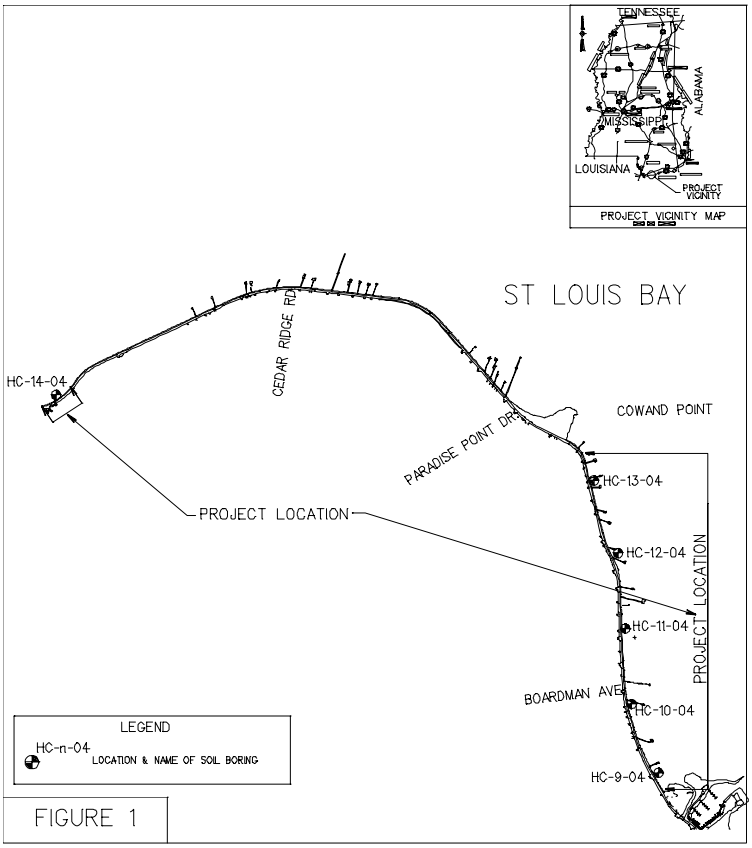


Figure 2.3.7-2. Cowand Point Existing Seawall and Proposed Rehab Locations

2.3.7.1 Coastal and Hydraulic Conditions

Hydrographic and topographic survey data performed in September 2003, determined the top elevation of the seawall varying between +2.5 and +8.0 feet NGVD.

2.3.7.2 Geotechnical Conditions

Historical as well as current wave attack against the shoreline of Hancock County has caused migration of soil through or under the seawall and scour below the sewall in various locations, resulting in damages to North Beach Boulevard and other infrastructure. Sections of the roadway have collapsed from time to time, disrupting and damaging utilities, and causing hazards and delays for residents and vehicular traffic. Hancock County has frequently repaired the seawall and road because of the loss of material from beneath the highway. Damaged utilities, which have required repair, include water, sewer, natural gas, electric power, and electronic communications. Figure 2.3.7-3 depicts a typical cross-section of the existing seawall condition.

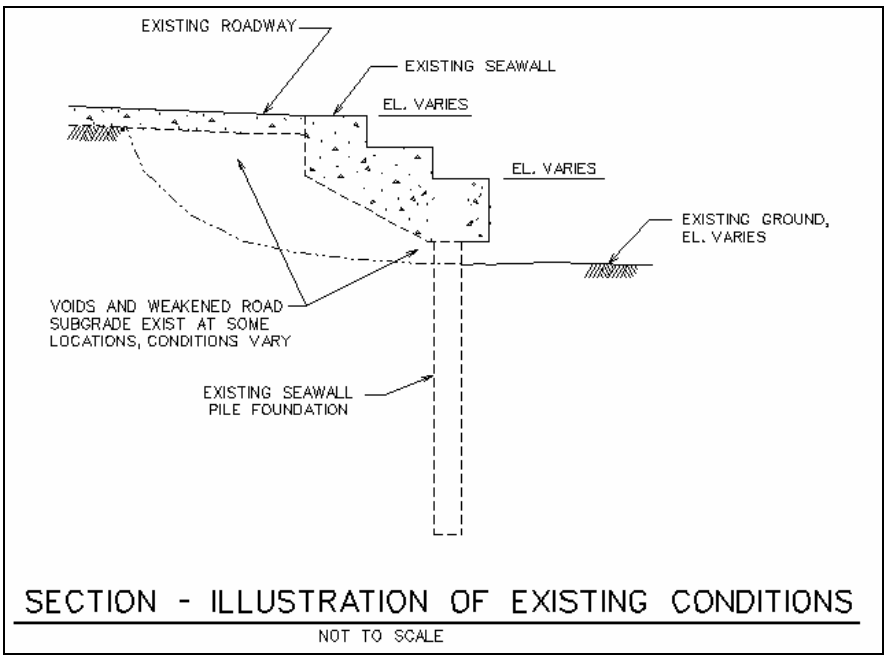


Figure 2.3.7-3. Cowand Point, Typical Section of Existing Seawall

2.3.7.3. Preferred Alternative. Rehabilitation of Existing Seawall with Vinyl Sheetpile

The preferred alternative involves the rehabilitation of the existing Cowand Point seawall using a vinyl sheet piling bulkhead attached to the face of the seawall, with a cast-in-place reinforced concrete cap, The project involves stabilization of approximately 5,000 feet of the Hancock County seawall along North Beach Boulevard in Hancock County. The project will provide protection for North Beach Boulevard through the rehabilitation of the deteriorating seawall by constructing an erosion protection system consisting of placement of vinyl sheetpile in front of the existing seawall. It has been determined that the vinyl material is the most inexpensive and effective material for use in this application as it is extremely resistant to the saltwater environment and is strong enough to resist the minimal loads imposed on the walls; therefore the vinyl sheetpile should serve almost indefinitely in providing toe protection for the existing seawall. The sheetpile will be anchored to the

seawall face using steel rock anchors and the void behind the bulkhead will be backfilled with gravel and sealed at the top with a reinforced concrete cap. Figure 2.3.7-4 gives a representative cross section of the work to be performed. The county has a 16 foot wide easement on the south side of North Beach Boulevard that could be used for equipment staging and construction materials.

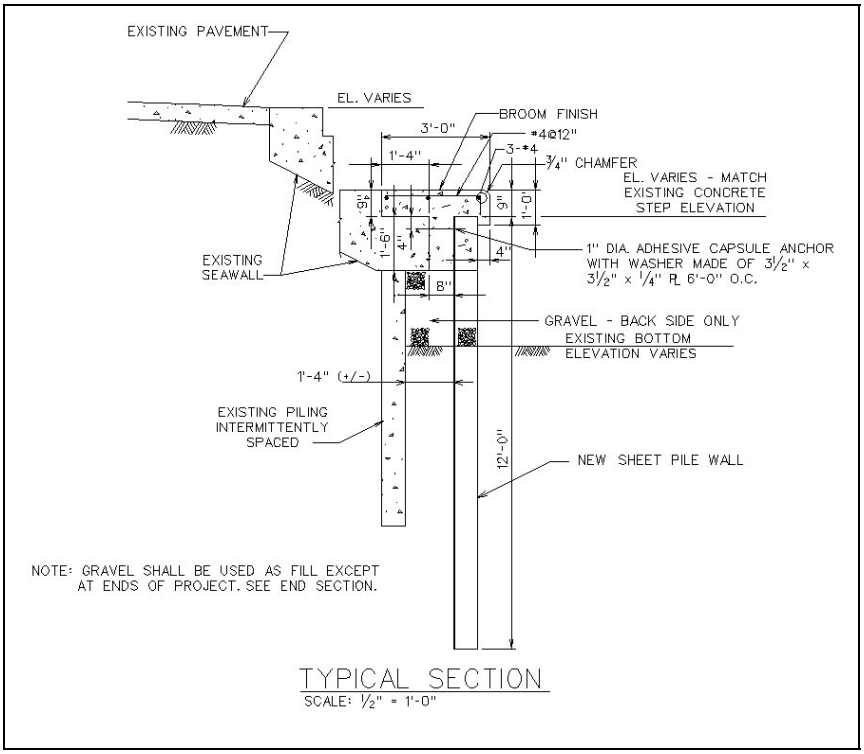


Figure 2.3.7-4. Cowand Point, Typical Section of Proposed Work

2.3.7.4. Other Alternatives

Alternative 1— 'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with structural improvements. Without corrective action, roadside erosion and seawall instability would continue with the resultant loss of valuable public land and facilities. This alternative was not selected because it would not correct the existing erosive conditions presently experienced along the highway.

Alternative 2—Rehabilitation of Existing Seawall With Steel Sheetpile. This alternative would consist of the installation of continuous interlocked steel sheetpiling along the face of the lower-most step of the existing stepped seawall for the entire project length of approximately 5,000 feet. The steel sheetpile bulkhead would be anchored to the seawall face using steel rock anchors; the void behind the bulkhead would be backfilled with gravel and sealed at the top with a reinforced concrete cap. This alternative was not selected because the vinyl sheetpile is less expensive and considered best for this application. The vinyl materials are extremely resistant to the saltwater environment, are strong enough to resist the minimal loads imposed on these walls, and therefore should serve almost indefinitely in providing toe protection for the existing seawall.

Alternative 3—Riprap Revetment Protection. This alternative is a structural protection plan consisting predominantly of riprap revetment protection for the existing seawall sections. The riprap revetment protection would consist of graded stone placed over bedding material, which would be placed over

a layer of filter fabric and granular fill. Top elevation will be the same as the bottom step of the existing seawall. The base of the revetment would extend from the base of the existing seawall to a point 15.5 feet out in Mississippi Sound. This alternative will require a variance to the Mississippi Coastal Program [Chapter 8 – Rules, Regulations, Guidelines and Procedures, Section 2 (Wetlands Management), Part III. D. (Guidelines for Regulated Activities – Bulkheads and Seawalls)] . This alternative was not selected because it would increase the environmental impacts to the St. Louis Bay water bottoms and the final costs for the project.

2.3.7.5 Environmental Effects

Overall aesthetic quality would be improved, since the existing seawall is crumbling in places. Implementation of the proposed action would reduce sediment movement and turbidity resulting from the failure of the seawall. Construction impacts may include temporary displacement of shoreline users in the immediate area of construction. The potential for wave-induced erosion in the vicinity of the project after construction was examined and a reduction is expected as a result of the project. Sheetpile will also serve as substrate for epifauna, such as barnacles. The project will provide protection for North Beach Boulevard through the rehabilitation of the deteriorating seawall by constructing an erosion protection system consisting of the placement of vinyl sheetpile in front of the existing seawall.

2.3.8 Long Beach Canals

The City of Long Beach is central on the Harrison County coast to the west of Highway 49. Approximately 70 percent of the total surface area of the City of Long Beach drains to one of two major canals, which traverse the northern part of the City from east to west. The southernmost of these is called “Canal Number One,” and ultimately discharges into the head of Johnson Bayou within the City of Pass Christian to the west. “Canal Number 2/3” discharges into the head of Bayou Portage near the unincorporated community of Cuevas. Both canals also drain a large area of unincorporated Harrison County, to the north of the Long Beach City Limits. Hurricane Katrina had an adverse affect on canals and drainage ways due to the deposition of sediment from the storm surge and windblown trees, and other debris. Interior drainage has been impaired by the Katrina effects. In addition to the flooding directly out of the canals, numerous areas within the city suffer flooding due to a combination of inadequacies of the lateral drainage pipes and ditches which drain to the canals, exasperated by high levels in the canals themselves, which decreases the available hydraulic head in the lateral pipes and ditches.

The project area, Turkey Creek Watershed, flows through Harrison County, Mississippi. This low-flow drainage basin is approximately 27.3 square miles. The basin flows tend to follow their natural drainage paths. The watershed is made of the main drainage channel Turkey Creek, Canal 1 to Johnson Bayou, and Canal 2 and 3 to Bayou Portage. Turkey Creek originates between Bernard Bayou and Wolf River in Harrison County, and flows through Gulfport, Mississippi and Long Beach, Mississippi. Figures 2.3.8-1 and 2.3.8-2 are location maps for the Long Beach Canals project.

2.3.8.1 Coastal and Hydraulic Conditions.

Complex flow patterns and steady urbanization has caused increased flooding within the low lying Turkey Creek floodplain. Flooding occurs when the water in the Turkey Creek channel overflows the stream banks and flows into the floodplain. During high flow conditions most of the water from the upper basin (the upper 7.7 miles, above 28th Street) overflows the streambank to the south. The overbank flows cross 28th Street and flow into canals that drain to the southwest through the City of Long Beach. A smaller percent of the upper basin flow continues to the east along the main stem of Turkey Creek to Bernard Bayou. Flooding occurs in the lower basin mostly from inflows along the

lower 6-mile reach of Turkey Creek and storm surges from the Mississippi Sound. The water spills out of the basin: (1) because of the very low elevation of the right over-bank near 28th Street, which carries most of the flood flow, and (2) the low elevation of 28th Street.

In addition, the floodplain is wide and flat in the lower reaches. Elevations in the over-bank range from 6-8 feet NGVD near the mouth to elevation 20-30 feet NGVD 6 miles upstream. The channel slope in the lower reach is 3-4 feet per mile. Once the flow from the Turkey Creek upper basin has spilled across 28th Street, the two canals carry the flow. Due to the increased flows from the upper Turkey Creek Basin, the canals do not have the flow carrying capacity to effectively hold the flows within the channel banks. The majority of the flow is carried by Canal 2 west to Bayou Portage. During very high flows, the water from Canal 2 spills into Canal 1, which flows downstream to Johnson Bayou and Bayou Portage. The lower part of Canal 1 always drains to the south to Johnson Bayou, but the upper end of the canal is near a road crossing in the golf course near the naval air station, and above that location water flows to the north, through culverts at 28th Street, in a drainage ditch along Canal Road to Turkey Creek. During high flows in Turkey Creek, the upper end of the Canal 1 cannot drain properly and could drain across the Canal 1 divide to the south.

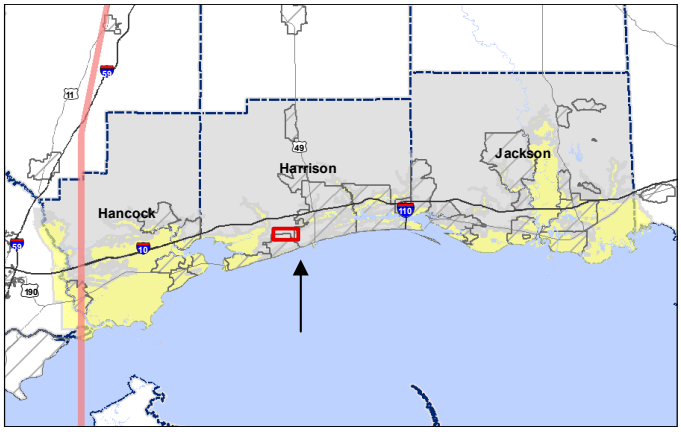


Figure 2.3.8-1. Long Beach Canals Project Area

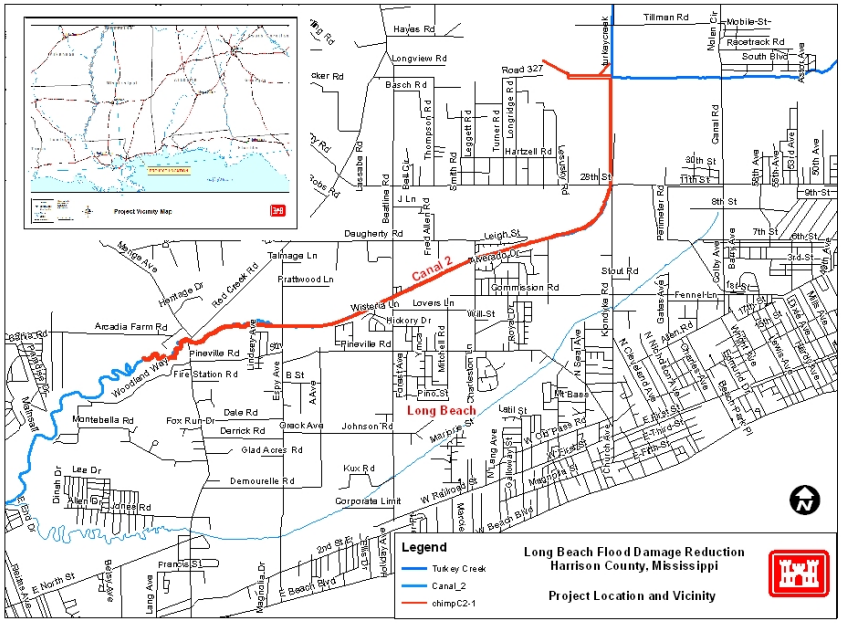


Figure 2.3.8-2. Long Beach Canals Vicinity Map. Canal 2 Shown

2.3.8.2 Geotechnical Conditions

The geological units that form the surface of coastal counties in Mississippi and Alabama range in age from the late Pliocene Epoch (3.4 million years ago) to the present. Holocene sediments fill the coastal estuaries and built up locally wide marshlands, rich in organic matter. These deposits consist mostly of sandy fine-grained silts and clays with significant organic material (marshes). Coastal deposits (beaches and dunes) are primarily formed by erosion of sandy parent material (Prairie and Gulfport Formations) and by longshore drift on the barrier islands.

2.3.8.3 Preferred Alternative. Culvert Enlargement at 28th Street and Modification of Canals 2 & 3

This preferred alternative consists of increasing the Canal 2 culvert at 28th Street and Klondike Road and modifying the geometry of Canal 2. This modification would include a 100-ft bottom width channel from Canal 2 station 14280 to 23414, 60-ft bottom width channel from 23814 to Turkey Creek. The channel width would transition to near vertical gabion walls at the remaining bridge crossings. A berm and diversion channel at the upper limits would divert Turkey Creek over bank flows into the modified Canal 2. The profiles indicate that there would be no changes to the water surface elevations along Turkey Creek, which indicates that only existing over bank flows from Turkey Creek across the floodplain and 28th Street would be directed and conveyed by the modified Canal 2.

A reduction in the water surface elevations along the upper end of Canal 1 would occur due to the modified Canal 2 being able to convey the water that overflows the Canal 2 banks and into the Canal 1 as occurs under the existing conditions. Along Canal 2, the water surface elevations would decrease significantly at the upper end of the modified Canal 2 where existing flooding occurs. However, model results indicate that the water surface would rise in the downstream Bayou Portage. Further analysis to mitigate for the downstream rise was not performed.

The bridges crossing Canal No. 2 to the south and west of the main channel of Turkey Creek are at 28th Street near the upstream end of the canal, then proceeding downstream, Daugherty Road, Beat Line Road, Espy Avenue, and Menge Avenue. The only crossing requiring modification to the existing structure is at 28th Street. The existing 28- foot wide by 30-foot long bridge would be removed and replaced in its entirety. The replacement bridge would be 28 feet wide by 120 feet long, and would consist of 4 precast-prestressed concrete roadway spans with precast New Jersey Curb type side barrier walls, all supported on precast concrete bent caps and abutments and 14" square precast-prestressed concrete piling. The abutments would be fitted with appropriate precast concrete wing walls also supported on 14" square precast-prestressed concrete piling. The tentative layout for this bridge was based on a department of transportation standard for bridges of this size and capacity.

For all the rest of the bridges that cross the Canal, the stream banks would be altered using gabion sidewalls to steepen the banks to provide a nominally larger bridge opening while using the existing bridges. This alternative was retained for further evaluations because model results indicated that flooding in the lower reaches of Turkey Creek would not increase, and reductions of flooding along 28th Street and Canals 1 and 2 could be achieved.

2.3.8.4 Other Alternatives.

Alternative 1— 'No Action'. The 'No Action' alternative involves the continuation of existing conditions regarding the drainageways and canals in the Long Beach Area. Current restrictions to water movement would continue to be restrictions. Water movement and flooding would continue to

be problems for the watershed. The no action would not improve the flooding issues in the project area. Thus, this alternative is not considered acceptable.

Alternative 2—Enlarging Culverts at 28th Street and Diverting Flows to Mississippi Sound. This alternative consists of increasing the size of the culverts under 28th Street to carry the flow presently going over the road. Channel enlargement and a berm across the floodplain perpendicular to the flow would be required to move the flows into Mississippi Sound instead of the natural flow towards the southwest and Bayou Portage Because of the significant change in natural flows of the area this alternative was not selected.

Alternative 3—Raising 28th Street. This alternative would raise 28th Street to elevation 24 ft NGVD and purchase residences that would incur induced flooding. Inducing flooding of some residences was not considered an acceptable alternative as an MsCIP Near Term Improvement.

Alternative 4—Levee at 28th Street. This alternative consists of a levee just north of 28th Street crossing the upstream ends of Canal 1 and Canal 2. A culvert through the levee would also be required at this site. The culvert would have a flap gate on the Turkey Creek side to prevent high water in the creek from coming through the levee. This alternative was incorporated into the preferred alternative.

2.3.8.4 Environmental Effects

Overall aesthetic quality would be improved, since the unsightly debris would be removed. Removal of sediment would provide flushing of the system and improvement to tidal exchange resulting in less stagnant water. Removal of the obstructions would allow fish to migrate up the systems to forage on the sub-adult and larvae. The improved habitat would also improve foraging areas for shorebird use. Removal of the non-biodegradable foreign material and deposition of sediments would improve overall water quality by improving circulation and enhance drainage in the area resulting in an overall reduction of flooding to nearby residences.

The preferred alternative would not preclude other future options that may provide more flood reduction benefits and/or that would take a longer timeframe to study and construct. The preferred alternative would function well as a component of a larger plan providing a higher level of protection to the City of Long Beach, particularly if additional long-term measures should be implemented such as watershed evaluation, implementation of State-recommended building codes and zoning codes aimed at residential and commercial structure damage reduction, hardening of rehabilitated or new structures within the City's affected area.

The preferred alternative does not, in and of itself, provide a high level of protection from large storm surges, but does provide a significant increase in damage reduction from more frequent events. As a near term project, it would only function to prevent damage from small to moderate storm events; however, it would also survive inundation by larger flood events, and would function as protection to the City's main street, utilities and utility lines that run parallel to the proposed seawall, and as protection for City and County emergency and public services required during lesser events.

The proposed actions within the drainageways will resuspend sediment in the immediate area of the work. Best Management Practices for erosion and sedimentation control will be used to minimize this resuspension. During construction activities fauna of the area will be displaced or impacted. These effects are unavoidable. Once the construction ends the fauna is expected to return or recolonize from adjacent areas.

2.3.9 Harrison County Beaches

The entire coast of Harrison County, the center coastal county in Mississippi, was severely impacted by Hurricane Katrina. The Harrison County Beach project area is located on Mississippi Sound running from Biloxi to the east to beyond Long Beach on the west about midway between Mobile, Alabama and New Orleans, Louisiana as illustrated by Figure 2.3.9-1. The beaches are positioned south of Highway 90.

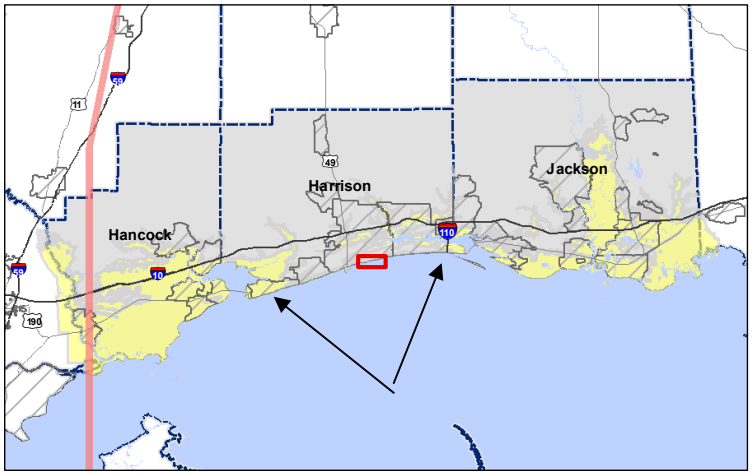


Figure 2.3.9-1. Harrison County Beaches Project Area

Prior to Hurricane Katrina, the sandy beach at the project site extended from Highway 90 approximately 230 feet to elevation 3.5 feet NGVD, and then another 40 feet to the water at elevation 0.0 feet NGVD. Storm water culverts passed beneath Highway 90 draining parts of Biloxi, Long Beach and Pass Christian. The project incurred damage from wind driven waves, debris scour, storm surge and ebb flow after the hurricane. The nature of the damage is scour or erosion of the beach as well as clogging and destruction of storm culverts. The rehabilitation of the beach project under authority of The Flood Control and Coastal Emergencies (FCCE) program was established in 1955 by Public Law 84-99, as amended (33 USC 701n).consists of re-nourishment of the beach and repair/replacement of storm drain culverts to their authorized limits. The area to be repaired extends the full length of the project limits, a distance of approximately 24 miles as shown in Figure 2.3.9-2. This project proposes to build dunes atop the reconditioned beach and an alternative would place fencing and plants atop the dunes.

Figure 2.3.9-2. Harrison County Beaches Project Limits

Figure 2.3.9-3 shows pre- and post-Katrina conditions at Gulfport Harbor and adjacent typical beach, in the midst of the project site. Figures 2.3.9-3 also shows before and after conditions at Pass Christian Harbor and in Biloxi which are on the Harrison County Beaches.

2.3.9.1 Coastal and Hydraulic Conditions

Mississippi Sound is a shallow waterbody bordered approximately 10 miles to the south by the barrier islands Cat Island and Ship Island. Typical depths in the Sound range from 6 to 15 feet. The shoreline slope in the vicinity is relatively flat with the 6-foot depth contour located a few hundred yards offshore and as far as 1.5 miles offshore. Sea bed materials are primarily fine sands and silt, with some areas of clay content and others, particularly offshore of Bay St. Louis, occupied by expansive oyster beds.

Circulation patterns within the vicinity of the study area are controlled by astronomical tides and prevailing winds. Aerial photography suggests an east-to-west littoral drift in the site vicinity, as is typical for the Mississippi coast. Some local variation in the generalized east to west drift pattern

may exist. The mean diurnal tide range at Harrison County is 1.6 feet, and the extreme (except during storms) range is about 3.5 feet. The velocity of normal tidal currents ranges from 0.5 to 1.0 foot per second (fps) and their direction is generally east to west. Predominant winds average 8 mph from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the sound causing current velocities of several knots in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline.

2.3.9.2 Geotechnical Conditions

Typical profiles for this plan can be seen herein. There are a total of 24 possible borrow sites for this project, located at least 1,500 feet offshore. Materials used for the re-nourishment and dune construction will have 90% passing the #40 sieve and only 10% will pass the #200 sieve. The sand fill shall not have noticeable amounts of shell and/or gravel. The sand will be pumped ashore and shaped along the proposed alignment.

The Harrison County Seawall was originally constructed between 1925 and 1928 to protect Highway 90. The seawall is a stepped concrete type wall founded on piles. The seawall crest elevation varies between approximately 8 to 11 feet mean sea level and is penetrated in a number of locations by drainage channels and culverts.

The study area has been impacted by several tropical storms and hurricanes, most recently from Tropical Storm Isidore in 2002 and Hurricane Katrina in August 2005. The preliminary high water mark data indicates that Hurricane Katrina surge reached a height of approximately 22 feet NGVD (National Geodetic Vertical Datum) near the mouth of Biloxi Bay, and approximately 27-28 feet NGVD near Pass Christian. The project site covers approximately 24 miles between these locations. Eight major hurricanes rated above Category 3 on the Saffir-Simpson Scale have hit the Mississippi coast prior to Katrina during the period 1851 – 2004. During the period 1950-2004, the area was hit by Elena (1985), Camille (1969), and Frederic (1979). Some of the historic storm induced water surface elevations in the project vicinity are presented in Table 2.3.9-1. The county was also damaged by Hurricane Betsy in 1965. Hurricane Katrina maximum surge heights exceed the previous record of Hurricane Camille by six to seven feet, and exceed by an order of nearly two or more the surge heights of all other storms.

Table 2.3.9-1.
Historic Maximum Storm Surge Elevations

Storm Event	Point of Landfall	High Water (ft NGVD)	Location of High Water
29 September 1915	Grand Isle, LA	12.8	Pass Christian, MS
July 1916	Gulfport, MS	10.8	Mobile, AL
19 September 1947	New Orleans, LA	15.2	Bay St. Louis, MS
12 September 1979 (H. Frederic)	Dauphin Island, AL	8.17	Dauphin Island, AL
17 Aug 1969 (H. Camille)	Waveland, MS	22.6	Pass Christian, MS
2 September 1985 (H Elena)	Biloxi, MS	6-8	-
29 August 2005 (H. Katrina)	Pearlington, MS	23.8	Biloxi Back Bay, Pt Cadet, MS

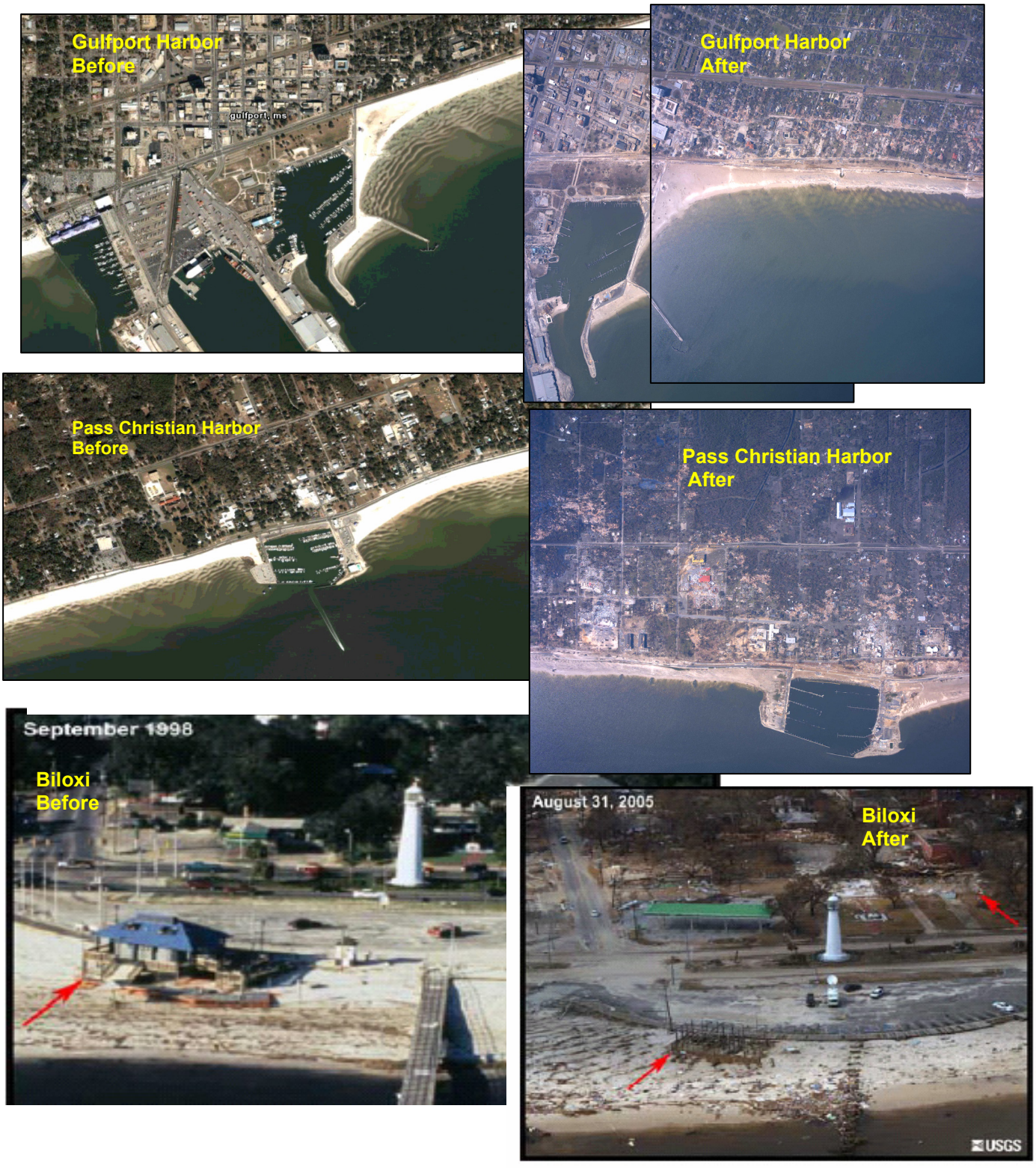


Figure 2.3.9-3. Harrison County Beaches Before and After Hurricane Katrina Photographs

2.3.9.3 Preferred Alternative. Placement of Dune With Vegetation and Fencing

The project involves providing a dune atop the re-nourished Harrison County Beach. All 26 miles of Harrison County Beach are proposed to be improved. The preferred alternative would be to place the dune material and stabilize it with fencing and plants. The finished stable dune will be 5 feet high with a crest width of 10 feet and side slopes of 1V:3H as illustrated in Figure 2.3.9-4. The material will come from the established borrow areas within 1,000 feet offshore. The dunes will be vegetated using natural dune vegetation indigenous to Mississippi beaches. The plantings will have a density of 1 plant per 4 square feet with dune fencing the entire linear length of the project. The dune alone project will require replacement within 10 years and the dune with plantings and fence will require replacement within 15 years.

Typical dune profiles of this plan can be seen in Figure 2.3.9-4. There are a total of 24 possible borrow sites for this project, located at least 1,500 feet offshore. Materials used for the re-nourishment and dune construction will have 90% passing the #40 sieve and only 10% will pass the #200 sieve. The sand fill shall not have noticeable amounts of shell and/or gravel. The sand will be pumped ashore and shaped along the proposed alignment. Approximately 681,000 cubic yards of sand will be required for the dune.

When dune construction is complete, the dune will be planted with species of dune vegetation indigenous to the area. Sand dunes are dynamic coastal features, which are formed and maintained by the accumulation of wind blown sand. The dune restoration project will be designed to create a dune that matches the surrounding natural dune patterns. Upon reconstruction immediate steps will be taken to plant and stabilize the dune for rapid stabilization. This will be accomplished through the use of sand fences and dune plants. The dune plants will be planted to cover 60-80% of the total area. Approximately 125 acres of beach will be planted. The vegetation will consist of local dominant species that populate nearby natural dune systems. The selection of the dune vegetation will consist of species that are most widely used for dune restoration and are readily available from local nurseries and suppliers. The selection will be coordinated with local environmental experts familiar with dune ecosystems in the immediate area. Dune plant species being considered are:

- sea oats *(Uniola paniculata)*
- bitter panic grass *(Panicum ararum)*
- sea rocket *(Cakile constricta)*
- beach morning glory *(Ipomoea imperati)*
- railroad vine *(Ipmea pes-caprae)*
- blue stem *(Schizachyrium scoparium)*
- blanket flower *(Gaillardi pulchella)*

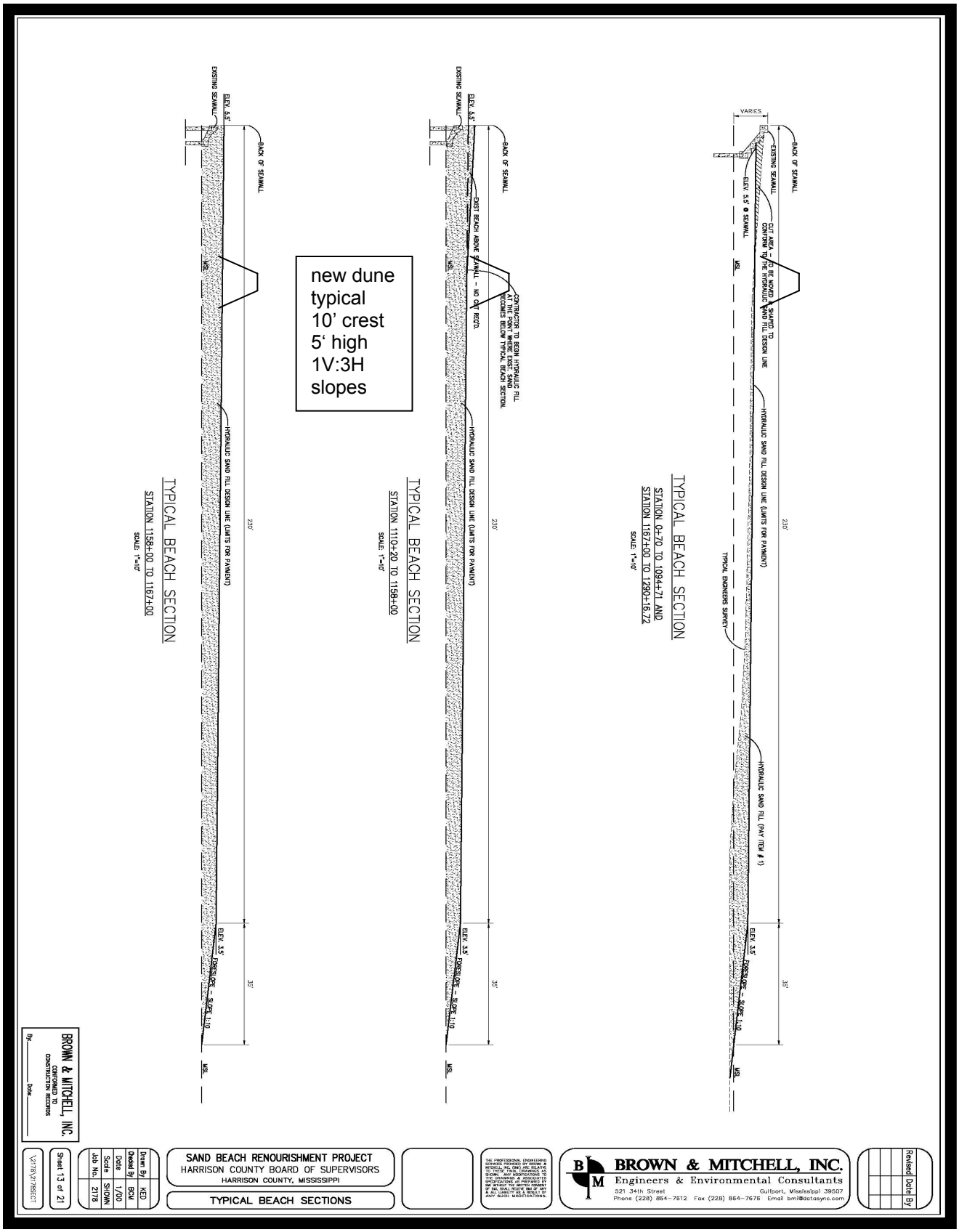


Figure 2.3.9-4. Typical Beach Section of Proposed Harrison County Beaches

2.3.9.4 Other Alternatives

Altenative 1— 'No Action'. The 'No Action' alternative includes not placing a dune system in association with the already planned beach nourishment project. Dunes provide a valuable level of protection from minimal storm surges and waves. Dunes also provide beneficial habitat for a variety of wildlife. Without a dune system, the shorelines will remain particularly vulnerable to storm damages and will not contribute to the benefits resulting from increased wildlife habitat.

Alternative 2—Placement of Dune Without Vegetation. When vegetated, stable dunes are considered a valuable coastal resource. Restoring dunes without associated vegetation would not contribute to the well being of various flora and fauna that once existed within the proposed project area. Achieving these goals will allow greater sustainability of a coastal environment contributing benefits to various indigenous wildlife species. Accordingly, the without vegetation alternative was not selected.

2.3.9.5 Environmental Effect

The proposed dune restoration at the Harrison County Beaches will produce numerous ecological benefits associated with the shoreline restoration. More natural vegetated dunes provide foraging and roosting habitats for various shore and migratory birds including least terns and the federally-listed (threatened) piping plover. The restored shoreline will provide additional resting and wintering areas for these birds. The creation of a dune would allow the establishment of multiple vegetation types associated with local dune habitats. The proposed project would also provide general benefits by creating opportunities for the production of food sources; thus, contributing to the general well being of waterfowl, raptors, nearshore fish and other wildlife associated with the coastal environment. A beach-dune system will be advantageous for increased overall stability of the entire beach ecosystem by providing reserves of sand acting as a buffer to resist erosive events. The increased beach stability will directly contribute to the sustainability of the restored habitats.

The placement of beach compatible sand on the existing man-made beach to create the proposed dunes will have minimal environmental effects. Activities during the construction period may displace shorebirds. Water impacts will be temporary and minimal. Beach compatible sand, dredged from nearshore areas, will be placed on the beach hydraulically and shaped with earth moving equipment. Beach visitors may be required to move from a specific location to another beach location. The equipment operation may present a temporary noise disturbance. A busy Highway 90 is a short distance away. These environmental impacts will be minor and temporary.

2.3.10 Courthouse Road

This project involves drainage channel repairs and environmental restoration at the Courthouse Road Pier within the City of Gulfport, Harrison County, Mississippi. The site is located on Mississippi Sound along the central coastal county in Mississippi. Gulfport is Mississippi's second largest city approximately 75 miles west of Mobile, Alabama and 78 miles east of New Orleans, Louisiana. Nearly the entire length of the county shoreline is fronted by four-lane Highway 90, which is protected by a concrete seawall.

The project site is seaward of Highway 90, known locally as East Beach Boulevard, at the Courthouse Road intersection. The site is occupied by the Courthouse Road Pier, a public fishing and boat launch facility; a sand beach fronting the seawall; and a concrete sheet-pile walled open channel drain typical of those on the County's shoreline. The site location is shown on Figure 2.3.10-1 and 2.3.10-2.

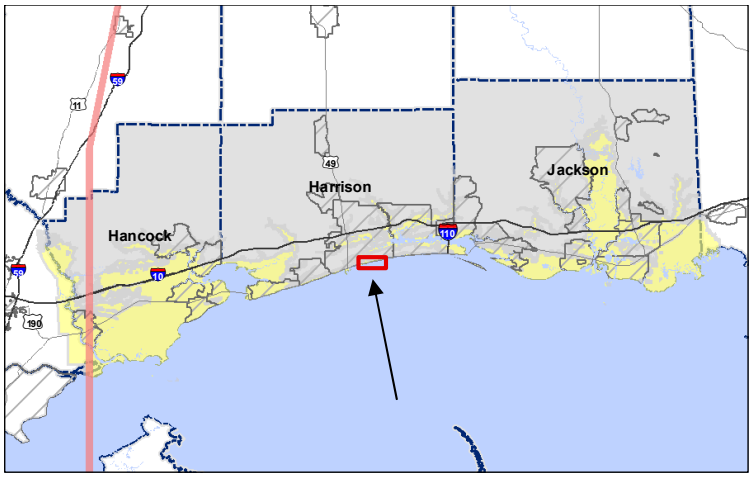


Figure 2.3.10-1. Courthouse Road Project Area

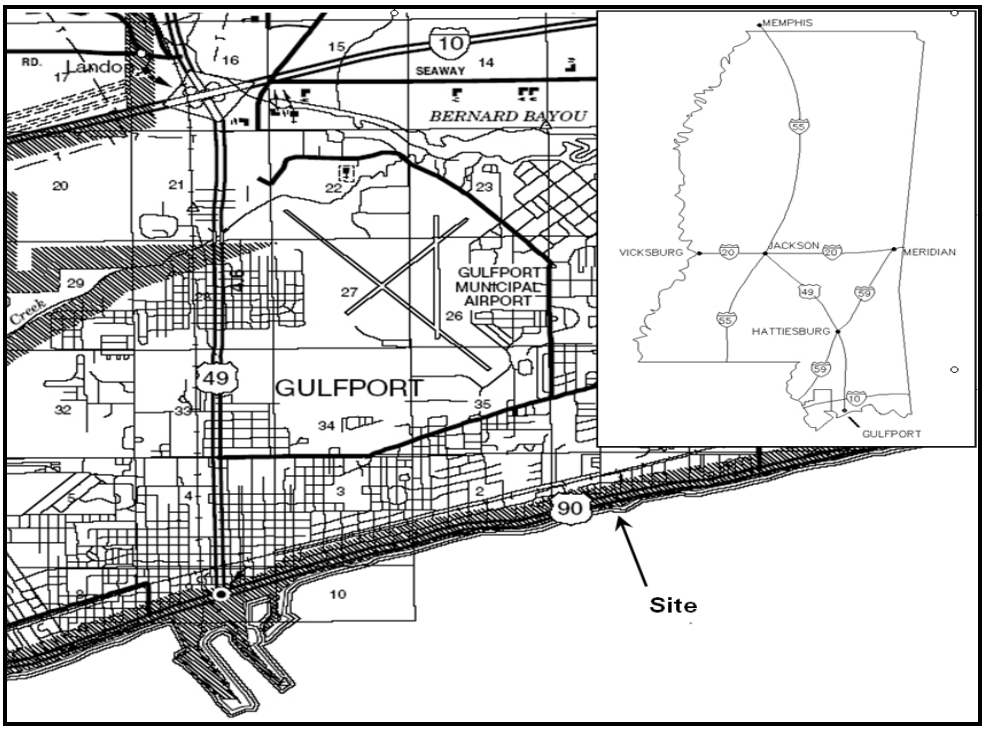


Figure 2.3.10-2. Courthouse Road Location Map

Aerial views depicting pre- and post-Katrina conditions are shown in Figure 2.3.10-3. The pier was originally extended from fill placed over an existing beach groin in the late 1940's. The pier was extended 400 feet in 1992, at which time an area of the beach between the open channel drain and the original groin was filled to accommodate expansion of the parking lot. Construction was underway in the summer of 2005 to improve the pier and boat launch facility. Notable improvements included a new boat ramp, ramp approach jetties and markers, parking lot revisions, and a mitigation wetland. The pre-Katrina view pre-dates these recent improvements and shows the pre-improvement marsh; Figures 2.3.10-4 and 2.3.10-5 show the facility improvement plan overlain on the post-Katrina aerial. The mitigation wetland is not evident in Figures 2.3.10-3 and 2.3.10-4, having

been completed approximately two weeks prior to Hurricane Katrina. It was destroyed by the hurricane, as were other existing and in-progress features of the public facility.

The seawall was originally constructed between 1925 and 1928 to protect Highway 90 (US. House of Representatives, 1948). The seawall is a stepped concrete type wall founded on piles. The seawall crest elevation varies between approximately 8 to 11 feet mean sea level and is penetrated in a number of locations by drainage channels and culverts. The existing drainage channel issues from the seawall and was probably completed by 1952, the year the Harrison County Shore Protection project was completed. That project provided for shoreline drainage improvements, seawall repairs, and beach construction along 24 miles of the Harrison County waterfront resultant mainly from the destructive 1947 hurricane.

The drainage channel (Figures 2.3.10-3 and 2.3.10-6) is approximately 235 feet long with a flow width of approximately 12.5 feet. The channel walls are tongue-and-groove concrete sheetpile panels with a concrete cap. The top of cap elevation slopes about 1 percent from the channel headwall to the channel terminus. Fourteen lateral braces originally spanned the channel to provide active support to the channel walls. The braces were displaced during Hurricane Katrina and all appear damaged, though 10 of these were recovered and placed back on top of the wall as a temporary measure. The braces are made of reinforced concrete of dimensions 12 inches wide by 11 inches deep and approximately 13.5 feet long.

Figure 2.3.10-3. Courthouse Road pre and post Katrina

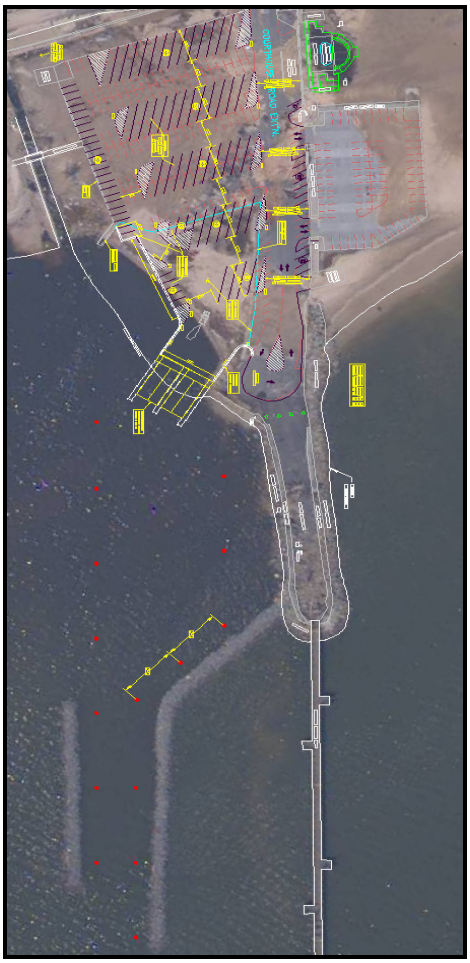


Figure 2.3.10-4. Plan of Improvements Overlain on Post-Katrina Photo

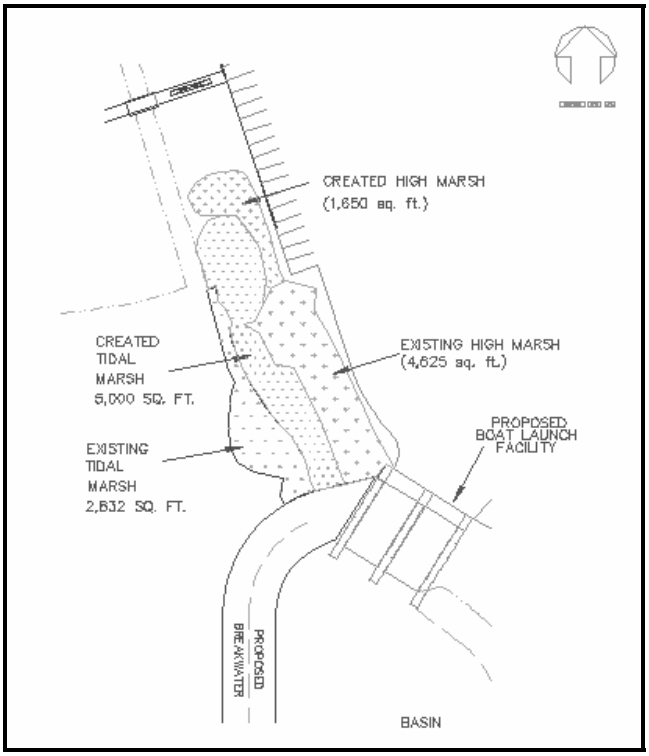


Figure 2.3.10-5. Courthouse Road Improvements Marsh Plan Detail

Figure 2.3.10-6. Courthouse Road drainage channel, looking towards the destroyed marsh and looking towards the beach. 3 April 2006 Photo

The project area lies directly on the coastal interface with the Mississippi Sound and has been altered with the construction of the seawall and related drainage structures in the late 1920's and early 1930's. The pier facility with parking, boat ramp and other structures was added years later. The stratigraphy of the work area is characterized by poorly graded loose to medium dense sands and silty sands from the surface to -5.0 NGVD. This is underlain by loose, silty sands with possible pockets of organics from -5.0 to -15.0 NGVD. These materials are further underlain by denser poorly graded and silty sands for the subsequent 20 to 30 feet.

The drainage channel will require removal of the poorly graded silty sands between the road and its outfall. The material is suitable for distribution within the wetland creation area adjacent to the discharge channel. Material used for the remainder of the marsh creation will required a greater silt and organic content and will be imported from off site sources within 5 miles of this project.

2.3.10.1 Coastal and Hydraulic Conditions

The climate in the project area is subtropical, characterized by warm summers and short, mild winters. The average daily temperature ranges in the summer and winter are 72 – 89 and 42 -63 degrees Fahrenheit, respectively. The average annual rainfall is about 60 inches, and is well distributed throughout the year. Precipitation records indicate July as the wettest month, while October is the driest. The climactic summary for the Gulfport Naval Center weather station is shown on Table 2.3.10-1.

Table 2.3.10-1.
Climactic Summary, Gulfport Naval Center, MS (Station No. 223671)
Source: Southeast Regional Climate Center.

Period of Record : 1/ 1/1948 to 9/30/2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	60.9	64.1	69.7	76.7	83.7	88.7	90.7	90.6	87.0	79.6	70.4	63.1	77.1
Average Min. Temperature (F)	42.5	45.5	51.0	58.6	66.1	71.5	73.5	73.0	69.2	59.0	50.4	44.4	58.7
Average Total Precipitation (in.)	5.46	5.15	5.67	5.23	4.85	5.45	7.33	5.83	6.91	3.00	4.18	5.06	64.12

Mississippi Sound is a shallow waterbody bordered approximately 10 miles to the south by the barrier islands Cat Island and Ship Island. Typical depths in the Sound range from 6 to 15 feet. The shoreline slope in the vicinity of Gulfport is relatively flat with the 6 feet depth contour located a few hundred yards offshore and as far as 1.5 miles offshore.

Circulation patterns within the vicinity of the study area are controlled by astronomical tides and prevailing winds. Aerial photography suggests an east-to-west littoral drift in the site vicinity, as is typical for the Mississippi coast. Some local variation in the generalized east to west drift pattern may exist in the lee of the pier due to influences of the pier facility infrastructure and discharge from the drain channel. The mean diurnal tide range at Harrison County is 1.6 feet and the extreme (except during storms) range is about 3.5 feet. The velocity of normal tidal currents ranges from 0.5 to 1.0 fps and their direction is generally east to west. Predominant winds average 8 mph from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the Sound causing current velocities of several knots in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline. The study area has been impacted by several tropical storms and hurricanes, most

recently from Tropical Storm Isidore in 2002 and Hurricane Katrina in August 2005. Hurricane Katrina surge estimated from high-water marks range from 23 to 25 feet mean sea level near the site. Based on the frequency curve for Biloxi, Mississippi, a community to the east of Gulfport in Harrison County, these heights suggest a 250 year recurrence interval event.

2.3.10.2 Geotechnical Conditions

The project area lies directly on the coastal interface with the Mississippi Sound and has been altered with the construction of the seawall and related drainage structures in the late 1920's and early 1930's. The pier facility with parking, boat ramp and other structures was added years later. The stratigraphy of the work area is characterized by poorly graded loose to medium dense sands and silty sands from the surface to elevation -5.0 NGVD. This is underlain by loose, silty sands with possible pockets of organics from elevation -5.0 to -15.0 NGVD. These materials are further underlain by denser poorly graded and silty sands for the subsequent 20 to 30 feet.

2.3.10.3 Preferred Alternative—Repair of Drainage Channel and Marsh Replacement

The project will involve removal and disposal of all fourteen (14) of the original concrete braces. The braces would be replaced by reinforced pre-cast concrete braces that would be anchored to the pile wall cap.

The project would replace the existing (prior to improvement) and mitigation high marshes and tidal marshes in the areas shown on Figure 2.3.10-5. Approximately one-third of an acre of marsh would be created, composed of approximately 6,300 square feet of high marsh and 7,900 square feet of tidal marsh. High marsh wetlands would be established by grading the existing sandy soils and adding soils to suit for planting high marsh species. Tidal marsh would be established by placing suitable soils and planting tidal marsh plant species within. Assuming an average depth of soil placement to be 3 feet, and that the entirety of the marsh area was eroded to mean low water as suggested by the post-hurricane photo, approximately 1,500 cubic yards of soil would be required.

Wetland soils would be obtained from upland sources within five miles of the project site and delivered by truck via the facility entrance. The soil would be dumped at the location of the wetlands, graded to suit by light earth-moving equipment, and planted with suitable plant species. The channel wall pile caps would be prepared to receive new braces. Chipped, damaged, cracked, or otherwise eroded concrete at the replacement brace seats would be patched with durable material. Brace anchors would be set on either end of the brace location. Replacement braces would be pre-cast offsite and transported to the site by truck, where they would be placed mechanically upon the wall.

Emergent aquatic vegetation would be planted at the site following adequate draining time and the re-working, if necessary, of the material at the site and will consist of the following: *Spartina alterniflora* (saltmarsh cordgrass), the low marsh species, would be planted at an elevation ranging from -0.5 to 1-foot NGVD 83. The middle marsh species, *Juncus roemerianus* (black needlerush), would be planted at elevations ranging between 1- and 2-foot NGVD 83 while *Spartina patens* (saltmeadow cordgrass) would be planted above the 2-foot NGVD 83 as the high marsh species.

Plants would either be purchased from a greenhouse-grown source or borrowed from a source site of similar habitat. Individual plants, depending upon their size, would be spaced approximately 18-inches to 4 feet apart from one another. The planting would be distributed throughout the site in patches to allow for further propagation of adjacent areas. In addition, the plants would be planted at the appropriate elevations described in the paragraph above. Fabric mats specifically designed for marsh planting would be utilized to stabilize the plants and sediment.

2.3.10.4 Other Alternatives

Alternative 1— 'No Action'. This alternative assumes that the drainage channel bracing is not repaired and that the mitigation wetlands are not replaced. If the bracing is not replaced, it is assumed that the bracing will cease to be effective due to displacement by breaking waves for events exceeding the 7 feet NGVD (approximately the 15-year recurrence interval event) and that failure of a significant portion of the channel walls would accompany that event. This alternative also assumes that the wetland would not re-establish itself. Thus, this is not an acceptable alternative.

2.3.10.5 Environmental Effects.

Overall the project will restore and maintain storm drainage for the upland areas on the landward side of the road. Maintaining storm drainage will prevent flooding from extreme rain and storm events that could result in erosion of upland resources. Structure repairs will maintain the integrity of the road and channel structure reducing sediment movement and turbidity resulting from the failure of the drainage channel. The restored marsh will serve the important function of providing nursery areas for fishes, shellfish, and crustaceans as well as stabilizing sediments in the immediate area. Various shorebirds and migratory birds utilize areas along the Mississippi shoreline. Restoring the marsh will provide valuable shorebird habitat.

The environmental impacts of this project will be limited to construction activities. Those will be very short term and minor for this small project.

2.3.11 Shearwater Bridge

The proposed project will provide additional protection of the approaches and abutments for the Shearwater Bridge that were damaged by the storm surge associated with Hurricane Katrina. The bridge is located on Shearwater Drive, a local evacuation route, in Ocean Springs, Jackson County, Mississippi, the eastern-most coastal county. Shearwater Drive is a paved road along the east end of the Ocean Springs Harbor on Mississippi Sound, as shown in Figures 2.3.11-1 through 2.3.11-3.

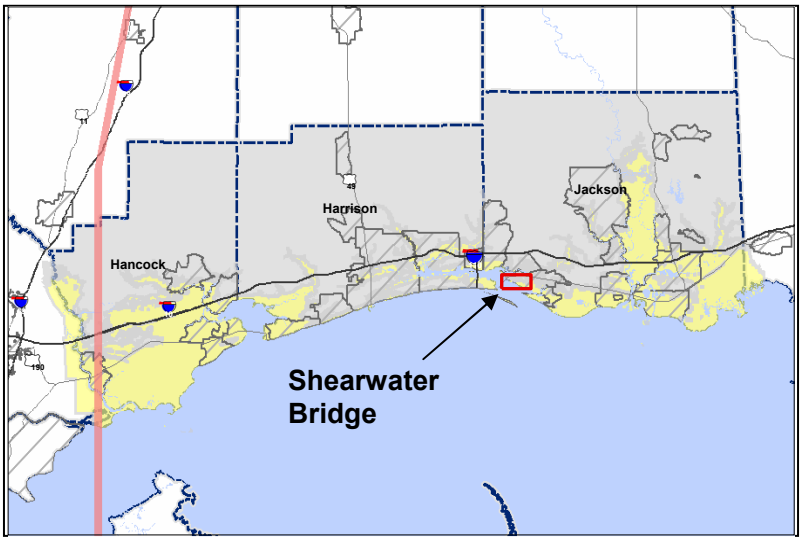


Figure 2.3.11-1. Shearwater Bridge Project Area

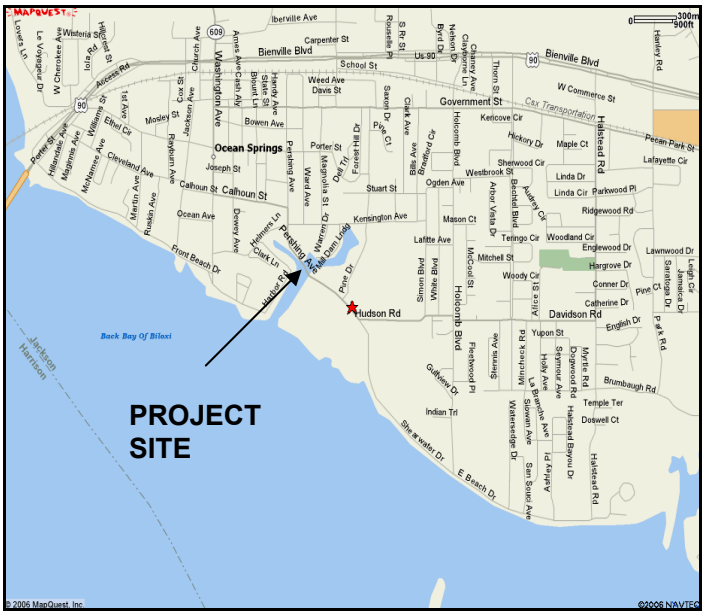


Figure 2.3.11-2. Shearwater Bridge Vicinity Map

Figure 2.3.11-3. Aerial view of Shearwater Bridge

Figure 2.3.11-4. Timber Wall Failure at North Abutment

The existing timber retaining walls protecting both approaches and abutments to the bridge are failing. The timber has deteriorated and the walls were inundated by the storm surge, which caused additional failure and loss of fill material, as shown in Figure 2.3.11-4. Another strong storm surge could cause the bridge to fail or the approaches to become impassable. Storm surge inundation limits at Shearwater Drive Bridge site from Hurricane Katrina are estimated approximately at elevation 21 feet National Geodetic Vertical Datum (NGVD).

2.3.11.1 Coastal and Hydraulic Conditions

Circulation patterns within the vicinity of the study area are controlled by astronomical tides and prevailing winds. Accumulations at culvert outfalls suggest a weak east-to-west littoral drift in the site vicinity. The mean diurnal tide range is on the order of 1.6 feet, and the extreme (except during storms) range is about 3.5 feet. Predominant winds average 8 mph from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the Sound causing current velocities of several knots in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline. The study area has been impacted by several tropical storms and hurricanes, most recently from Tropical Storm Isadore in 2002 and Hurricane Katrina in August 2005. Hurricane Katrina surge estimated from high-water marks range from 16.5 to 18 feet mean sea level near the site. Based on the maximum annual sea stage-frequency curve for Biloxi, Mississippi, a community to the west of Ocean Springs, these heights suggests, approximately, a 100-year recurrence interval storm surge event.

2.3.11.2 Geotechnical Conditions

The bridge carries Shearwater Road over the upland harbor channel. The bridge elevation is approximately 20 feet NGVD with the approaches falling at a 3 percent grade to elevation 10 feet to the west and falling at a grade of 7.4 percent to the east to elevation 10 feet. The toes of the south side of the approach embankments are accessible from a road that connects to the approach ends and runs to the channel edge on each side. This road allows access to the bulkhead and slips along the harbor channel. The bridge was replaced in 2003 but the embankments and any stabilization efforts remain from the original construction. The approach side embankments are extremely steep (>1V:1H), rendering conventional slope protection unstable. Attempts have been made to stabilize the slopes through a combination of timber bulkheading with closely spaced piled installed for lateral support and concrete rubble. These walls have deteriorated to the point of failure and no longer provide adequate support. The existing embankments have been constructed by placing compacted poorly graded sands and silty sands from elevation 5 feet to elevation 20 feet. Medium to dense poorly graded sands and silty sands can be expected below elevation 5 feet with more silty sands and possible organic content beyond elevation -10 feet, becoming less silty beyond elevation -15 feet.

2.3.11.3 Preferred Alternative—Bridge Repair with Vinyl Sheetpile

The proposed protection project would consist of the installation of continuous interlocked vinyl sheet piling along both sides of the north and south approaches of the bridge. The total of sheet pile wall would be approximately 675 feet the top elevation varies from elevation 20.48 ft to elevation 12; the average height is 17 feet. The sheet pile bulkheads would be anchored to each other by using steel tie rods under the roadway; the bulkhead would be backfilled with gravel and sealed at the top with a reinforced concrete cap.

2.3.11.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with the repairs. Without corrective action, failure of the bridge would occur with the resultant loss of and further damages to the existing bridge structure, the existing infrastructure, the public roadway used by nearby residents, and the removal of an evacuation route. This alternative was not selected because it would not provide protection to Shearwater Bridge.

Alternative 2—Steel Sheetpiling. This alternative would consist of installing continuous interlocked steel sheetpiling along both sides of the north and south approaches of the bridge. The total of sheetpile wall would be approximately 675 feet the top elevation varies from elevation 20.48 ft to elevation 12, the average height is 17 feet. The sheetpile bulkheads would be anchored to each other by using steel tie rods under the roadway; filter fabric will be placed behind the bulkhead and the bulkhead would be backfilled with gravel and sealed at the top with a reinforced concrete cap. Due to structural considerations discussed below, this alternative was not selected.

Alternative 3—Timber. This option would be similar to what currently exists, with the exception of extending and raising the walls. More substantial piling and depth of embedment would be used. Filter fabric and proper backfill will also be used. This alternative was not considered as permanent as the other sheetpile material alternatives and was not considered further.

Structural Considerations. In assessing the relative value and effectiveness of steel sheetpiling and vinyl sheetpiling, the durability provided was of paramount importance. The forces imposed on these sheetpile structures will be moderate to high, consisting of vertical weight of a portion of the small concrete cap, backfill pressures generated by the sand fill placed behind the bulkhead, roadway or vehicular loads, and periodic lateral seepage pressures generated by migrating water. Either the steel or vinyl sheetpile sections should be more than adequate to resist these pressures. The critical factor will be the ability of the bulkhead to resist saltwater corrosion. Considering all these parameters, the vinyl or some vinyl composite Z-pile, engineered for the purpose, is considered best for this application. These materials are extremely resistant to saltwater environments, are strong enough to resist loads imposed on the bulkhead, and therefore should serve almost indefinitely in providing protection for the bridge approaches.

2.3.11.5 Environmental Effects

Overall aesthetic quality would be improved, since the unsightly rubble used to temporarily stabilize the abutments would be replaced and erosion of the fill material would be minimized. Best Management Practices for erosion and sediment control will be used during construction to minimize sediment entering the water. The structural integrity of the bridge would be reinforced by the protection afforded from the completed project. The public would be able to continue to use the roadway during normal circumstances as well as during evacuations when necessary. Erosion of the fill material would be prevented thus water quality of the tidal waterbody would improve. The eroded material would not be deposited into the waterbody, which would negate the need for future dredging. The overall health of the tidal waterbody would improve as a result of the stabilization of the bridge abutments and shoreline armoring.

The adverse environmental impacts of the proposed action are insignificant or very minor and short term.

2.3.12 Gautier Coastal Streams

The sites are located in Gautier, Jackson County, Mississippi and are shown in Figures 2.3.12-1 and 2.3.12-2.

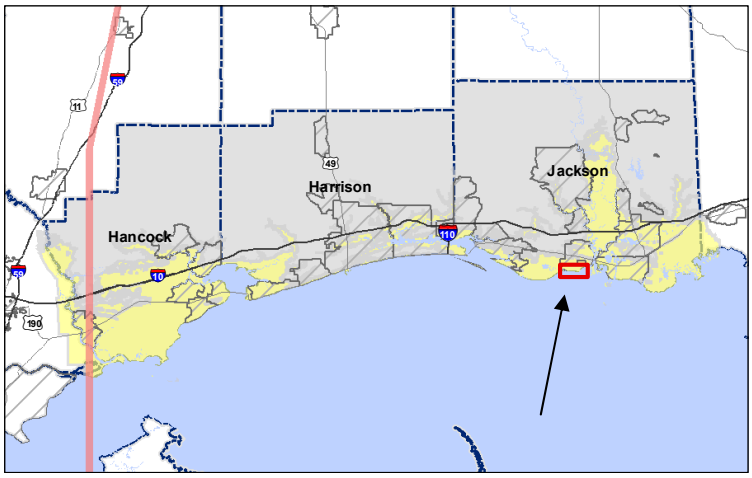


Figure 2.3.12-1. Gautier Coastal Streams Project Area

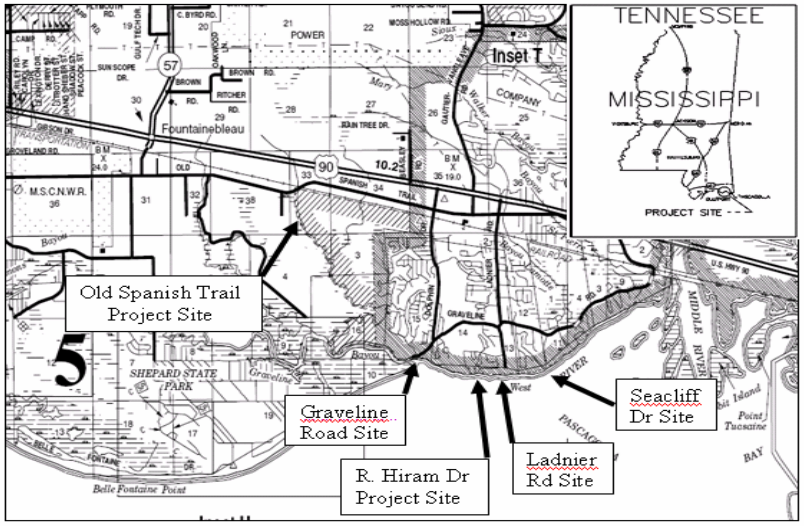


Figure 2.3.12-2. Location of Gautier Coastal Streams Proposed Improvements

2.3.12.1 Coastal and Hydraulic Condition

The hurricanes of 2005 caused damage to drainage ways by blowing trees and other debris into these areas and by deposition of sediment in many areas.

2.3.12.2 Geotechnical Conditions

Sediment filled the drainage canals as a result of the 2005 hurricane season. This influx of sediment obstructed typical flowing canals which then resulted in flooding.

2.3.12.3 Preferred Alternative—Sediment Removal in Selected Drainageways

The preferred alternative involves removal of debris and sediment from the following drainageways and streams:

- Old Spanish Trail Site – removal 1 foot sediment
- Graveline Bayou – removal 3 ft sediment
- Hiram Drive Site – removal 3 ft sediment
- Ladnier Road Site – removal 3 ft sediment
- Seacliffe Bayou Site – removal 3 ft sediment.

These project sites are specifically described in following paragraphs. At each location, sediment and debris would be removed by mechanical excavation. A back-hoe or other mechanical excavation equipment would be used for debris and sediment removal for placement into dump trucks for disposal in an upland disposal site located offsite. The sediment would be used for beneficial purposes where feasible. Removal of some debris would be necessary in order to obtain the sediment. A 30-foot wide equipment access clearing adjacent to the streams would be required. Debris would be separated for appropriate disposal. The project would be constructed in low flow months, when there is very little water in the channel and low flow.

At the *Old Spanish Trail project site*, trees, debris, and sediment are blocking drainage in a previously improved stream for approximately 1,750 feet downstream of Old Spanish Trail in the area shown in Figure 2.3.12-3 . At the end of the previously improved section, the flow enters a wooded area, which extends approximately 1,000 feet, extending to a larger area of tidal water. Sediment and debris would be removed to a depth of about 1 foot. Approximately 1,600 cys of material would be removed. This project is expected to reduce flooding to a minimal degree.

At *Graveline Bayou*, debris and sediment are blocking drainage in the stream for approximately 6,900 feet upstream of the mouth in the area shown in Figure 2.3.12-5. The width of the stream is approximately 50 feet wide. Shoaling is estimated to be approximately 3 feet deep. The average width of the channel is approximately 50 feet and depth is an average of approximately 3 feet thick. Some parts of the stream are lined with bulkheads. The excavation would provide a moderate reduction in flooding on the lower end of the channel and would reduce flooding to a lesser degree above Lucina Cove, 2,000 feet above the mouth.

At the *Hiram Drive Site*, debris and sediment are blocking drainage in the stream for approximately 2,640 feet upstream of the mouth in the area shown in Figure 2.3.12-6. The width of the stream is approximately 50 feet wide and sediment accumulation depth is approximately 3 feet. Some parts of the channel are lined with bulkheads. The excavation would provide a moderate reduction in flooding on the lower end of the channel and would reduce flooding to a lesser degree above Hiram Drive, 1,700 feet above the mouth.

At the *Ladnier Road Site*, debris and sediment are blocking drainage in the stream for approximately 1,150 feet upstream of the mouth in the area shown in Figures 2.3.12-7 and 2.3.12-8. The width of the stream is approximately 40 feet wide. Removal of some debris would be necessary in order to obtain the sediment. The average width of the channel is approximately 40 feet and depth is an average of approximately 3 feet thick. Some parts of the stream are lined with bulkheads, as shown in Figure 2.3.12-8. The excavation would provide a moderate reduction in flooding on the lower end of the channel and would reduce flooding to a lesser degree above Graveline Road, 3,000 feet above the mouth.

At *Seacliffe Bayou*, debris and sediment are blocking drainage in stream for approximately 2,440 feet upstream of the mouth in the area shown in Figure 2.3.12-9. The width of the stream and

sediment deposition is approximately 50 feet wide and depth is approximately 3 feet. Removal of some debris would be necessary in order to obtain the sediment. The average width of the channel is approximately 50 feet and depth is an average of approximately 3 feet thick. Some parts of the stream are lined with bulkheads, as shown in Figure 2.3.12-9. The excavation would provide a moderate reduction in flooding on the lower end of the channel and would reduce flooding to a lesser degree above Seacliffe Drive, 2,400 feet above the mouth.

Figure 2.3.12-3. Old Spanish Trail Site

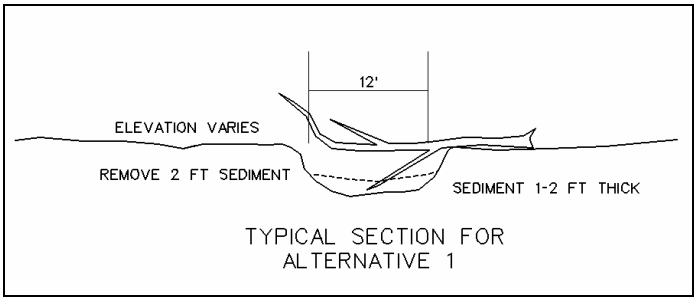


Figure 2.3.12-4. Sediment Removal - Old Spanish Trail

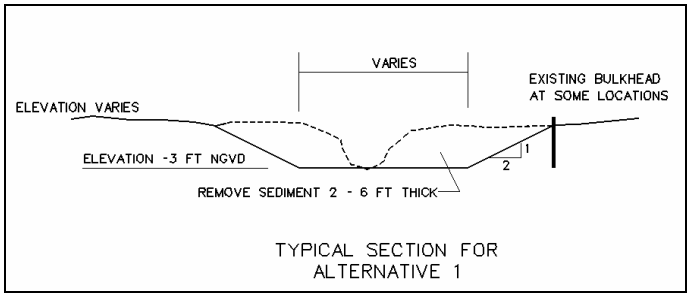


Figure 2.3.12-5. Graveline Bayou

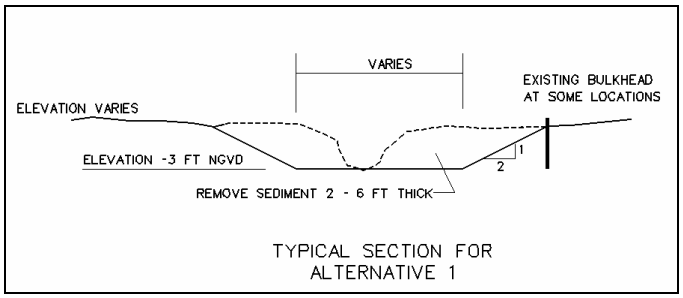


Figure 2.3.12-6. Hiram Drive Site

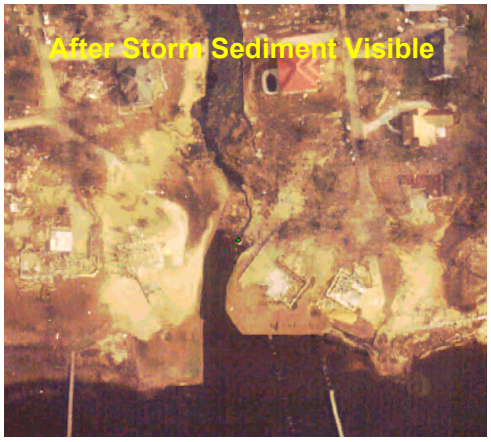


Figure 2.3.12-7. Ladnier Road Site

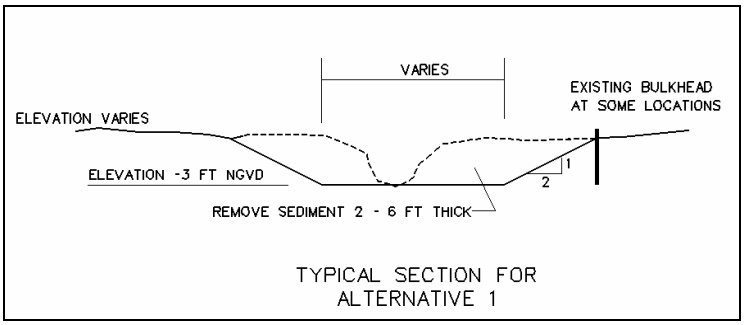


Figure 2.3.12-8. Ladnier Road Sediment Removal

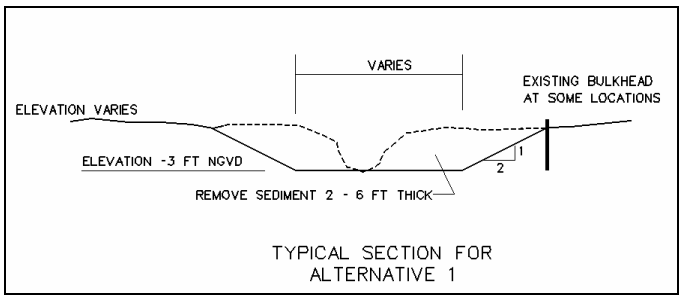


Figure 2.3.12-9. Seacliffe Bayou

2.3.12.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with the removal process. Without corrective action to remove sediment, increased flooding would occur with the resultant loss of and damage to existing infrastructure, public lands, and residences. This alternative was not selected because it would not reduce flooding within Gautier.

Alternative 2—Sediment Removal Minimal Depth. This alternative consists of removing approximately 1 ft of sediment from the effected areas. This alternative would result in slightly less benefits than the preferred alternative above. The environmental effects of the removal to a minimal depth and the removal to the preferred alternative depth would be similar. Accordingly, the minimal depth removal alternative was not selected.

2.3.12.5 Environmental Effects

Overall aesthetic quality would be improved, since the unsightly debris would be removed. Removal of the sediment would provide flushing of the system and improvement to tidal exchange resulting in less stagnant water. Removal of the obstructions would allow fish to migrate up the systems by the sub-adult and larvae for use as a forage area. The improved habitat would also improve foraging areas for shorebird use. Removal of the non-biodegradable foreign material and deposition of sediments would improve overall water quality by improving circulation and enhanced drainage in the area resulting in an overall reduction of flooding to nearby residences.

Localized, minor, and temporary adverse impacts will take place during removal of the sediment. Temporary increases in turbidity in the immediate area of sediment removal will unavoidably occur. Bottom living organisms will be displaced or lost. Recolonization is expected to occur quickly. Mobile organisms may just leave the area until construction activity is over.

2.3.13 Pascagoula Beach Boulevard Restoration Project

The study shoreline areas are located in Jackson County, the eastern-most coastal county in Mississippi as shown in Figure 2.3.13-1. The site is located on the western half of the Pascagoula waterfront on Mississippi Sound. Pascagoula is 44 miles by road west of Mobile, Alabama and 110 miles east of New Orleans, Louisiana. More than 28 million tons of cargo pass annually through the Port of Pascagoula, the state's largest port. The site location is shown on Figures 2.3.13-1, 2.3.13-2, and 2.3.13-3. The Pascagoula Shoreline between Spanish Point and Bayou Chico is fronted by Beach Boulevard, which is protected by a concrete seawall. The project site is primarily seaward of Beach Boulevard between Spanish Point and Beach Park, and about 50 feet of the shoreline at the east end of Beach Boulevard.

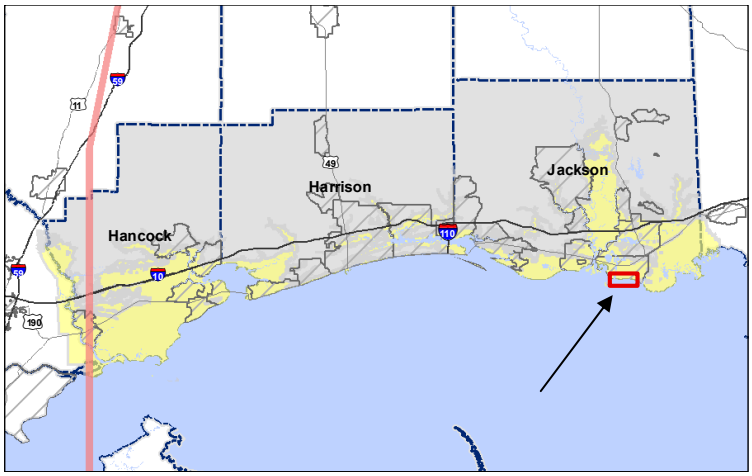


Figure 2.3.13-1. Pascagoula Beach Boulevard Project Area

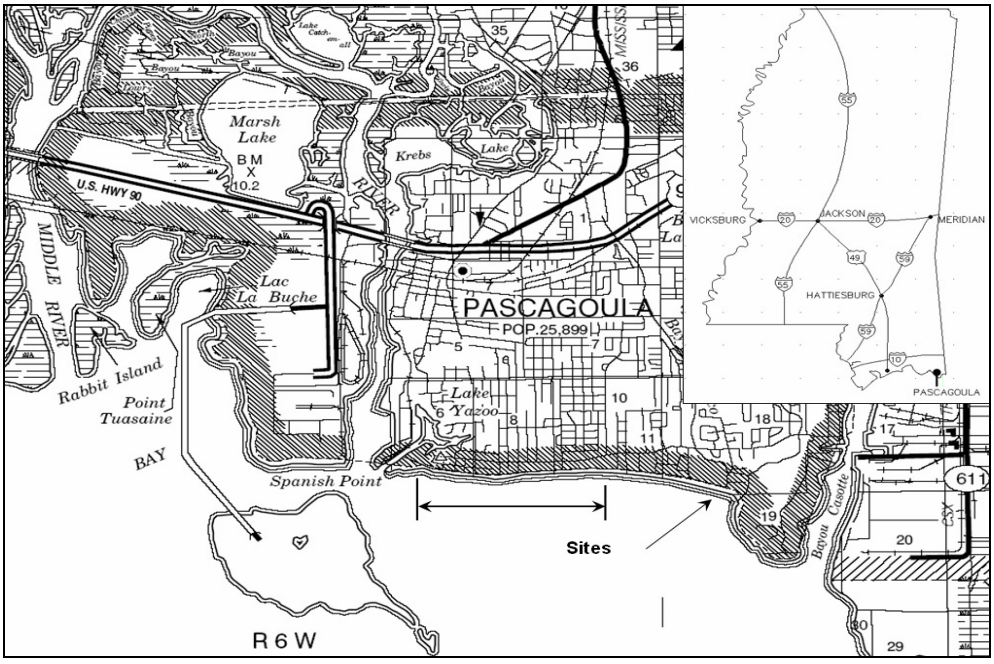


Figure 2.3.13-2. Pascagoula Beach Proposed Work Limits

The Pascagoula waterfront extends from Spanish Point, at the mouth of the Pascagoula River (drainage area 9,498 sq. miles) east to Bayou Casotte. The project limits generally coincide with the western half of the waterfront, from Spanish Point to Beach Park. The majority of the shoreline and Beach Boulevard there is protected by a concave seawall constructed in 1929 (Figure 2.3.13-4). Electrical conduits for street lighting are housed in a concrete curb placed adjacent to and landward of a low concrete railing atop the seawall. The conduit housing was broken and severed in numerous locations during Hurricane Katrina. The seawall foundation details are presently unknown, but it is believed to be founded variously on the shoreline bed, and/or upon irregularly spaced pile, and/or upon debris previously placed to stem beach erosion and storm damage. The seawall crest elevation varies somewhat and is slightly lower than the centerline of Beach Boulevard, the elevation of which varies between 4.1 and 6.2 feet NGVD, which is on the order of 10 to 15 feet below the estimated maximum Hurricane Katrina surge heights in the area as depicted in Figure 2.3.13-3.

Land use north of the roadway in this area is primarily residential, with at grade elevations generally between elevations 8 to 14 feet NGVD.

The seawall is penetrated in fourteen locations by circular concrete drainage culverts as shown in Figure 2.3.13-4. The culverts are held in place by 'T' shaped concrete monoliths. Chevron shaped concrete flow deflectors are deployed off the southeast corner of each monolith to help prevent the culverts from filling with sediments. No hurricane damage occurred to the culvert outfall structures.

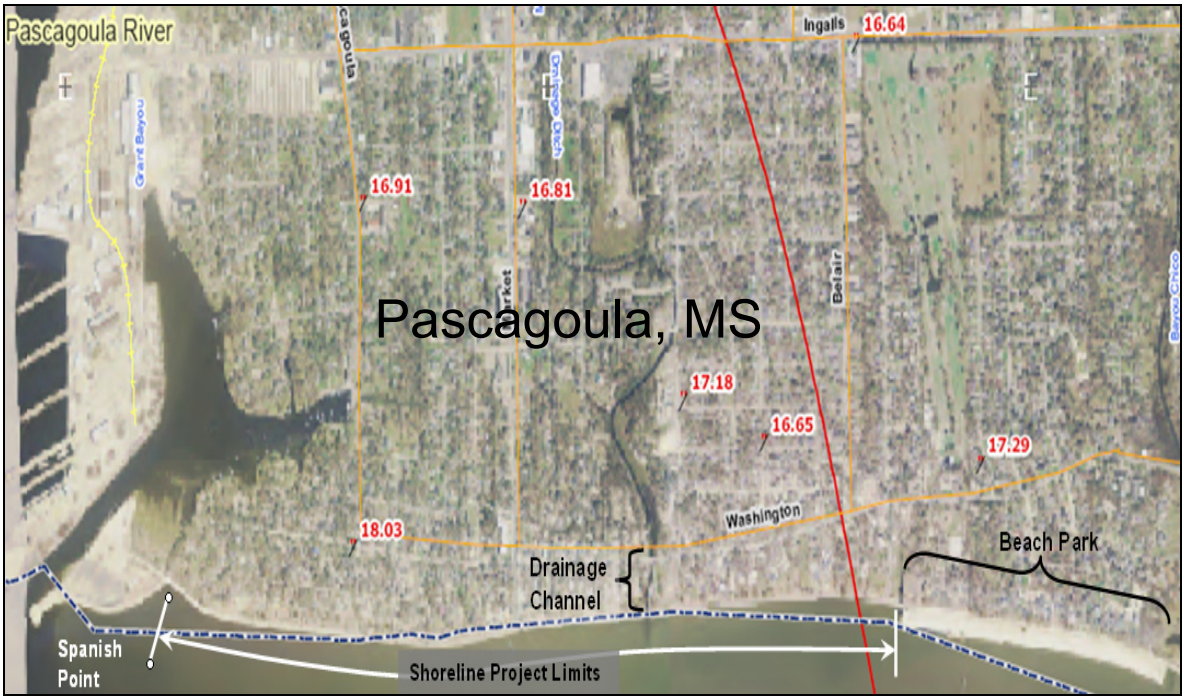


Figure 2.3.13-3. Pascagoula Shoreline West from the East End of Beach Park. Hurricane Katrina High Water Marks in Feet NAVD 88 Datum Shown in Red

Figure 2.3.13-4. Concave Seawall, Culvert Outfall, and Pier, Looking East Beach Boulevard Is to the Left

Figure 2.3.13-5. Pascagoula Beach Boulevard Before and After Hurricane Katrina

Figure 2.3.13-6. Drainage Channel Near 11th Street Before and After Hurricane Katrina

The seawall is also penetrated in two locations by open drainage channels. One channel is west of 11th Street (see Figure 2.3.13-6), the other adjacent to the west end of Beach Park. Upstream of the Beach Boulevard bridge, the channel west of 11th Street consists of concrete panel walls with a concrete cap and a natural streambed. Each pile panel is approximately 30 feet long, one-foot thick, and of unknown height (possibly 12 to 15 feet). The channel is "S" shaped between the Beach Boulevard Bridge and the Washington Street Bridge and approximately 330 feet long. All concrete panels exhibit rotational and/or translational failure with localized erosion behind the panels. Downstream of the Beach Boulevard Bridge, the channel is confined by concrete pile training walls extending out to sea. About 60 feet of the concrete pile cap upon the right (looking to sea) training wall appears to have been damaged during Hurricane Katrina.

A vertically-walled, cellular seawall extends east of Beach Park to the east end of Beach Boulevard. This seawall was apparently built in the 1970's. The seawall protects the west end of Beach Boulevard and a portion of un-armored public right-of-way beyond it. This portion of the seawall is approximately 8 feet wide and also functions as a walkway. The wall appears to have been backfilled with soil and capped with approximately 6 feet by 8 feet irregularly-shaped architectural concrete panels. Seven of the panels were displaced and broken by hurricane surge in the region of the unarmored shoreline. The open cells have since served as a repository for miscellaneous storm debris.

The Beach Boulevard roadway surface reportedly has been historically subject to periodic, localized subsidence associated with persistent wave activity and aggravated by wind and rain storm events due to migration of fill to Mississippi Sound. Fill migration paths are interpreted to be through failed construction joint seals and/or beneath exposed portions of the seawall footing. Loss of fill through these pathways may be exacerbated by storm events, but the constant ebb and flow of the tide and the normal wave regime can also recruit fines past the seawall. No evidence of damages attributable to loss of fines under or through the seawall due to Hurricane Katrina were observed during field inspections in April 2006. There were also numerous locations of impact damage on the seawall face, with exposed and corroding reinforcement steel at some of these locations. Nearly every seawall panel exhibited longitudinal cracking, and vertical cracking. Construction joints and cracks in the seawall face are a potential roadbed fines migration pathway (see Figure 2.3.13-7).

Figure 2.3.13-7. Damaged Seawall Joint with Exposed Reinforcing Steel

2.3.13.1 Coastal and Hydraulic Conditions

The climate in the project area is subtropical, characterized by warm summers and short, mild winters. The average daily temperature ranges in the summer and winter are 72–89 and 42–63 degrees Fahrenheit (F), respectively. The average annual rainfall is about 64 inches, and is well distributed throughout the year. Precipitation records indicate July as the wettest month, while October is the driest. The National Climatic Data Center climactic summary for Pascagoula is shown on Table 2.3.13-1.

Mississippi Sound is a shallow water body bordered approximately 10 miles to the south by the barrier islands Cat Island and Ship Island. Typical depths in the sound range from about 6 to 16 feet. The shoreline slope in the vicinity of Pascagoula is relatively flat with the 6 foot depth contour located a few hundred yards offshore and as far as 1.5 miles offshore. The water is knee deep at 150 yards in the vicinity of Beach Park.

Table 2.3.13-1.
Climactic Summary, Pascagoula 3 NE, MS (Station No. 226718)
Source: Southeast Regional Climate Center

Period of Record : 1/ 1/1948 to 8/31/2005

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Average Max. Temperature (F)	60.6	63.5	69.2	76.3	83.0	88.2	90.1	90.0	87.0	79.7	70.2	63.3	76.7
Average Min. Temperature (F)	41.9	44.4	50.8	58.1	65.6	71.5	73.6	73.0	69.2	58.6	49.7	44.1	58.4
Average Total Precipitation (in.)	4.90	4.94	6.03	4.70	4.81	5.59	7.30	6.73	6.99	3.81	4.11	4.54	64.47
Average Total SnowFall (in.)	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1
Average Snow Depth (in.)	0	0	0	0	0	0	0	0	0	0	0	0	0

Circulation patterns within the vicinity of the study area are controlled by astronomical tides and prevailing winds. Accumulations at culvert outfalls suggest a weak east-to-west littoral drift in the site vicinity. Bottom sediments near Pascagoula are composed of fine sands and silts. The mean diurnal tide range is on the order of 1.6 feet, and the extreme (except during storms) range is about 3.5 feet. Predominant winds average eight miles per hour (mph) from the south during the summer and from the northeast during the winter. Though the tides produced by astronomical forces are relatively small in magnitude, the wind can produce larger variations. Strong winds from the north can evacuate the Sound causing current velocities in the passes to the Gulf. Winds from the southeast can produce high tides, piling water up against the shoreline. The study area has been impacted by several tropical storms and hurricanes, most recently from Tropical Storm Isadore in 2002 and Hurricane Katrina in August 2005. Hurricane Katrina surge estimated from high-water marks range from 16.5 to 18 feet mean sea level near the site. Based on the maximum annual sea stage-frequency curve for Biloxi, Mississippi, a community to the west of Pascagoula, these heights suggests, approximately, a 100-year recurrence interval storm surge event.

2.3.13.2 Geotechnical Conditions

Typical profiles for the beach and dune alternatives are shown herein. The materials to be used for this effort will come from inland sources within 10 miles of the project. Materials used for the re-nourishment and dune construction will have 90% passing the #40 sieve and only 10% will pass the #200 sieve. The sand fill shall not have noticeable amounts of shell and/or gravel. The sand will be transported by truck, dumped ashore and shaped along the proposed alignment. The beach will be about 150 feet wide and sloped from elevation 5.0+/- to elevation 3.5 and then sloped to mean lower low water (MLLW) at 1V:10H.

The existing sub-grade behind the existing concrete stream walls to be replaced consist of poorly graded sands and silty sands from elevation 5 feet with more silty sands and possible organic content beyond elevation -10 feet, becoming less silty beyond elevation -15 feet.

The alternative solutions provide for various types of sheetpiling to be driven along the streambank channel wall alignment on both sides. The design of the sheetpiles should be based on soils having an in place density of 110 PCF, a cohesion of 300 PSF and an angle of internal friction of 25 degrees. The soils will assume to be saturated below elevation 3.0 NGVD. The new walls can be access from both sides. Lateral earth pressure coefficients can be derived from the soil values

provided but the wall penetration should be on the order of 1.5 times the unsupported length for any section of wall.

2.3.13.3 Preferred Alternative—Seawall and Channel Repair and Beach with Dune and Plantings

The preferred plan evaluated actions to provide shoreline protection and environmental enhancement along the beaches in the City of Pascagoula.

The proposed plan involves seawall repairs and replacement of the streambank walls of the drainage channel west of 11th Street and the placement of a beach and dune system to provide a source of sand replenishment for beach sand lost over time to littoral processes. This action will restore the shoreline storm defense system by improving the seawall's damaged condition and improve degraded drainage capacity. Placing a beach and dune system will provide storm protection and ecological benefits. Coastal resources along the Pascagoula shoreline have consistently been diminished due to the high historical shoreline recession rates and subsequent coastal armoring to protect Beach Boulevard along the proposed action area. The result has been the loss of valuable beach habitat and recreational functions. Restoring the beach system will restore the existence and contribute to the well being of various flora and fauna that once existed within the proposed area. The dune system would provide vertical ecological complexity to the beach. The dune would be utilized by species that would otherwise not inhabit a flat sand beach. Achieving these goals will allow greater sustainability of a coastal environment contributing benefits to various coastal wildlife species. Replacing the beach and dune will also contribute to restoring recreational activities that once existed in the area.

The beach and dune system along a reach of approximately 7,700 feet of Mississippi Sound shoreline immediately adjacent to the City of Pascagoula would be restored along with repairs to the existing seawall and outlet channels.

The concave seawall west of Beach Park would be repaired. Seawall joints would be cleaned and re-sealed (approximately 237 joints); impacted and spalled areas re-surfaced; exposed rebar cleaned, treated, and re-covered; and significant longitudinal and transverse cracks would be sealed. The seven destroyed cell caps of the cellular seawall east of Beach Park would be repaired with new cell caps. The cells covered by the caps would first be cleared of debris and backfilled with suitable material.

The failed stream bank panels of the drainage channel west of 11th street would be removed and replaced and the remains of approximately 60 feet of this stream's extension wall cap would be removed and replaced with a new reinforced concrete cap. Either vinyl sheet pile or concrete wall panels would be used for channel wall replacement. Existing drainage channel guidewalls would not need to be extended for this alternative. However, because the drainage culverts on the beach side of the seawall must be extended at nearly 15 times their current length, it is necessary to assume that all 14 culverts would need to be enlarged. Culverts may need to be replaced in their entirety in order to provide adequate conveyance.

The beach would extend from the west end of the seawall near Spanish Point to the drainage channel just west of Beach Park, a distance of approximately 7,700 feet. A schematic elevation view of the preferred alternative is shown in Figure 2.3.13-8. Approximately 229,000 cubic yards of medium to fine-grained sand would be needed. Sand would be trucked in from upland sources, dumped on-site, and graded to the recommended configuration. The beach would need to be periodically re-nourished; beach maintenance experience in neighboring Harrison County suggests a 12-year re-nourishment cycle.

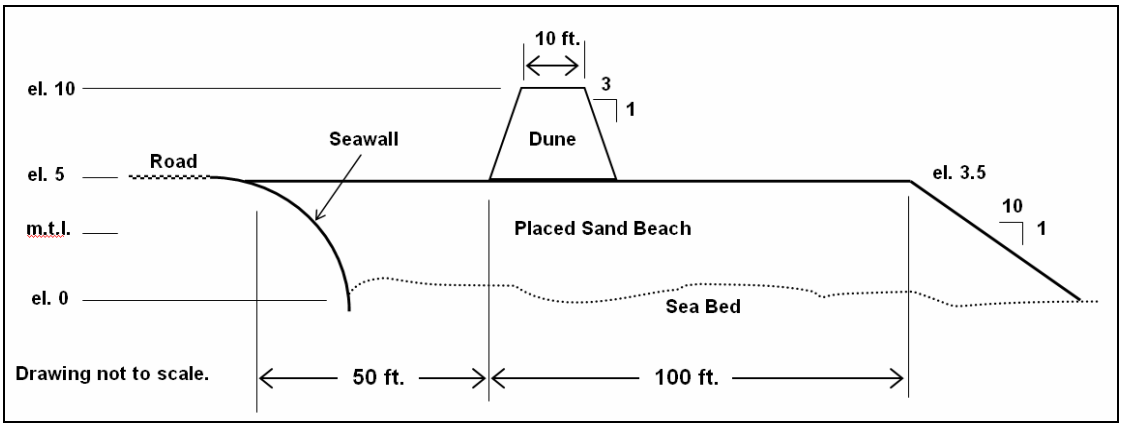


Figure 2.3.13-8. Elevation View, Alternative 2 and Alternative 3 (with Dune) Beach

Dunes would be constructed on the beach. Because the primary purpose of the dune is to provide ecological benefit, pedestrian pathways would not be constructed over them. The dunes would be vegetated and sand fencing would be installed to help resist landward dune migration and wind-borne sand loss. The dune would also provide a source of beach material for sand borne away by nearshore currents. The estimated quantity of sand required to construct the dunes is approximately 41,000 cubic yards, with 8 acres of plantings and approximately 8,470 feet of sand fencing.

The dune will be planted with species of dune vegetation indigenous to the area. Sand dunes are dynamic coastal features, which are formed and maintained by the accumulation of wind blown sand. The dune restoration project will be designed to create a dune that matches the surrounding natural dune patterns. After placement of sand immediate steps will be taken to plant and stabilize the dune for rapid stabilization. This will be accomplished through the use of sand fences and dune plants. The dune plants will be planted to cover 60-80% of the total area (about 8 acres of plantings). The vegetation will consist of local dominant species that populate nearby natural dune systems. The selection of the dune vegetation will consist of species that are most widely used for dune restoration and are readily available from local nurseries and suppliers. The selection will be coordinated with local environmental experts familiar with dune ecosystems in the immediate area. Dune plant species being considered are:

- sea oats *(Uniola paniculata)*
- bitter panic grass *(Panicum ararum)*
- sea rocket *(Cakile constricta)*
- beach morning glory *(Ipomoea imperati)*
- railroad vine *(Ipmea pes-caprae)*
- blue stem *(Schizachyrium scoparium)*
- blanket flower *(Gaillardi pulchella)*

It is anticipated that maintenance of the beach and dune would require periodic re-nourishment on a 15 to 20-year cycle. Shoreward dune migration may require periodic shaping of the beach from the front of the dunes to the shore.

2.3.13.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative includes not performing repairs to the Pascagoula Beach Boulevard seawall, drainage channels, and other structural systems, and not replacing the shoreline beach sand.

Shoreline erosion would continue without replenishment of lost sand.

If drainage channel walls and drainage channel extension wall caps are not replaced, the channel walls will fail progressively. The most likely mode of failure is for them to fall one by one over time into the drainage channel and obstructing it. As a result, the ability of the channel and drainage network to convey stormwater would be compromised due to direct blockage of flow and related sediment deposition. This alternative also assumes the channel extension wall panels, lacking a competent cap, would progressively fail. Failure of the extension wall panels would represent a breaching of the extension channel, which would promote deposition of sediment within the channel and thereby hinder the conveyance of stormwater through the channel.

The seawall would not be repaired. The types of seawall damages observed can result in corrosion of exposed rebar, accelerated seawall deterioration, and loss of fines from behind the seawall. Such damages will reduce the useful life of the seawall, reduce the reliability and safety of the infrastructure it houses and protects, and increase the risk of damage and loss over time.

Future conditions associated with not conducting structural repairs and restoring the beach and dune system would result the area remaining particularly vulnerable to wave and storm activity. In addition damage to drainage systems would impair stormwater drainage. Without replenishment, valued beach habitats and associated benefits would continue to be lost through shoreline erosion. The immediate area would remain particularly vulnerable to wave and storm activity that continually threaten the immediate area and prevent the re-establishment of precious natural resources. The no action alternative would not contribute to the recovery of coastal Mississippi from the impacts of Hurricane Katrina, and would not provide shore habitat values. Accordingly, the no action alternative was not selected.

Alternative 2—Seawall and Channel Repair. This alternative involves making repairs to the seawall and drainage channel walls. No replenishment of beach sand would occur.

This alternative would improve the protection to infrastructure and facilitate stormwater drainage. However, the beach component would continue to degrade through shoreline erosion. This alternative was not selected because the shore protection and environmental features of other alternatives is superior than this seawall and channel repair only alternative.

Alternative 3—Repair of Structures and Beach (without dune). In addition to seawall and channel repair, this alternative would provide for the placement of a sand beach to enhance the environmental value of the shoreline. However this alternative does not provide for the construction of a dune system. Historically, a delicate balance existed between the available sand supplied to the beach and that borne away by near-shore currents. Where they exist, seawalls along the Mississippi Coast have eliminated the shoreline supply and reflected local wave energy. Over time, the sand beaches have disappeared most of the armored south facing Mississippi coast, as have the shoreline ecological communities dependent upon the sand beaches. A secondary benefit is that the sand, being placed up to and against the seawall, would greatly reduce the migration of fines through and beneath the seawall, which is a recurring and expensive maintenance issue for the city.

This alternative is similar to the preferred alternative but was not selected because the benefits of beach dunes would not be provided. Dunes provide an additional level of protection from minimal storm surges and waves as well as providing a stockpile source of beach material for sand borne away by storms and nearshore currents.

The dunes would also provide beneficial habitat for a variety of wildlife. Without a dune system, the shorelines be more vulnerable to storm damages than the same shoreline with a dune system. The dunes increase environmental and recreational benefits of the project.

2.3.13.5 Environmental Effects

The proposed beach and dune restoration at Pascagoula will produce numerous ecological benefits associated with the shoreline restoration. Constructing a beach and associated dune system will be conducive to restoring wildlife habitat once present in this area. Beaches and dunes provide foraging and roosting habitats for various shorebirds the least tern and the federally-listed (threatened) piping plover. The restored shoreline will provide additional resting and wintering areas for these birds. The creation of a dune would allow the establishment of multiple vegetation types associated with local dune habitats. The proposed project would also provide general benefits by creating opportunities for the production of food sources thus contributing to the general well being of waterfowl, raptors, nearshore fish and other wildlife associated with the coastal environment. A beach-dune system will be advantageous for increased overall stability of the entire beach ecosystem by providing reserves of sand acting as a buffer to resist erosive events. The increased beach stability will directly contribute to the sustainability of the restored habitats.

The proposed action would likely result in a number of short-term negative impacts to the immediate Pascagoula shore. Adverse impacts include smothering of benthos, reduced esthetics, reduced air quality, increased turbidity, increased noise, and aquatic organism disturbance. Impacts to benthic organisms would be encountered as a result of the direct placement on the beach and nearshore area. While most of the immobile organisms within the beach and nearshore are quite adaptable to seasonal changes in temperature, salinity, dissolved oxygen, water clarity, and water level fluctuations due to the tidal cycle, the physical placement of dredged material would destroy some sediment dwelling organisms in the placement area. Also, some motile organisms may be covered by placement of the material. Natural recruitment into these areas by benthic organisms, encrusting organisms and fishes would occur rapidly such that the overall impact would not be significant.

2.3.14 Upper Bayou Casotte

The upper portion of Bayou Cassotte was adversely affected due to the deposition of sediment from the Hurricane Katrina storm surge and windblown and surge borne trees and debris. The significant debris in the drainage way, especially at some of the culverts, would have to be removed to facilitate removal of the sediment. The sediment and debris decreases the conveyance of water in coastal stream drainage ways and increases the potential for future flooding in the surrounding area. There are numerous commercial and residential properties surrounding the Upper Bayou Casotte area in Moss Point, Mississippi. This project involves the removal of storm related sediment and debris from drainage ways to reduce future flooding events.

2.3.14.1 Coastal and Hydraulic Conditions

The hurricanes of 2005 caused damage to drainage ways by blowing trees and other debris into these areas and by depositing sediment in many areas of Jackson County, Mississippi. An unnamed drainage project that eventually flows into Bayou Casotte or Point Aux Chennes Bay, as shown in Figures 2.3.14-1 and 2.3.14-2, received sediment and debris deposition resulting in increased flooding within the project vicinity. The area is in the City of Moss Point near the intersection of Highway 63 and Highway 90 and is relatively flat, with some small interconnecting ditches that drain in different directions. Upper Bayou Casotte varies in width from approximately 9 feet to 15 feet with an average depth of approximately 12 feet. The U.S. Geological Survey quad sheets indicate that the elevation of the subdivisions is between elevation 15 feet and 20 feet NGVD. Upper Bayou

Casotte partially flows into Bangs Lake and Point Aux Chennes Bay, and partially into Bayou Casotte through interconnected drainage ways. Hurricane Katrina inundation limits provided by the Federal Emergency Management Agency (FEMA) are estimated to be 15 feet NGVD.

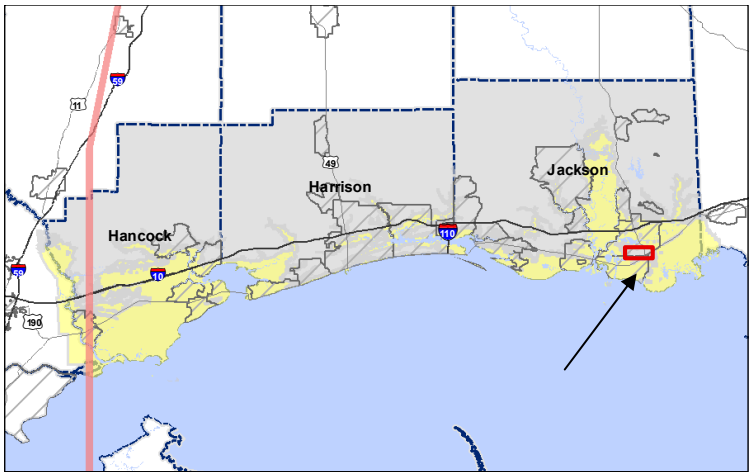


Figure 2.3.14-1. Upper Bayou Casotte Project Area.

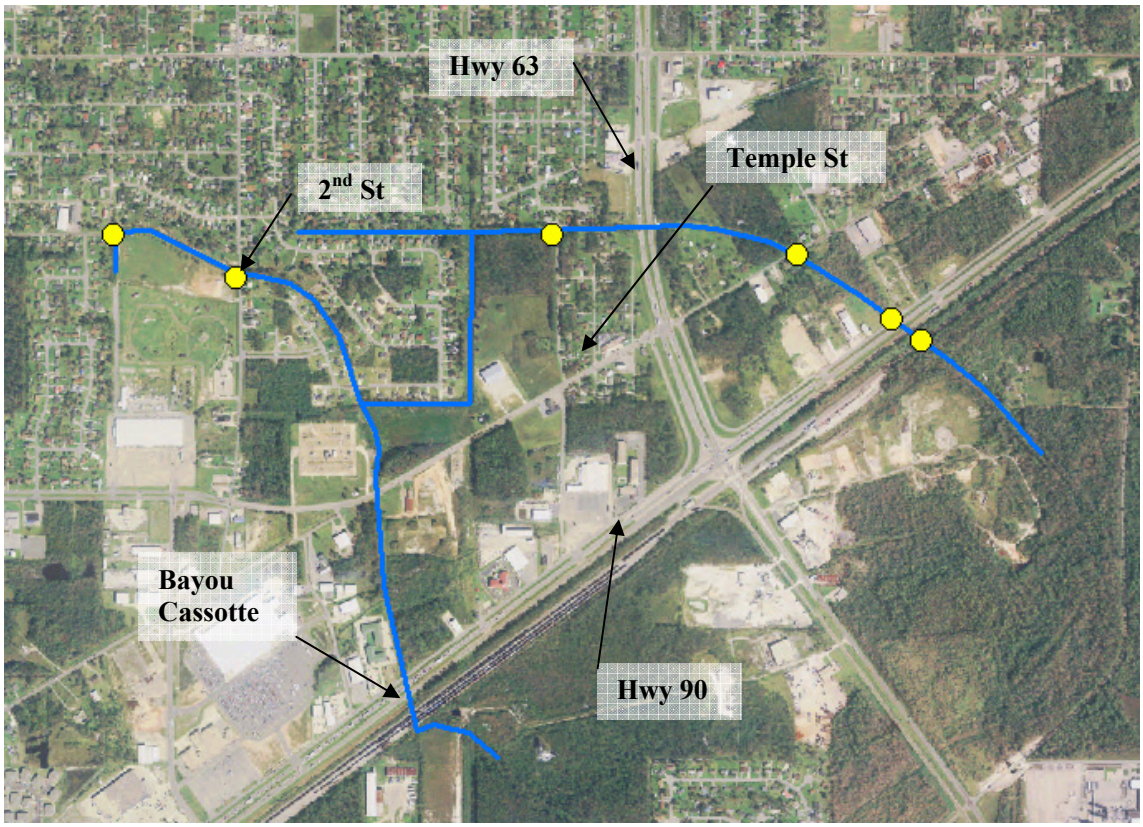


Figure 2.3.14-2. Upper Bayou Casotte Proposed Work Areas

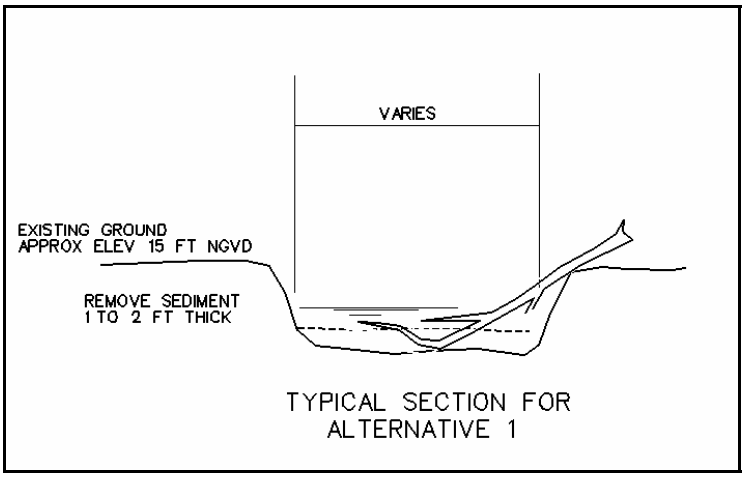


Figure 2.3.14-3. Upper Bayou Casotte, Sediment Removal Plan

2.3.14.2 Geotechnical Conditions

Sediment and debris deposition have resulted in clogged ditches in the area. The sediments are coastal sediments consisting of predominately silts and clays with some sands.

2.3.14.3 Preferred Alternative—Sediment and Debris Removal (2-Ft)

The project involves short-term improvement of drainage in order to reduce flooding by removal of debris and sediment from within the drainage way, and would consist of removing approximately 2 feet of sediment over an average width of 15 feet and length of 2.71 miles, as shown in Figure 2.3.14-3. Debris in the drainage way, especially at some of the culverts would also be removed to facilitate removal of the sediment. Mechanical excavation of the debris and sediments would be accomplished by using a marsh buggy type back-hoe or other mechanical excavation equipment and dump trucks. Approximately 159,000 cubic yards of sediment would be removed. Material would be stockpiled to drain, the debris sorted out, and all materials hauled to a land fill or appropriate upland disposal or beneficial use area.

2.3.14.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids both the monetary investment and potential adverse impacts associated with the removal process. Without corrective action, increased flooding would occur with the resultant loss of and damage to existing infrastructure, public lands, and residences. This alternative was not selected because it would not reduce flooding in the area.

Alternative 2—Sediment Removal (1ft). This alternative is the same as Alternative 1 except that only 1 foot of sediment would be removed. No additional drawing is provided. This alternative would result in slightly less benefits than the preferred alternative (Removal to 2-Ft) and was therefore not selected.

2.3.14.5 Environmental Effects

Overall aesthetic quality would be improved, since the unsightly debris would be removed. Removal of the sediment would provide flushing of the system and improvement to tidal exchange resulting in

less stagnant water. Because several culvert locations appeared to be significantly clogged with sediment and debris, the results of this work is expected to have significant drainage benefit. Removal of the large obstructions would allow fish to migrate up the systems to forage on the sub-adult and larvae. The improved habitat would also improve foraging areas for shorebird use. Removal of the non-biodegradable foreign material and deposition of sediments would improve overall water quality by improving circulation and enhanced drainage in the area resulting in an overall reduction of flooding to nearby residences.

Localized, minor, and temporary adverse impacts will take place during removal of the sediment. Temporary increases in turbidity in the immediate area of sediment removal will unavoidably occur. Bottom living organisms will be displaced or lost. Recolonization is expected to occur quickly. Mobile organisms may just leave the area until construction activity is over.

2.3.15 Franklin Creek Floodway

The project area is near the communities of Orange Grove and Pecan, Mississippi in Jackson County, near the Alabama – Mississippi state line. Flooding along this tributary of Franklin Creek in Jackson County, Mississippi has been a chronic problem for years. Highway construction has interrupted overland flow resulting in ponding which floods the area of Pecan, Mississippi. Franklin Creek and Franklin Creek Tributary flow into the Escatawpa River which flows into the Pascagoula River. The project vicinity and general area are shown in Figures 2.3.15-1 and 2.3.15-2.

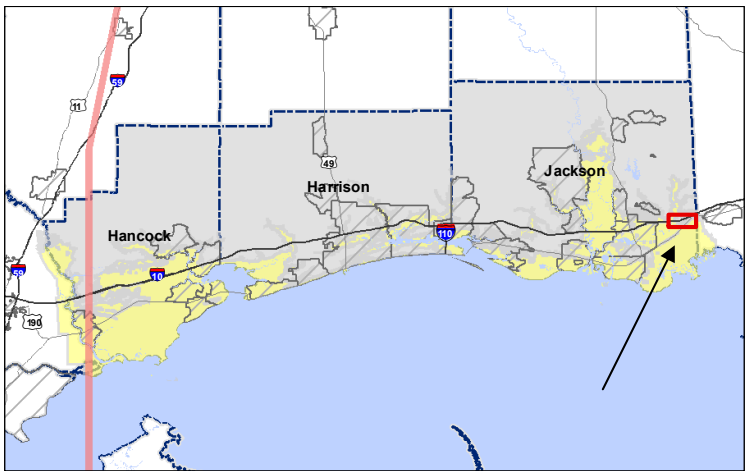


Figure 2.3.15-1. Franklin Creek Floodway Project Area

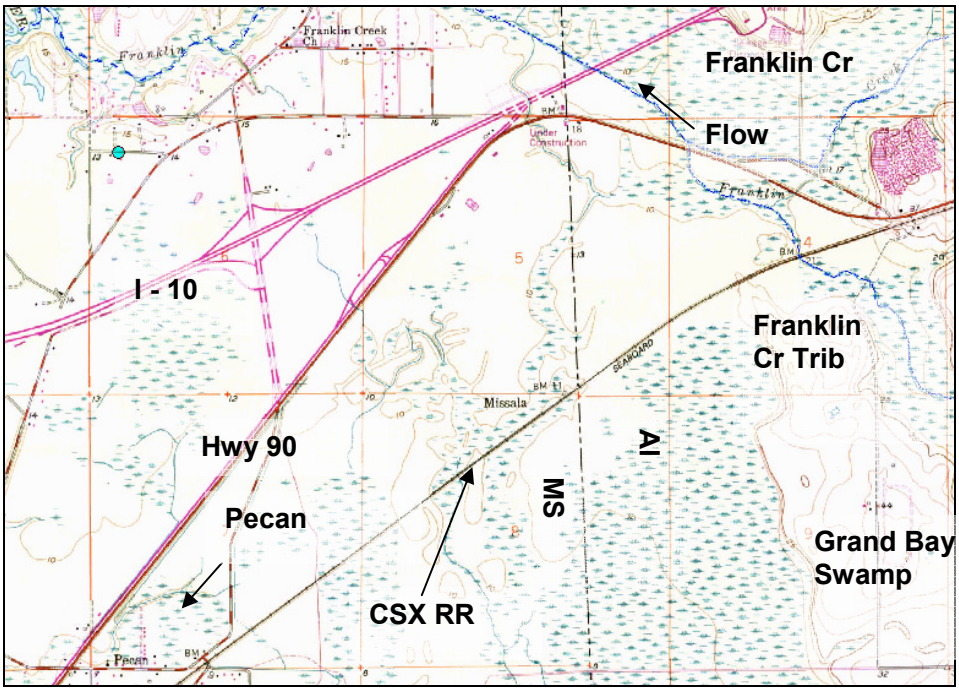


Figure 2.3.15-2. Franklin Creek and Pecan MS Location Map

2.3.15.1 Coastal and Hydraulic Conditions

Franklin Creek Tributary intersects Franklin Creek above the CSX Railroad and Highway 90, flooding the area bounded by Highway 90 and the railroad, including Pecan, Mississippi. This occurs especially during high water on the Pascagoula River and the Escatawpa River. Prior to 1950 and construction of the railroad, high flow from Franklin Creek and Franklin Creek Tributary could spill into a swamp and flow south-westerly into Grand Bay. Since construction of Highway 90 and the railroad, water from the creek and tributary cannot easily flow in the original overbanks along the low flow path to the Escatawpa River or to the south to Grand Bay. Although during the 1950's, the low flow channel of Franklin Creek was relocated by the Alabama State Highway along the north side of the old highway, during high water, some of the Franklin Creek water still continues southward, where it meets the Franklin Creek Tributary and then flows along the north side of the railroad to Pecan.

2.3.15.2 Geotechnical Conditions

Subsurface investigation has not been conducted for this project and subsurface conditions at this site are unknown. Subsurface conditions are assumed to be similar to those at the closest available geotechnical boring. The closest geotechnical boring to these sites is the Mississippi Department of Geology boring identified as JK9. This boring is located approximately 25,000 feet west of the proposed excavation at the site. Sample descriptions and grain size data for the upper 10 feet of this boring are summarized in Table 2.3.15-1.

Table 2.3.15-1.
Mississippi Department of Geology Boring JK9
Mississippi Department of Geology Boring JK9 (upper 10 feet)

Depth	Description	% Grvl	% Sand	% Silt/Clay
0'0" – 1' 6"	Muddy Fine Sand	0.0	76.0	15.1 / 8.9
2' 6" – 4' 0"	Clayey Fine Sand	0.0	76.6	7.8 / 15.6
5' 0" – 7' 0"	Clayey Fine Sand	0.0	57.7	10.2 / 32.1
7' 0" – 8' 6"	Fine Sandy Clay	0.0	35.5	20.6 / 43.9
8' 6" – 10' 0"	Fine Sandy Mud	0.0	30.6	42.2 / 27.2

2.3.15.3. Preferred Alternative

The recommended plan is the purchase and removal of the approximately 30 (24 traditional structures and 6 mobile homes) residences remaining within the community of Pecan, Mississippi, for the purposes of storm-and flood-damage reduction. When residential structures and land are purchased for the purpose of evacuating the floodplain, the structures are demolished and the land is no longer available for residential or commercial development.

2.3.15.4 Other Alternatives

Alternative 1—'No Action'. The 'No Action' alternative involves the continuation of existing conditions and no new solutions for existing problems. This alternative avoids the monetary investment, potential adverse impacts, and environmental benefits associated with the project. Without correction action, continued flooding would occur as well as impairment of freshwater flows and continued saltwater intrusion. The adjacent wetlands would continue to degrade due to the present shortage of natural water flow. The presence of invasive species would remain causing further degradation. Because it does not contribute to the recovery of coastal Mississippi, this alternative was not selected.

Alternative 2—Elevation of Damageable Property. The elevation of key infrastructure above the 1% chance storm surge height, and incorporation of design codes into the reconstruction of damageable property would require demolition of almost every structure in the community. This measure was determined to be more expensive, at a cost of at least $50,000 per structure, than purchase and removal, as it would not guarantee prevention of all future flood or storm-induced damage, primarily due to the excessively low-lying nature of the land on which Pecan is situated, and its close proximity to the coastline. Additionally elevation does not remedy the problems flooding causes by limiting access to the homes Because this alternative is not cost-effective and offers an incomplete solution to the flooding problems, this measure was not selected.

Alternative 3—Improve the Hydraulic Conveyance of Franklin Creek. Preliminary engineering assessments of the hydraulic conveyance improvements of Franklin Creek have been conducted and further analysis is needed to determine if this measure would prevent storm-surge-induced flooding within the community of Pecan. Because insufficient data is available, this measure was not selected at this time. Future studies under the MsCIP or other programs may provide information to determine if this alternative is environmentally or socially acceptable.

Alternative 4—Construction of Additional Railroad Bridge Relief Openings to Increase Flows. Initial hydraulic review of the existing railroad trestles determined the size of existing openings were adequate to convey storm water flows. This alternative would consist of constructing additional railroad bridge relief openings to allow high water on the north side of the railroad to move southward towards Grand Bay. The elevation of the railroad is approximately 25 feet NGVD and the

ground elevation is approximately 10 feet NGVD, so the bridge would be approximately 15 feet high. There would be four bridges, each 300 feet in length for a total length of 1,200 feet. This alternative would not be cost effective compared to the proposed alternative.

Alternative 5—High Flow Diversion Plan. This alternative involves creation of a high water flow diversion by removing approximately 3-5 feet of material over an area of 7.4 acres. The excavation would be in an area where prior fill has restricted flow. The project would allow high flow from Franklin Creek Tributary to spill into the adjacent swamp draining into Grand Bay, thus reducing the flow entering Franklin Creek. This alternative is anticipated to have significant flood damage reduction benefits however further analysis is needed to determine the extent of benefits and properly design features. Construction would be done by using mechanical excavation equipment and dump trucks. Material could be hauled to a land fill area. No water control would be required. However, plantings and invasive species controls would be used to restore natural vegetation. Because sufficient information about this alternative is not available, this alternative was eliminated as an MsCIP Near Term Improvement. Future studies under the MsCIP or other programs may provide information to determine if this alternative is environmentally or socially acceptable.

2.3.15.5 Environmental Effects

The recommended plan would not preclude other future options that may include study of ecosystem restoration alternatives to restore overland flow into Grand Bay Marsh by removal of debris of obstructions to flow. The recommended plan does provide complete elimination of all future flood damages within the community of Pecan. Implementation of this plan provides the opportunity for future ecosystem restoration in this area.

There minimal adverse environmental effects to the proposed purchase and relocation. The existing houses will be removed

2.4 Need for the Proposed Projects

Hurricane Katrina and the other hurricanes/storms of the 2005 season completely devastated coastal Mississippi. Many coastal communities have been completely washed out to sea. Many waterbodies, infrastructure, and natural environmental settings have been destroyed and/or adversely impacted. These ‘low hanging fruit’ projects are would provide assistance to those devastated areas. Although these projects would not protect against a large hurricane, they do provide relief from the day-to-day storms and smaller hurricanes. As a result of the public and agency process described, potential recovery and restoration projects or ideas for coastal Mississippi were identified. As mandated in the MsCIP Congressional Authorization, potential projects were divided in terms of near term (otherwise known as ‘low hanging fruit’) and long-term projects. The near term projects are those which contribute to the recovery of coastal Mississippi and can be implemented in the near term without significant engineering, economic, and environmental impacts and controversy. There are 15 near term projects categorized in the following groups. Without implementation of these projects, the recovery of Coastal Mississippi may be impaired or delayed.

3.0 AFFECTED ENVIRONMENT

3.1 Land Use Changes

Over the last several decades, coastal Mississippi has experienced large development and, as a result, the environmental landscape has significantly changed. From 1972 to 1992, Mississippi in the three coastal counties underwent a number of changes. Developed land acreage increased by 37 percent, and natural land cover decreased by 8 percent. Losses in coniferous forest/savanna and emergent wetlands accounted for most of the natural land cover loss. During the same period, impervious surfaces increased by 36 percent. From 1992 to 2000, developed land increased by 11 percent; concurrently, impervious surfaces increased by 16 percent. Between 1992 and 2000, developed land acreage continued to increase, but it increased only two-thirds as much as the population (by 11 percent compared to 17 percent). High-density urban land in the three coastal Mississippi counties, however, increased twice as much as population did between 1992 and 2000. Impervious surfaces increased about 50 percent more than developed land but less than population.

3.2 Coastal Area Population Changes

Population growth in the Mississippi Coastal Region during the past three decades has been characterized by alternating periods of relatively robust growth and stagnation. In the decade spanning the 1970s, for example, the three-county coastal area experienced significant growth, as the population increased by more than 25 percent. During this decade, the coastal area population increased at almost double the growth rate for the State of Mississippi and more than twice that of the United States. In contrast, during the 1980s the coastal area region of influence (ROI) population expanded by only 4 percent. This rate of increase, while exceeding that for the Mississippi, was less than half the growth rate for the United States. The most recent decade, however, has seen a modest rebound in the region's population growth. During that period, the ROI population increased by about 16 percent, compared to about a 13 percent growth for the nation as a whole.

Population growth patterns also have varied within the three counties that comprise the ROI. Jackson County experienced a steep growth in population during the 1970s (34 percent), which was followed by a decade during which population actually decreased. Hancock County, the smallest of the three counties, expanded at a fairly consistent rate during the 30-year period from 1970 to 2000, although the fastest growth in terms of percentage was in the 1970s. Harrison County, the largest of the three counties and accounts for about half of the total ROI population, has experienced relatively slow growth through much of the 30-year period, except in the 1990s. Table 3.2-1 summarizes population trends for each of the ROI counties for the last three decades. Table 3.2-2 provides percentage changes in population for each of the counties presented in Table 3.2-1. Data for Mississippi and the United States are also provided for comparison purposes. As shown in the tables, Mississippi has been characterized by sluggish growth throughout the period, especially during the 1980s, when total state population increased by only 2 percent.

Table 3.2-1.
Coastal Mississippi Population Changes.

Location	1970	1980	1990	2000
Hancock	17,387	24,537	31,760	42,967
Harrison	134,582	157,665	165,365	189,601
Jackson	87,895	118,015	115,243	131,420
Mississippi	2,216,912	2,520,638	2,573,216	2,844,658
Coastal Area - Region of Influence	239,944	300,217	312,368	363,988
USA	203,211,926	226,545,805	248,709,873	281,421,906

Source of 1970, 1980, and 1990 data: US DOC, Census, 1995.
Source of 2000 data: US DOC, Census, 2001a.

Table 3.2-2.
Coastal Mississippi - Population Changes by Percentages.

Location	% Change 1970–1980	% Change 1980–1990	% Change 1990–2000	% Change 1970–2000
Hancock	41.1	29.4	35.3	**47.1**
Harrison	17.2	4.9	14.7	40.9
Jackson	34.1	2.3	14.0	49.4
Mississippi	13.7	2.1	10.5	28.3
Coastal Area Region of Influence	25.1	4.0	16.5	51.7
USA	11.5	9.8	13.2	38.5

3.3 Climate

The coastal area is a humid, warm-temperature to sub-tropical climate. Occasional subfreezing temperatures occur in the area. The Gulf of Mexico greatly influences air temperatures of the coastal counties. During the spring months of March through May, synoptic scale weather systems, highlighted by very active frontal passages, move through the region on an average of every 5 to 7 days. The average temperature is 67° F with a mean minimum of 57° F and a mean maximum of 77° F. The prevailing wind direction is typically east-southeast to southeast at 7 to 13 miles per hour outside of thunderstorms. Passage of frontal systems is significantly reduced during the summer months of June through August. Hot and hazy conditions are normal with an average temperature of 81.7° F while the mean minimum temperature is 72.8° F and the mean maximum is 91.2° F. The prevailing wind direction maintains a southerly component at 4 to 8 knots, outside of thunderstorms. Thunderstorms and rain showers diminish during the September to November time period. The average temperature is 69° F with a mean minimum temperature of 58.5° F and a mean maximum temperature of 78.5° F. A 4 to 7 knot north-northwest prevailing wind is dominant during this period. From December to February, synoptic scale weather systems pass through the region with a northerly prevailing wind direction of 6 to 13 miles per hour. The average temperature is 52° F with a mean minimum of 41.5° F and a mean maximum of 62.1° F. The record low temperature for the region, 5° F, was recorded during this period. Annual rainfall is between 55 and 64 inches per year (USACE 1984).

3.4 Topography

Mississippi lies entirely within two lowland plains. Extending eastward from the Mississippi River, the Mississippi Alluvial Plain, popularly known as the Delta, is very narrow south of Vicksburg but stretches as much as a third of the way across the state farther north. The Gulf Coastal Plain, covering the rest of the state, includes several subregions, of which the Red Clay Hills of north-central Mississippi and the Piney Woods of the south and southeast are the most extensive. Mississippi's generally hilly landscape ascends from sea level at the Gulf of Mexico to reach its maximum elevation, 806 feet, at Woodall Mountain, in the extreme northeastern corner of the state.

Mississippi Sound is 81 miles long, 7 to 15 miles wide and averages 9.9 feet in depth (Eleuterius C. 1976). Its seaward limit is formed by five barrier islands, and on the southwest, between Half Moon (Grand) Island and Isle au Pitre, by marsh island remnants of the St. Bernard subdelta. The five barrier island system is comprised of Cat, East and West Ship, Horn, Petit Bois and Dauphin Island.

3.5 Geology

Coastal Mississippi is situated in the Outer Coastal Plain Mixed Forest Province Ecoregion according to the United States Department of Agriculture's (USDA) *Description of the Ecoregions of the United States* (Bailey et al., 1994). Along the coast, flat coastal plains generally have gentle slopes and local relief of less than 100 feet. Most of the numerous streams in the region are sluggish: marshes, lakes, and swamps.

There are two major physiographic regions in the Mississippi coastal region. The Gulf Coast Flatwoods form an irregular belt through the southern half of the three-county region. This belt consists mainly of wet lowlands and poorly drained depressions, with some higher, adequately-drained areas. The second physiographic region, the Southern Lower Coastal Plain, is rolling and gently undulating interior uplands. Elevations range from sea level along the coast in Hancock, Harrison, and Jackson Counties to about 420 feet above sea level. The slope of the land surface is generally oriented to the south. The area is underlain by a thick sequence of sedimentary deposits dipping to the south and west.

Geologic processes have shaped the present configuration and geomorphology of the Mississippi Gulf coast for the past 1.6 million years, particularly in the past 18,000 years, and efforts of man to stabilize an eroding shoreline with structures and artificial fill. The Biloxi Formation is a transgressive unit deposited in marine and brackish water both nearshore and offshore. This formation is not exposed along the coast, but is visible in the excavated banks of the Industrial Seaway in Gulfport. It consists of clays, fine sands, and sandy clays with abundant fossils, including both shells and microscopic fossils called foraminifers, which help to identify its environment of deposition (Otvos 1985). It ranges from 15 to 45 feet in thickness in Harrison County to as much as 120 feet thick in Jackson County.

The Prairie Formation is the alluvial (river system) equivalent of the marine Biloxi Formation. It was deposited in the river channels and inter-channel swamps, which formed where the rivers met the coastal marine environment. It is composed of primarily sands and muddy sands with fossil tree trunks, leaves, and occasionally pine cones. The Prairie Formation ranges from 15 to 40 feet thick, and is visible in the Industrial Seaway cut in Harrison County.

The Gulfport Formation is the most prominent and probably the most exploited geologic formation on the coast. It is a regressive sand unit deposited during the highest sea level stage of the Pleistocene. It forms the high ridge upon which the cities along the Harrison County coast are built (i.e. Pass Christian – Long Beach – Gulfport – Biloxi). The Gulfport Formation beach ridges probably extended

several miles south from the present shoreline immediately after they were deposited, but subsequent erosion has resulted in their current geographic extent. All sand on the mainland beaches of Mississippi comes indirectly from the Gulfport Formation. Two islands in the Mississippi Sound, Round Island in Jackson County and Deer Island in Harrison County, are remnant Gulfport Formation sand ridges, which were once connected to the ancient mainland (Otvos 1985).

3.6 Sediments

Jackson County is comprised of several major soil types including Troup, Benndale, Harleston, and Atmore. The Troup series consists of well-drained, nearly level to gently sloping soils on uplands. These soils formed in unconsolidated marine sediments of loamy sands, sandy loams, and sandy clay loams. Water permeates through the sandy layers and in the loamy layers. Native vegetation consists of scrub oak, scattered longleaf or loblolly pine, and dogwood. Benndale series consists of well-drained soils on uplands. This series is prevalent in unconsolidated beds of sandy loams and sandy clay loams. Native vegetation consists of mainly longleaf and loblolly pines, dogwood, and various oaks. Harleston series consists of moderately well-drained soils. This series formed in marine or stream deposits consisting of thick beds of sandy loam. This series is prevalent on terraces and uplands of the Southern Coastal Plain. The Atmore series consists of deep, poorly drained, moderately slowly permeable soils that formed in loamy marine sediments. These soils are on slight depressions and gently sloping interstream divides of the coastal plain.

Southern Hancock County is characterized by large areas of hydric or wetland soils. Hydric soils are frequently flooded and/or waterlogged soils. Hydric soils are characterized by thick organic deposits in their upper layer, grayish soils in their subsoils, mottled soils in their lower layers. Anaerobic bacteria, which omit a rotten egg odor, are commonly found within the hydric soils. Sediment sampling revealed soils that consist of very peaty sediment up to approximately 4.5 feet thick and occur as channel-fill deposits near the Pleistocene mainland and blanket deposits between the levees of some of the larger tidal creeks.

Harrison County is dominated by the following soils:

- Eustis loam sand, 0 to 5 percent slopes (hydric inclusions)
- Lakeland fine sand (not hydric)
- Sulfaquepts (hydric inclusions)
- Poarch fine sandy loam, 2 to 5 percent slope (hydric inclusions)
- Atmore silt loam (hydric)
- Latonia loamy sand (hydric inclusions)
- Harleson fine sandy loam, 0 to 2 percent slopes (hydric inclusions)

3.7 Surface Water

Surface waters in coastal Mississippi primarily support recreation activities, commercial fishing and shellfish, wildlife and fish, and industrial use. Surface water quality generally supports the intended uses.

The urban characteristics of some of the watershed cause some use impairments. The Turkey Creek and Pascagoula River Basins have impaired waters. Heavy industries surrounding the Pascagoula Basin area contribute municipal and industrial discharges to surface waters. In addition, agricultural and forestry activities, mining, and waste management also contribute to the degraded water quality in the area. Increasing beach closures between 1999 and 2001 due to high measured in-stream fecal coliform concentrations have been noted. Principal causes of water quality problems

in the Pascagoula River Basin identified in the 2000 Section 305(b) Report are excessive concentrations of metals (mercury), pathogens, and low dissolved oxygen (DO) from non-point source pollution.

Temperatures of the nearshore surface water of the northern Gulf of Mexico closely imitate air temperatures. Records of water temperatures in the study area range from about 38.1° to 97.7°F. Extreme temperatures vary considerably from year to year but averages reach about the same highs and lows in August and January or February. The system is well mixed throughout the water column except within the navigation channels. Salinity is highly variable in the Sound. Salinity in the nearshore Gulf of Mexico is more oceanic in nature ranging from about 29 to 35 parts per thousand. DO levels in the area are usually above lethal levels. However, the State of Mississippi has recognized problems existing on the Escatawpa River near Moss Point by reducing the DO standard from 5.0 milligrams per liter (mg/l) to 3.0 mg/l (USACE 1984). The pH values range from 4.4 to 7.8.

3.8 Flora

Coastal Mississippi is in the Temperate Deciduous Forest Biome (Eleuterius 1998). Hancock, Harrison, Jackson counties are in the Coastal Pine Meadows physiographic region, sometimes referred to as the Coastal Terraces. Hot summers, mild winters, and abundant rainfall (usually 40 to 60 inches per year) falling mostly during the spring and summer months support a diverse assemblage of herbaceous plants, shrubs, and trees (Eleuterius 1998). Delineating geographic boundaries of forest types and natural communities is made difficult due to natural variation and is of limited utility for planning purposes except on a very small scale (for example, on-site wetland delineation to protect wetlands).

Upland deciduous forests occur in generally cool and moist areas, and they burn much less frequently than pine forests or mixed forests. Deciduous forests can be found on upper river terraces, slopes, and coves, and infrequently on flooded stream bottoms. Some deciduous forests support tree species that are in the extreme southern portions of their ranges. Scattered pockets of forest dominated by American beech (*Fagus grandifolia*) and southern magnolia (*Magnolia grandiflora*) are thought to be relicts of Pleistocene ice age conditions in the East Gulf Coastal Plain, and they contain many species found in northern forests in addition to species endemic to southern Mississippi. Oaks (*Quercus* spp.), maples (*Acer* spp.), blueberry shrubs (*Vaccinium* spp.), greenbriar vines (*Smilax* spp.), and many spring wildflower species are common in beech and magnolia forest communities (Natureserve Explorer 2002).

Seepage areas in pine-dominated uplands also can support deciduous forest. The tree canopy in these areas is variable with tulip poplar (*Liriodendron tulipifera*), swamp black gum (*Nyssa biflora*), and southern magnolia (*Magnolia virginiana*) in the overstory, but sweetgum (*Liquidambar styraciflua*), loblolly pine (*Pinus taeda*), and red maple (*Acer rubrum*) can make up a significant portion of the canopy. Seepage areas often have well-developed shrub and herbaceous layers (Natureserve Explorer 2002).

Oak forests are often found on moist slopes in the East Gulf Coastal Plain. Tree species often dominant in the canopy are white oak (*Quercus alba*), water oak (*Quercus nigra*), laurel oak (*Quercus hemisphaerica*), tulip poplar, sand hickory (*Carya pallida*), white ash (*Fraxinus americana*), and American elm (*Ulmus americana*) (Natureserve Explorer 2002). Shade-tolerant species persist as medium and small trees in the mid-story. Magnolias (*Magnolia* spp.), American beech, paw paw (*Asimina triloba*), American holly (*Ilex opaca*), and flowering dogwood (*Cornus florida*) are often found in oak forests. Shrubs and woody vines are numerous. Woody vines represented are grapevine (*Vitis rotundifolia*), Virginia creeper (*Parthenocissus quinquefolia*), poison ivy

(*Toxicodendron radicans*), greenbriar, and cross-vine (*Bignonia capreolata*). Herbaceous vegetation is usually sparse and not well developed.

Upland mixed forests are mostly mid-successional secondary forests found on drier sites that have been subject to timber harvest and fire suppression. The canopy is a mix of loblolly pine (*Pinus taeda*) and assorted hardwoods, such as southern red oak (*Quercus falcata*), white oak, post oak (*Quercus stellata*), and black oak (*Quercus velutina*). Small trees are well represented in this forest type. Flowering dogwood, hop-hornbeam (*Ostrya virginiana*), black cherry (*Prunus serotina*), winged elm (*Ulmus alata*), and sourwood (*Oxydendrum arboreum*) are commonly observed. Shrubs include witch hazel (*Hamamelis virginiana*), wax myrtle (*Myrica cerifera*), and blueberry. Grapevine and longleaf spikegrass (*Chasmanthium sessiliflorum)* are often dominant in the understory (Natureserve Explorer 2002).

Slash pine (*Pinus elliottii*) upland flatwoods are found on barrier islands and also in mainland locations very near the water. Most remaining examples of this community are considered threatened by fragmentation, development, and fire suppression (Natureserve Explorer 2002). The canopy varies from open to closed, and may support a mix of slash pine and longleaf pine (*Pinus palustris*). Live oak (*Quercus virginiana*), sand live oak (*Quercus geminata*), laurel oak (*Quercus hemisphaerica*) are common in the subcanopy. Typical understory species are similar to those found in coastal shrublands and include yaupon (*Ilex vomitoria*), saw palmetto (*Serenoa repens*), wax myrtle (*Myrica cerifera*), greenbriar, blueberry, and grapevine.

Dry longleaf pine sandhill woodland is found on well-drained sandy soils. Lakeland soils often support dry longleaf pine forests. Fire suppression, development, and conversion to pine plantation have degraded or destroyed most of this forest type in the Southeast (Natureserve Explorer 2002). In the presence of prescribed fire or natural wildfires, longleaf pine covers from 10 to 30 percent of the overstory. The size and density of understory oaks, such as turkey oak (*Quercus laevis*), blue-jack oak (*Quercus incana*), sand live oak, and sand post oak (*Quercus margaretta*), are variable and would be expected to depend on the effects of periodic fires. Herbaceous species include little bluestem (*Schizachyrium scoparium*), three-awn grass (*Aristida* spp.), and broom snoutbean (*Rhynchosia cytisoides*).

Areas with wetter soil conditions can support forests dominated by longleaf pine and southern red oak. This forest type occurs on somewhat poorly drained to well-drained loamy soils with clay layers in the B horizon, such as Benndale, Cahaba, Smithdale, Petal, and Susquehanna. Species more common in wetlands can occur in patches where clay content in the soil is high. Longleaf pine is the canopy dominant. Beneath the pine canopy, some hardwoods can be co-dominant in the canopy depending on the frequency and intensity of the fire regime. Hardwood trees can include southern red oak, water oak, flowering dogwood, black gum (*Nyssa sylvatica*), and red bay (*Persea borbonia*). Shrubs are blueberries, hollies (*Ilex* spp.), wax myrtle, and horse sugar (*Symplocos tinctoria*). The herbaceous layer is very diverse and often well developed with grasses (*Aristida* spp., *Schizachyrium* sp.), forbs, sunflowers (Asteraceae), and meadow-beauty (*Rhexia alifanus*) (Natureserve Explorer 2002).

Wet scrub-shrub plant communities include shrublands dominated by black willow (*Salix nigra*) and buttonbush. This plant community type is found on the wet shorelines of lakes and ponds, particularly reservoirs and farm ponds, and is dominated by fast-growing species such as black willow, sweetgum, and red maple (*Acer rubrum*). The shrub layer features dense, almost pure stands of buttonbush and little else (Natureserve Explorer 2002).

Gulf Coast barrier islands and barrier spits can support stunted oak and yaupon shrublands. These scrub-scrub habitats are most often located on rises surrounded by black needlerush (*Juncus roemarianus*) salt marshes and have been reported from the Gulf Islands National Seashore (Natureserve Explorer 2002). Stunted slash pine may be present in the overstory, but most cover will

be in a shrub layer dominated by yaupon, live oak, sand live oak, wax myrtle, saw palmetto, and salt bush (*Baccharis halimifolia*).

One common wetland shrub community is the black titi (*Cliftonia monophylla*)–shining fetterbush (*Lyonia lucida*)–blaspheme-vine (*Smilax laurifolia*) shrubland. This shrub community occurs in wetlands larger than 741 acres that remain flooded for extensive periods of time (Natureserve Explorer 2002). Peat soils between 1 to 2 meters deep form in these shrublands. Black titi is the dominant shrub, but occasional longleaf or slash pine trees may be present, especially in transition zones. Herbaceous cover is patchy and not well developed. Herb species might include pitcher plants (*Sarracenia* spp.), bladderwort (*Utricularia* sp.), and beakrush (*Rhynchospora* sp.). Peat moss is common in the ground layer and is an important component of peat soils. Fire is not common in this community, although shrublands are probably more common because of logging and fire suppression in recent years (Natureserve Explorer 2002).

Upland areas that have been cutover or burned are identified by remote sensing as having been recently subject to removal of vegetation because of timber harvest or wildfire. Under normal conditions, these areas would be expected to undergo succession from herbaceous and shrub species to mature forest as the landscape naturally revegetates or is manually replanted.

These areas have been identified as having significant amounts of exposed mineral soil. Naturally occurring beaches are common near the coast and may support some dune grasses and scattered small shrubs. Disturbed areas in inland habitats not yet supporting vegetative cover might also appear as this land use type.

Bottomland hardwoods are tree species that grow vigorously in frequently flooded and saturated soils. Swamps are wetlands in which large and medium-sized trees are dominant. Away from the coast, extensive areas of bottomland hardwoods are found along the Pearl and Pascagoula Rivers.

Water tupelo (*Nyssa aquatica*)–swamp blackgum forests are found in swamps and floodplains. Bald cypress (*Taxodium distichum*) can also be present, but it seldom occupies more than 25 percent of the canopy (Natureserve Explorer 2002). Other tree species are green ash (*Fraxinus pennsylvanica*), black willow, and ironwood (*Carpinus caroliniana*). These swamp forests are submerged at least several months of the year. Shrubs and herbs are not common. Fetterbush (*Leucothoe racemosa*) and titi are sometimes present in the shrub layer Lizard's tail, poison ivy, crossvine, planer tree (*Planera aquatica*), and pepper-vine (*Ampelopsis arborea*) are found in the ground layer.

Smaller patches of bottomland hardwood forest occur in swampy habitats along small, seepage-fed streams. Swamp blackgum-sweetbay (*Magnolia virginiana*)–bayberry (*Morella* spp.) communities dominate dense swamp forests in these habitats. Slash pine may be present, although it has often been removed by timber harvest. Canopy species often include red maple, sweetgum, tulip poplar, and loblolly pine. Shrubs are fetterbush (*Lyonia lucida*), titi (*Cyrilla racemiflora*), and pepperbush. The herbaceous layer is scattered and features clumps of ferns (*Osmunda* spp. and *Woodwardia* spp.). Other herbaceous species are sedges (*Carex* spp.), beakrushes, and lizard's tail. The endangered plant species Louisiana quillwort (*Isoetes louisianensis*) is known from this plant community (Natureserve Explorer 2002).

The canopy of this wet pine savannah plant community contains longleaf pine and slash pine. The shrub stratum features clumps of gallberry (*Ilex glabra*) or other wetland shrub species. The ground layer is dominated by a well-developed community of diverse carnivorous plants such as pitcher plants (*Sarracenia alata*, *Sarracenia psittacina*) and sundews (*Drosera* sp.) that trap and digest insects to obtain nutrition not otherwise available in highly acidic wetland soils. Because pitcher plant bogs are generally found in wet pine savannahs, the names are used somewhat interchangeably. Other plants known from this community are toothache grass (*Ctenium aromaticum*), beakrush

(*Rhynchospora chapmanii*), gulf chaffhead (*Carphephorus pseudoliatris*), numerous sunflowers (Asteraceae), milkworts (*Polygala* spp.), forbs, and sedges. (Natureserve Explorer 2002). The Mississippi sandhill crane is found in this habitat type in its wildlife refuge in coastal Jackson County.

Wetlands lacking trees or dominant woody vegetation are frequently called marshes. Marshes are dominated by emergent vegetation, which is herbaceous vegetation that grows above the waterline most of the year. Freshwater marshes are found in the lower portions of river systems, usually between forested wetlands and deepwater habitats. Spikerushes (*Eleocharis* spp.), bullrushes (*Scirpus* spp.), sedges, wild rice (*Zizania aquatica*), lizard's tail, marsh fleabane (*Pluchea purpurascens*), and knotweeds (*Polygonum* spp.) are found there (Eleuterius 1998). Marshes studied by Eleuterius (1973) "showed a progressive increase in vascular plants from saline to freshwater."

Intermediate and brackish marshes are found in tidal areas with higher concentrations of salt. Saltwater concentrations vary over the course of the year. Brackish marshes have higher salt concentrations than intermediate marshes. In the brackish zone there is some overlap between species characteristic of freshwater and saltwater marshes, although some plants are found in this zone exclusively (Eleuterius 1998). These plants include black needlerush (*Juncus roemerianus*), common reed (*Phragmities communis*), sawgrass (*Cladium jamaicense*), knotweed (*Sagittaria lancifolia*), and cordgrass (*Spartina patens*, *Spartina alterniflora*). The most common tidal marsh in coastal Mississippi consists of extensive stands of black needlerush (MDMR 1998a).

Salt marsh (saline marsh) is found in areas with nearly full-concentration seawater. These marshes have black needlerush, various cordgrass species, sea lavender (*Limonium carolinianum*), and salt marsh aster (*Aster tenuifolius*). Hypersaline salt flats have only the most salt-tolerant vegetation. Annual glasswort (*Salicornia bigelovii*), sea blites (*Suaeda linearis*), and saltwort (*Batis maritimus*) are known from these areas.

High turbidity and lack of suitable substrate have limited distribution of submerged aquatic vegetation (SAV) in Mississippi. SAVs have been restricted to relatively quiet waters along the mainland and barrier island shores. Isolated patches occur only several hundred acres in size north of Horn and Petit Bois Islands. Freshwater SAVs are found along the edge and bottom of the river tributaries of Mississippi; however, these SAVs are more abundant in more inland portions of the estuarine areas. In turbid waters of the Sound, seagrass beds are typically found in shallow water less than six feet in depth, most in two or less. With the exception of shoal grass (*Halodule wrightii*), which grows on hard sand bottoms, the species characteristic of Mississippi Sound area prefer soft muddy substrates. A study of the Mississippi portion of Mississippi Sound by Eleuterius in 1969 indicated that about 20,000 acres of SAVs were present including turtle grass (*Thalassia testudinum*), manatee grass (*Cymodocea manatorum*), shoal grass, *Halophilia engelmanni* (no common name), and widgeon grass (*Ruppia maritima*). In 1969, Hurricane Camille destroyed the majority of SAVs along the Mississippi Gulf coast (Eleuterius 1973). Moncreiff et al. (1998) identified the northern shorelines of Ship, Horn, and Petit Bois Islands as potential habitat for seagrass beds. These areas have historically supported populations of shoal grass, *Halophila engelmannii*, manatee grass, and turtle grass. Currently, these locations only appear to support beds of shoal grass. Seagrass beds were also identified in the Grand Batture area south of the marshes in eastern Jackson County and along the Mississippi-Alabama border. In areas where SAVs are present, significant quantities of benthic and epibenthic macroalgae are found, such as red, brown, and green species.

3.9 Fauna

Many species of invertebrates and vertebrates make up the various fauna population along the Gulf coast. Invertebrate populations in Mississippi Sound and the nearshore area of the Gulf of Mexico transfer energy through the coastal food web. Microscopic estuarine zooplankton live throughout the water column with limited mobility. Larval stages of benthic forms and eggs and larval stages of many fish species are often interspersed throughout zooplankton. Many important commercial species feed upon zooplankton.

Vittor and Associates (1982) investigated the macrofauna of Mississippi Sound and selected areas in the Gulf of Mexico. Over 532 taxa from offshore Mississippi and Alabama and 437 taxa from the Mississippi Sound were identified. Densities of individuals varied from 910 to 19,536 individual/ yard^2 for the offshore and 1,200 and 38,863 individual/ yard^2 for the Sound area. Abundance of macrofauna is temporal with greatest densities occurring from fall to spring.

Oyster production in Mississippi depends on public reefs managed by the Mississippi Department of Marine Resources (MDMR). The State of Mississippi accounts for about 13% to 17% of Gulf oyster landings. Reefs are located along the coast across the entire state with the largest reefs near the western boundary. According to a 1966 survey by W.J. Demoran, there were 9,934 acres of oysters. At that time, there were 582 acres of planted oyster beds. Additional acreage has been planted. A few small areas of oyster bottom have been leased for private development; however, production from these areas has been negligible. There have been considerable annual variations in size of productive areas due to natural environmental fluctuations, such as freshwater flow into the oyster beds. Many of Jackson County's most productive areas have been closed to harvest due to increased pollution associated with coastal development.

Many commercially important species of crustaceans are harvested in Mississippi Sound and the nearshore of the Gulf of Mexico. Brown shrimp (*Penaeus aztecus*) is the main shrimp species harvested by commercial fishermen in the Gulf of Mexico and is the most important commercial species in the Mississippi Sound and Mobile Bay area. White shrimp and blue crab are also harvested within the study area. In addition to those commercial species, there is a very diverse community of crustaceans within Mississippi Sound and adjacent waters including a wide variety of forms and habitat preferences. Epibenthic crustaceans dominate the diet of flounder, catfish, croaker, porgy, and drum.

Christmas and Waller (1973) reported 138 fish species in 98 genera and 52 families taken from areas across Mississippi Sound. The major fisheries landed along the Mississippi Gulf coast are anchovies, menhaden, mullet, croakers, shrimp, and oyster. Jackson County, primarily the ports of Pascagoula and Moss Point, receives greater than 85% of all Mississippi landings, including all industrial fish (menhaden), 95% of the mullet, trout, and red snapper, and 74% of the croaker landed (Corps 1992).

Coastal wetlands of Mississippi Sound, St. Louis Bay, Biloxi Bay, Pascagoula Bay, and the tidal Pascagoula River provide the resource base for commercial and marine recreational fishing and tourism in Mississippi. The dockside value of commercial fish landings in Mississippi was almost $42 million in 1995. Recreational fisheries also play an important role in the state's economy. In 1991, 500,000 people spent more than $236 million fishing in Mississippi's waters, generating almost $14 million in state sales tax, resulting in $131 million in earnings, and supporting more than 8,000 jobs. Approximately one-quarter of the recreational fishing occurs in coastal waters. Communities such as Moss Point, Pascagoula, Gautier, Ocean Springs, Biloxi, Long Beach, Gulfport, Pass Christian and Bay St. Louis all depend on fishing to support their local economies (NMFS, 2002).

Coastal Mississippi supports an array of reptiles, amphibians, birds, and mammals. Reptiles and amphibians found in the area include snakes, turtles, lizards, toads, frogs, salamanders, and crocodilians. Coastal Alabama and Mississippi have a great diversity of reptiles including 23 species of turtles, 10 species of lizards, 39 species of snakes, and the alligator. Eighteen species of salamanders and 22 species of frogs and toads are indigenous to the coastal region.

Mammals found within the area include marsupials, moles and shrews, bats, armadillos, rabbits, rodents, carnivores, even-toed hoofed mammals, and dolphins. Mammals occur within all habitats of the system, using underground burrows, the soil surface, vegetative strata, the air, and the water for feeding, resting, breeding, and bearing and rearing young. There are 57 species of mammals found in the area. Several species of mammals include the raccoon, river otter, gray fox, striped skunk, mink, whitetailed deer, bottlenose dolphin, beaver, possum, and nine-banded armadillo. A number of whales are known to occur offshore Mississippi and Alabama and occasionally are sighted within the Mississippi Sound.

Over 300 species of birds have been reported as migratory or permanent residents within the area, several of which breed there as well. Shorebirds include osprey, great blue heron, great egret, piping plover, sandpiper, gulls, brown and white pelicans, American oystercatcher, and terns. Birds of the area eat a great variety of foods, are also food to many predators, and exhibit a diversity of nesting behaviors.

3.10 Endangered and Threatened (T&E) Species

The Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531-1543), as amended, establishes a national policy designed to protect and conserve T&E species and the ecosystems upon which they depend. The Department of Interior [referring to the U.S. Fish and Wildlife Service (USFWS)] and the Department of Commerce [referring to the National Oceanic and Atmospheric Administration (NOAA) Fisheries] administer the ESA. The USFWS has cognizance over terrestrial and freshwater organisms, while NOAA Fisheries is primarily responsible for marine species. All Federal agencies are required to protect T&E species while carrying out projects and to preserve T&E species habitats on Federal land.

Coastal Mississippi is home to 20 federally listed T&E or candidate species, including four taxa found nowhere else in the world. Federally listed species known to occur within the project area are listed in Table 3.10-1. NOAA Fisheries also lists the blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), sei whale (*Balaenoptera borealis*), sperm whale (*Physeter macrocephalus*), green sea turtle (*Chelonia mydas*), hawksbill sea turtle (*Eretmochelys imbricata*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), loggerhead sea turtle (*Caretta caretta*), and the Gulf sturgeon (*Acipenser oxyrinchus*).

Table 3.10-1.
Federally Listed Rare, Threatened, and Endangered Species

Common Name	Scientific Name	Status	County	Habitat
Inflated heelsplitter	*Potamilus inflatus*	LT	Hancock	Submerged freshwater reaches
Bald eagle	*Haliaeetus leucocephalus*	LT	Hancock, Harrison, Jackson	Shorelines near open water
Black pine snake	*Pituophis melanoleucus ssp. lodingi*	C	Harrison,	Fire-dependent, upland longleaf pine forests
Brown pelican	*Pelecanus occidentalis*	LE	Hancock, Harrison, Jackson	Feeds over water in coastal areas, nests on small islands.
Eastern indigo snake	*Drymarchon corais couperi*	LT	Harrison, Jackson	Fire-dependent, upland longleaf pine forests
Gopher tortoise	*Gopherus polyphemus*	LT	Hancock, Harrison, Jackson	Fire-dependent, upland longleaf pine forests
Green sea turtle	*Chelonia mydas*	LT	Hancock, Harrison	Shallow coastal waters with SAV and algae, nests on open beaches.
Gulf sturgeon,	*Acipenser oxyrhynchus desotoi*	LT	Hancock, Harrison, Jackson	Migrates from large coastal rivers to coastal bays and estuaries
Kemp's ridley sea turtle	*Lepidochelys kempii*	LE	Hancock, Harrison, Jackson	Nearshore and inshore coastal waters, often in salt marshes
Loggerhead sea turtle	*Caretta caretta*	LT	Hancock, Harrison, Jackson	Open ocean; also inshore areas, bays, salt marshes, ship channels, and mouths of large rivers
Louisiana black bear	*Ursus americanus luteolus*	LT	Hancock, Harrison, Jackson	Bottomland hardwood forest; frequently ranges into other habitats
Louisiana quillwort	*Isoetes louisianensis*	LE	Hancock, Harrison, Jackson	Small blackwater streams with sand and gravel substrate and forest cover
Mississippi gopher frog (proposal under review)	*Rana capito sevosa*	PE	Harrison	Fire-dependent, upland longleaf pine forests; open, ephemeral upland pools
Mississippi sandhill crane	*Grus canadensis pulla*	LE	Jackson	Wet pine savannah
Pearl darter (Pascagoula River System)	*Percina aurora*	C	Jackson	Rivers and large creeks with sand and gravel bottoms and flowing water.
Piping Plover	*Charadrius melodus*	LT	Hancock, Harrison, Jackson	Barrier islands and coastal beaches
Red-cockaded woodpecker	*Picoides borealis*	LE	Harrison, Jackson	Fire-dependent, upland longleaf pine forests
Yellow-blotched map turtle	*Graptemys flavimaculata*	LT	Jackson	Rivers and large creeks with habitat suitable for basking

LT = listed threatened, LE = listed endangered, C = candidate for listing, PE = proposed endangered
Source: Mann, 2000.

The threatened inflated heelsplitter has an oval, compressed to moderately inflated, thin shell freshwater mussel (mollusk). The valves may gape anteriorly, the umbos are low, and there is a prominent posterior wing that may extend anteriorly to the beaks in young individuals. The shell is brown to black and may have green rays in young individuals. The umbonal cavity is very shallow and the inside of the shell is pink to purple. Shell length reaches 5 and one-half inches in adults (Stern 1976). The inflated heelsplitter was known historically from the Amite and Tangipahoa Rivers, Louisiana; the Pearl River, Mississippi; and the Tombigbee, Black Warrior, Alabama, and Coosa Rivers, Alabama (Hurd 1974; Stern 1976; Hartfield 1989.). The presently known distribution is limited to the Amite River, Louisiana, and the Tombigbee and Black Warrior Rivers, Alabama (Stern 1976; Hartfield 1989.). The preferred habitat of this species is soft, stable substrate in slow to moderate currents (Stern 1976). It is usually collected on the protected side of bars and may occur in depths over 20 feet. The occurrence of this species in silt may be because it was established prior to deposition of the silt.

The threatened bald eagle is a familiar bird of prey with a wingspan of 6 to 7 feet. Adult birds feature a black body with a distinctive white head and tail, while juvenile birds are mostly brown with lighter patches on the wings and tail. The bald eagle's primary food is fish, but it will also feed opportunistically on rodents, birds, and carrion. Bald eagles nest in trees near large bodies of water. Some nests are used year after year. Bald eagles are known throughout most of the United States and Canada. Bald eagles have been observed in Back Bay of Biloxi and St. Louis Bay on the Mississippi Gulf Coast (Mann 2000). The bald eagle is currently listed by the USFWS as threatened and has been proposed for delisting. Before it was banned in the United States, the pesticide DDT was responsible for weakening the shells of eagle eggs and dramatically reducing reproductive success for the species. In recent years, the bald eagle population has rebounded in the lower 48 states. Bald eagles are vulnerable to human disturbance while nesting and rearing young.

The candidate species black pine snake is one of 15 subspecies of a widespread snake species commonly called bullsnake or gopher snake. This non-venomous snake with black or dark brown scales and a reddish or white snout can grow up to 8.3 feet in length (Jordan 1998). Black pine snakes feed on small mammals, but will also take other vertebrates, such as birds, lizards and other snakes. The black pine snake was once known in longleaf pine forests from extreme southeastern Louisiana, east to southern Mississippi, to extreme southwestern Alabama (Jordan 1998). Recent surveys have found the highest concentration of black pine snakes in DeSoto National Forest in Mississippi, including habitat in Harrison County (USFWS 2001b). The snakes are known from eight other Mississippi counties and three counties in Alabama. Black pine snake is believed to be extirpated from Louisiana (Natureserve 2001a), and has been listed as a candidate for protection under the ESA.

The endangered brown pelican is a large brown and gray seabird with a characteristic long bill attached to an expandable pouch used for capturing prey. Brown pelicans can reach up to 8 pounds and have wingspans of more than 7 feet (USFWS 2001c). These birds are known from marine environments in coastal areas of the United States; they feed by diving for small fish. Breeding pairs use small coastal islands for nesting, building nests in trees or on the ground. The brown pelican suffered dramatic population losses during the middle of the 20th century because DDT poisoning impaired reproductive success. Since DDT use was banned in the United States, brown pelican populations have increased or stabilized. In the Southeastern United States, the brown pelican is considered endangered only in Mississippi and Louisiana (USFWS 2001c). Threats to brown pelicans include disturbance of nesting colonies, entanglement in fishing gear, oil and toxic chemical spills, severe storms, heavy tick infestations, and unpredictable food availability (USFWS 2001c).

The threatened Eastern indigo snake is a large constrictor, usually 5 to 7 feet in length, with a heavy black body and red or orange on the chin and throat. This snake actively forages along wetland edges to feed on rodents, birds, reptiles, and amphibians. In coastal Mississippi, Eastern indigo

snakes prefer high, dry, mature pinelands dominated by longleaf pine (*Pinus palustris*), wiregrass (*Aristida stricta*), and turkey oak (*Quercus laevis*). They are often found in association with gopher tortoise, using gopher tortoise burrows for shelter. The species is most abundant in peninsular Florida and south Georgia, although scattered populations persist in coastal Mississippi, Alabama, the Florida panhandle, and coastal South Carolina (Natureserve 2001b). Species decline is thought to be directly related to the loss of mature longleaf pine forest in the Southeast coastal plain. The decline in the Eastern indigo snake may also be related to the decline in the gopher tortoise. Fewer gopher tortoises create fewer burrows, reducing shelter for the Eastern indigo snake as well as many other vertebrates and invertebrates.

The threatened gopher tortoise is a terrestrial turtle with a carapace (top shell) length between 15 to 37 cm (USFWS 1990a). The carapace is dark brown to gray-black, and often worn smooth from moving through the deep burrows it digs for shelter. The gopher tortoise is found in the southeastern coastal plain from Louisiana to South Carolina, although it is rare and scattered throughout its range. Gopher tortoises can live for several decades. Depending on habitat quality, it may take between 10 and 20 years for tortoises to become sexually mature. Egg laying and nesting takes place in the spring months. Clutch size is usually between 5 and 9 eggs. Nest predation is high, with roughly 90 percent of gopher tortoise nests destroyed by predators such as raccoons, armadillos, and opossums. Predation on hatchling tortoises is also very high. Research indicates that hatchling mortality rates of more than 90 percent are not unusual (Natureserve 2001c).

Gopher tortoises are found in a variety of upland habitats. The best tortoise habitat consists of open upland woodlands with well-drained sandy soils suitable for easy burrowing. An open tree canopy lets in sunlight necessary for the growth of grasses and herbaceous plants on which the gopher tortoise feeds (USFWS 1990a). Sunlight is thought to be necessary for tortoise basking thermoregulation, and also for egg incubation while nesting (Natureserve 2001c). Periodic low-intensity fires have been observed to be beneficial to maintaining gopher tortoise habitat. In the western part of its range, including Mississippi, gopher tortoises inhabit xeric longleaf pine-scrub oak forests located on sand ridges. They may also found on the edges of crop fields, in pastures, and power line right-of-ways (USFWS 1990a).

Threatened green sea turtles range throughout the Atlantic, Pacific, and Indian Oceans, primarily in tropical regions and shallow waters (except during migration), inside reefs, bays, and inlets. The green sea turtles are attracted to lagoons and shoals with abundant marine grass and algae on which the turtles feed. Green sea turtles have been observed in the Mississippi Sound. In fact, a juvenile green sea turtle was captured in the mouth of Back Bay of Biloxi several years ago (Mann 2000; Mann T. 2003. Personal comm.). The turtles are not known to nest on the Mississippi coast or barrier islands, but might be attracted to seagrass beds as a food source in nearshore waters (Gunter 1981). Exploitation of green sea turtle nesting grounds either by human interference or pollution poses the greatest threat to these turtles. The greatest cause of decline in green turtle populations is commercial harvest for eggs and food in nesting areas outside the United States. Incidental catch during commercial shrimp trawling is a continuing source of mortality that adversely affects recovery in North America (NMFS 2001). Today, turtle excluder devices (TEDs) pulled by shrimp boats help reduce mortality from net entanglement.

The threatened Gulf sturgeon, considered a subspecies of the Atlantic sturgeon, is an anadromous fish, migrating from saltwater into large coastal rivers. Historically, the Gulf sturgeon occurred in rivers from the Mississippi River to the Suwanee River, and in bays and estuaries from Florida to Louisiana. Little is known about current population levels outside the Suwanee, Apalachicola and Pearl Rivers, but they are thought to have declined from historic levels (USACE 2000).

Adult fish spend 8 to 9 months each year in rivers and 3 to 4 of the coolest months in estuarine Gulf rivers. Adult fish tend to congregate in deeper waters of rivers with moderate currents and sandy and

rocky bottoms. Seagrass beds with mud and sand substrates appear to be important marine habitats (Mason and Clugston 1993). The adult Gulf sturgeon is known to spend the fall and winter months in the estuary of the Mississippi Sound and migration routes extend from the Sound to the Back Bay of Biloxi. Occurrences of the Gulf sturgeon have been documented by the Mississippi Natural Heritage Program (MSNHP) database within the Mississippi Sound, Biloxi River, and Pascagoula River area. The Gulf sturgeon is known to spawn in the Pearl River system. Major threats to this rare, primitive species include physical barriers (e.g., locks and dams) to spawning grounds, habitat loss, and poor water quality.

On March 19, 2003, USFWS and NOAA Fisheries designated 14 geographic areas among the Gulf of Mexico rivers and tributaries as critical habitat for the Gulf sturgeon (FR Vol. 68, No. 53). These 14 geographic areas encompass approximately 2,783 river kilometers (1,739 river miles) and 6,042 square kilometers (2,333 square miles) of estuarine and marine habitat. In Mississippi, the critical habitat includes 632 kilometers of the Pearl River, including Bogue Chitto, and 203 kilometers of the Pascagoula River, including the Leaf, Bouie, Chickasawhay, and Big Black Creek tributaries (FR Vol. 68, No. 53).

The endangered Kemp's ridley sea turtle population has declined since 1947 (when an estimated 42,000 females nested in one day) to a nesting population of approximately 1,000 in the mid-1980s. The decline of this species was primarily due to human activities including collection of eggs, fishing for juveniles and adults, killing adults for meat and other products, and direct take for indigenous use. In addition to these sources of mortality, Kemp's ridley turtles have been subject to high levels of incidental take by shrimp trawlers. Kemp's ridley turtles are occasionally caught on fishing hooks and incidentally injured by recreational anglers and boaters (Mann, personal communication 2003). Today, under strict protection, the population appears to be in the earliest stages of recovery. The increase can be attributed to two primary factors: full protection of nesting females and their nests in Mexico, and the requirement to use TEDs in shrimp trawls both in the United States and Mexico (NMFS 2001). The major habitat for Kemp's ridley sea turtle is the nearshore and inshore waters of the northern Gulf of Mexico, especially Louisiana waters outside of the nesting season.

The threatened loggerhead sea turtle is widely distributed throughout its range and may be found hundreds of miles out to sea as well as in inshore areas such as bays, lagoons, salt marshes, creeks, ship channels, and the mouths of large rivers (USACE 2000). Loggerheads are seen annually inshore in the Mississippi Sound, but are more commonly seen offshore in the proximity of oil rigs (Mann, personal communication 2003). Most recent evidence suggests that the number of nesting females in South Carolina and Georgia may be declining, while the number of nesting females in Florida appears to be stable. Until the 1970s, loggerhead turtles were commercially harvested for their meat, eggs, leather, and fat. Because of their feeding behavior and their habit of wintering in shallow waters, loggerheads, along with Kemp's ridley sea turtles, are more likely to be caught in large shrimp trawl nets and drown. Today, TEDs pulled by shrimp boats help reduce mortality from net entanglement by allowing turtles to escape from the nets. However, loggerhead turtles are hooked by recreational fishermen offshore near oil rigs and are frequently injured by being struck by boats and boat propellers (Mann, personal communication 2003). As of 1981, there was no record of loggerhead turtles nesting in Mississippi, although a small group of these turtles were seen swimming off the western end of Horn Island in 1976. MS Heritage Program data includes a record for loggerhead turtle southeast of Deer Island (Mann 2000). Loggerheads are know to nest annually in small numbers on the Gulf Island National Seashore in Mississippi, with one nest being documented on the mainland beach and one nest several years ago on Round Island (Mann, personal communication 2003).

The threatened Louisiana black bear is one of 16 subspecies of American black bear. Black bears are large, bulky mammals that can grow to more than 600 pounds. The Louisiana black bear differs from other subspecies by having a longer, narrower skull and larger molar teeth (USFWS 1995).

Louisiana black bears typically inhabit bottomland hardwood forests, but may also use other habitat types, especially when food is available. Bottomland hardwood forests feature the food sources and denning sites that are necessary for successful bear reproduction. Large hollow trees common in swamps provide ideal dens for winter hibernation and birthing young. Bottomland hardwood forests along lower Pearl River and lower Pascagoula River have suitable habitat that might be occupied by Louisiana black bears (USFWS 1995). There has been at least one confirmed sighting of a female with cubs in Mississippi, and USFWS monitoring data indicate that females will cross the Mississippi River from Louisiana to Mississippi (Rummel 2002).

Habitat loss is thought to be the primary threat to the survival of the Louisiana black bear. Former bear habitat had been reduced by 80 percent within its historic range by 1980 (USFWS 1995). Remaining bear habitat has been fragmented and degraded; degraded habitats often do not provide sufficient food for bears.

The endangered Louisiana quillwort is a primitive seedless wetland plant with a grass-like appearance, although it is actually more closely related to ferns. It has many simple, hollow leaves 2 to 3 mm wide and up to 40 cm long. Quillworts reproduce by producing spores in special structures embedded in the leaves. The Louisiana quillwort is restricted to gravel bars and sandy soils in or near shallow blackwater creeks and overflow channels in narrow riparian woodlands or bayheads in pine flatwoods and upland longleaf pine vegetative communities (USFWS 1996). This species has been documented in the Pleistocene High Terraces ecoregion in southern Mississippi. In 1996, it was known from a handful of sites in southeastern Louisiana and in two Mississippi counties, Jackson and Perry (USFWS 1996). Recent survey work however, has discovered this plant in more than 50 locations spread over 10 Mississippi counties (Natureserve 2001d). Threats to quillwort populations include timber harvest, sand and gravel mining, construction, and other activities with potential to alter the hydrology of small stream habitats (Natureserve 2001d).

The proposed endangered Mississippi gopher frog is a medium-sized, stocky frog with brown, black, or gray coloration and many dark spots and warts. Adult frogs reach approximately 3 inches in body length. These frogs spend considerable time underground in abandoned gopher tortoise burrows, mammal burrows, and under tree stumps (USFWS 2000). Mississippi gopher frogs breed in isolated ponds surrounded by sandy, upland, longleaf pine forest. Breeding ponds only fill with water after substantial winter rains; Mississippi gopher frogs, therefore, do not reproduce successfully in drought years. The Mississippi gopher frog population has been reduced to approximately 100 known individuals near one breeding pond in Harrison County, Mississippi. Development projects in the vicinity of the pond have severed movement corridors that formerly helped sustain the frog population and otherwise have deteriorated remaining frog habitat. The species was at one time known from coastal counties and parishes from the Mississippi River in Louisiana east to the Mobile River in Alabama (USFWS 2000).

The endangered Mississippi sandhill crane is a large wading bird similar in appearance to herons and other cranes. Sandhill cranes have gray feathers with long legs and neck. Adult sandhill cranes have a red patch on the forehead. The Mississippi sandhill crane is a non-migratory subspecies of sandhill crane found only in Jackson County, Mississippi. Most sandhill cranes are migratory, but there are three recognized subspecies that do not migrate: Florida sandhill crane, Cuban sandhill crane, and Mississippi sandhill crane. Somewhere between 110 to 120 Mississippi sandhill cranes existed in the wild in 2000 (Natureserve 2001e). A USFWS captive breeding program has been successful in reintroducing several breeding cranes to the Mississippi Sandhill Crane National Wildlife Refuge. These cranes are found in wet and dry open forests and savannahs with longleaf pine, slash pine, and cypress. Mississippi sandhill cranes feed on live prey such as amphibians, worms and insects. At certain times of the year the cranes also eat plant foods such as corn, roots, tubers, and pecans. Mississippi sandhill cranes reproduce slowly, raising only one chick per year. Hatching success is low, and very few young birds have been observed. Low population levels and

inbreeding might be responsible for low hatching success and a high rate of disease in Mississippi sandhill cranes (USFWS 2001d).

Critical habitat for the Mississippi sandhill crane covers about 26,000 acres in Jackson County. The main threat to the survival of this subspecies is loss and fragmentation of habitat. Conversion of open forests to dense pine plantation, fire suppression, encroachment of residential and commercial developments, roads that facilitate access to and fragment crane habitat, and chemical spraying on roadsides all contribute to population decline (Natureserve 2001e; USFWS 2001d). These cranes are territorial when nesting. Nests can be separated by a half mile or more. If the Mississippi sandhill crane population recovers, more suitable habitat will be needed so that adult cranes have space to hatch and rear young. Habitat maintenance, which requires occasional fire—either prescribed or wild, is increasingly difficult with the encroachment of suburbia and urban areas on crane habitat.

The candidate species pearl darter is a small fish in the perch family that usually grows to just over 2 inches in length. It has a blunt nose, horizontal mouth, large eyes placed high on the head, and a black spot on the caudal fin. Pearl darters have been collected in rivers and large creeks with moderate current and sand and gravel substrates. Chironomids and small crustaceans probably make up a large part of pearl darter diet (USFWS 2001e). Never considered abundant, the pearl darter was once found in both the Pearl and Pascagoula River systems. It has not been collected in the Pearl River system since 1973. The pearl darter is thought to be restricted to 88 river miles of the Pascagoula River watershed (USFWS 2001e). The pearl darter has the potential to occur in the Pascagoula River and its tributaries in Jackson County. Threats to the pearl darter include sedimentation from forestry and development in the watershed, permitted industrial and municipal discharges of toxic chemicals and sewage, sand and gravel mining, and proposed impoundments for reservoirs. Sand and gravel mining activities are ongoing in the Pascagoula River system. In-stream mining not only removes substrates preferred by the pearl darter, it also delivers sediment to aquatic habitats downstream. Holes in river channels left by sand and gravel mining activities function similar to lake habitats, which pearl darters avoid (Natureserve 2001f).

The threatened piping plover is a small, stocky, sandy-colored bird resembling a sandpiper. The adult has yellow-orange legs, a black band across the forehead from eye to eye, and a black ring around the base of its neck. Like other plovers, it runs in short starts and stops. When still, the piping plover blends into the pale background of open, sandy habitat on outer beaches where it feeds and nests. The piping plover breeds on sandy or pebble coastal beaches of Newfoundland and southeastern Quebec to North Carolina. Decline in piping plover populations has been linked to loss of breeding habitat. Shoreline development, river flow alteration, river channelization, and reservoir construction have all led to loss of breeding habitat. The piping plover winters along the Gulf coast but does not nest in Mississippi. The MSNHP database indicates three over-wintering sightings of piping plovers: one along the beaches of Gulfport, one on Deer Island, and one on Ship Island.

Piping plovers begin arriving on the wintering grounds in July, with some late-nesting birds arriving in September. Behavioral observations of piping plovers on the wintering grounds suggest that they spend the majority of their time foraging (Nicholls and Baldassarre 1990; Drake *et al*. 2001). Of the birds located on the United States wintering grounds during these two censuses, 89 percent were found on the Gulf Coast and 8 percent were found on the Atlantic Coast.

On August 9, 2001, the USFWS designated 137 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas as critical habitat for the wintering population of the piping plover. This includes approximately 1,798.3 miles of mapped shoreline and approximately 165,211 acres of mapped area along the Gulf and Atlantic coasts and along margins of interior bays, inlets, and lagoons (USFWS, 2001h).

The primary constituent elements for the piping plover wintering habitat are those habitat components that are essential for the primary biological needs of foraging, sheltering, and roosting,

and only those areas containing these primary constituent elements within the designated boundaries are considered critical habitat. The primary constituent elements are found in coastal areas that support intertidal beaches and flats (between annual low tide and annual high tide) and associated dune systems and flats above annual high tide.

USFWS calculated linear distances of critical habitat shoreline by ownership for the state of Mississippi. In addition, state-level values of area in hectares and acres were calculated for the critical habitat units by ownership (Table 3.10-2). Ownership for both the shoreline and units were broken into three classes (Federal—Federally owned lands, State—state owned lands, and Other—non-Federal or non-state mapped lands). Assignment of ownership was based on existing digital state-level managed/protected lands geodata set (Geological Information System data set) where possible. If no existing digital data were available, ownership was assigned based on other data sources. Detailed descriptions of critical habitat units for the piping plover are provided in Table 3.10-3.

Table 3.10-2.
Approximate Land Area of Designated Critical Habitat Units for Wintering Piping Plover (Rows)

Land Owner	Shoreline Ownership In Hectares (acres)	Shoreline Ownership In Kilometers (miles)
Federal	2,376 (5,870)	98.2 (61.4)
State	0 (0)	0 (0)
Other	1,479 (3,655)	105.9 (66.2)
Total	3,855 (9,525)	204.1 (127.6)

Table 3.10-3.
Piping Plover Critical Habitat In Mississippi

Map Unit	Description
MS-1	Lakeshore through Bay St. Louis. 41 ha (101 ac) in Hancock County. This unit extends from the north side of Bryan Bayou outlet and includes the shore of the Mississippi Sound following the shoreline northeast approximately 15.0 km (9.3 mi) and ending at the southeast side of the Bay Waveland Yacht Club. The landward boundary of this unit follows the Gulf side of South and North Beach Boulevard and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-2	Henderson Point. 34 ha (84 ac) in Harrison County. This unit extends from 0.2 km (0.12 mi) west of the intersection of 3rd Avenue and Front Street and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Pass Christian Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned
MS-3	Pass Christian. 77 ha (190 ac) in Harrison County. This unit extends from the east side of Pass Christian Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 10.5 km (6.5 mi) to the west side of Long Beach Pier and Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-4	Long Beach. 38 ha (94 ac) in Harrison County. This unit extends from the east side of Long Beach Pier and Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.4 km (2.7 mi) to the west side of Gulfport Harbor. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.

Table 3.10-3.
Piping Plover Critical Habitat In Mississippi

Map Unit	Description
MS-5	Gulfport. 39 ha (96 ac) in Harrison County. This unit extends from the east side of Gulfport Harbor and includes the shore of the Mississippi Sound following the shoreline northeast approximately 4.8 km (3.0 mi) to the west side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-6	Mississippi City. 62 ha (153 ac) in Harrison County. This unit extends from the east side of the groin at the southern terminus of Courthouse Road, Mississippi City, MS, and includes the shore of the Mississippi Sound following the shoreline northeast approximately 7.9 km (4.9 mi) to the west side of President Casino. The landward boundary of this unit follows the Gulf side of U.S. Highway 90 and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-7	Beauvoir in Harrison County. **Excluded.** The proposed rule included this unit, but it was deleted for lack of evidence of regular use by piping plovers.
MS-8	Biloxi West in Harrison County. **Excluded.** The proposed rule included this unit, but it was deleted for lack of evidence of regular use by piping plovers.
MS-9	Biloxi East in Harrison County. Excluded. The proposed rule included this unit, but it was deleted for lack of evidence of regular use by piping plovers.
MS-10	Ocean Springs West. 11 ha (27 ac) in Jackson County. This unit extends from U.S. 90 and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.9 km (1.2 mi) to the Ocean Springs Harbor inlet. The landward boundary of this unit follows the Bay side of Front Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-11	Ocean Springs East. 7 ha (17 ac) in Jackson County. This unit extends from the east side of Weeks Bayou and includes the shore of Biloxi Bay following the shoreline southeast approximately 1.8 km (1.1 mi) to Halstead Bayou. The landward boundary of this unit follows the Bay side of East Beach Drive and the seaward boundary is MLLW. The shoreline of this unit is privately owned.
MS-12	Deer Island. 194 ha (479 ac) in Harrison County. This unit includes all of Deer Island, where primary constituent elements occur to the MLWW. Deer Island is privately owned
MS-13	Round Island. 27 ha (67 ac) in Jackson County. This unit includes all of Round Island to the MLWW and is privately owned.
MS-14	Mississippi Barrier Islands. 3,168 ha (7,828 ac) in Harrison and Jackson Counties. This unit includes all of Cat, East and West Ship, Horn, Spoil, and Petit Bois Islands where primary constituent elements occur to MLLW. Cat Island is privately owned, and the remaining islands are part of the Gulf Islands National Seashore.
MS-15	North and South Rigolets. 159 ha (393 ac) in Jackson County, MS, and 12 ha (30 ac) in Mobile County, AL. This unit extends from the southwestern tip of South Rigolets Island and includes the shore of Point Aux Chenes Bay, the Mississippi Sound, and Grand Bay following the shoreline east around the western tip, then north to the south side of South Rigolets Bayou; then from the north side of South Rigolets Bayou (the southeastern corner of North Rigolets Island) north to the northeastern most point of North Rigolets Island. This shoreline is bounded on the seaward side by MLLW and on the landward side to where densely vegetated habitat, not used by the piping plover, begins and where the constituent elements no longer occur. Approximately 4.4 km (2.7 mi) are in Mississippi and 2.9 km (1.8 mi) are in Alabama. Almost half the Mississippi shoreline length is in the Grand Bay National Wildlife Refuge.

Endangered Red-cockaded woodpeckers are small- to medium-sized woodpeckers 18 to 20 cm long, with a 35 to 38 cm wingspan. White spots on black feathers give the bird a “ladder- back” appearance. Red-cockaded woodpeckers have a white cheek patch on either side of the head, as well as a black cap. Male woodpeckers have thin red streaks on the cheeks that are barely visible (Natureserve 2000). Red-cockaded woodpeckers nest and forage in mature pine stands frequently

burned to promote an open understory and thick herbaceous layer. Research indicates that red-cockaded woodpeckers excavate nest cavities in pines 60 years or older (USFWS 1998a). The birds were once abundant in pinelands throughout the southeastern United States, but fire suppression, subsequent hardwood encroachment, conversion to short-rotation pine plantations, and development have eliminated most suitable habitat. Scattered populations exist from southeastern Oklahoma to southern Virginia, south to Florida and eastern Texas. In Mississippi, red-cockaded woodpeckers have been reported in Harrison and Jackson Counties.

The threatened yellow-blotched map turtle is a small turtle that gets its name from the distinctive yellow blotches on its carapace (top shell). The turtle has a greenish-black body covered with yellow stripes. The plastron (bottom shell) is yellow to tan in color. Adult male turtles have been observed with carapace length between 3.5 to 4.8 inches, while the normally larger female turtles have been observed with carapace length of 4.1 to 8.5 inches (USFWS 1993). Several prominent spine-like projections extend from the top of the carapace. Yellow-blotched map turtles are endemic to the Pascagoula River system. They live in the main channels of rivers and large creeks; they have also been observed in oxbow lakes (USFWS 1993). These turtles have been observed in the Pascagoula and Escawtawpa Rivers in Jackson County. Yellow-blotched map turtles avoid small streams where the surface of the water is shaded by bank vegetation. Aquatic insects and snails are thought to make up a large part of the turtles' diet. Turtles often bask on snags and logs that have fallen in the water. Nesting occurs during the summer months on sandbar beaches (USFWS 1993).

Yellow-blotched map turtle populations in the upper Pascagoula watershed have been in decline since the early 1990s. Navigation improvement projects to remove logs and snags from the Pascagoula River have taken away structures needed by the turtles for basking (USFWS 1993). Snag removal has also adversely impacted populations of the turtles' invertebrate prey that use snags as habitat. Gravel mining activities in the watershed have increased sedimentation and further impacted aquatic invertebrate populations. Four reservoirs and ongoing channel modification projects in the Pascagoula River system have altered or eliminated sandbars that turtles use for nesting. These small, colorful turtles are illegally collected for the pet trade, and basking turtles are used for target practice by some individuals (USFWS 1993). Some turtles have been observed to drown in illegal catfish traps.

There are 14 T&E species that use terrestrial or freshwater aquatic habitats, known from the three coastal counties in Mississippi. Several of these species are endemic to Mississippi or the Gulf Coast, while others migrate long distances to breed or winter in coastal Mississippi. Population declines in some of these species are linked to effects of habitat loss, taking for food or pets, or water pollution in Mississippi. In other species, declines have been linked to phenomena outside the study area. Because most T&E species are rare, population information is difficult to obtain.

3.11 Essential Fish Habitat (EFH)

The Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), established a new requirement to describe and identify "EFH" in each fishery management plan. This act sets forth a new mandate for the National Marine Fisheries Service (NMFS), regional fishery management councils (FMCs), and other Federal agencies to identify and protect important marine and anadromous fish habitat. The EFH provisions of the act support maintenance of sustainable fisheries, which is one of the overall management goals for the nation's marine resources.

As defined in the interim final rule (62 Federal Register 66551), "EFH means those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." For the purpose of interpreting the definition of EFH: 'Waters' include aquatic areas and their associated physical,

chemical, and biological properties that are used by fish, and may include aquatic areas historically used by fish where appropriate; 'substrate' includes sediment, hardbottom, structures underlying the waters, and associated biological communities; 'necessary' means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem; and 'spawning, breeding, feeding, or growth to maturity' covers a species' full life cycle." (Table 3.11-1)

EFH includes all waters and substrates (mud, sand, shell, rock, and associated biological communities) within these estuarine boundaries, including the sub-tidal vegetation (seagrasses and algae) and adjacent tidal vegetation (marshes). Estuaries provide essential habitat for many species, serving primarily as nursery areas for juveniles and also as seasonal habitat for adults. Emergent vegetation found in marsh is an integral part of the estuarine ecosystem, serving as nursery grounds for larvae, postlarvae, juveniles and adults of many species, most notably the brown shrimp (NMFS 1998). Marshes also export nutrients to adjacent waters; provide an important water quality function in the form of secondary and tertiary waste treatment through removal and recycling of inorganic nutrients; serve as an important buffer against storms by absorbing energy of storm waves and acting as a water reservoir, thus reducing damage farther inland; and serve an important role in global cycles of nitrogen and sulfur (Gosselink et al. 1974; Turner 1977; Thayer et al. 1975; Zimmerman et al. 1984).

In 2000, there were approximately 55,226 acres of emergent wetlands in the three coastal Mississippi counties (USACE 2005). Wetlands of south Mississippi, are dominated by *Juncus roemerianus* (black needlerush) (NMFS 1998). *Spartina alterniflora* (oyster grass), *Spartina patens* (wiregrass) and *Scirpus olneyi* (threecorner grass) composed the remaining acreage. Tidal marsh is most extensive in the Pascagoula and Pearl River areas of Jackson and Hancock counties, respectively.

As with emergent vegetation, submerged vegetation is extremely important to fisheries production and is often populated by diverse and abundant fish faunas (NMFS 1998). The relative abundance and diversity of submerged vegetation, which is found along most of the Gulf coast, depends mainly on bottom type, turbidity, salinity, water temperature, bottom slope, and tidal range (NMFS 1998). Seagrasses and the epiphytic algae, benthic fauna and flora associated with seagrasses provide shelter and food to fishes, and are also used by many species as nursery grounds. Turner (1977) related shrimp yield to total acreage of intertidal vegetation present in adjacent estuaries.

Discontinuous beds of shoal grass (*Halodule wrightii*), turtle grass (*Thalassia testudinum*), and manatee grass (*Syringodium filiform*) can be found north of the islands, and shoal grass has also been found in the sandy substrates east of Pascagoula (Point-aux-Chenes Bay) and near Bayou Caddy in western Mississippi Sound. Widgeon grass (*Ruppia maritime*) dominates the area near the mainland, and is also found in low-salinity ponds and lagoons on Horn and Cat Islands. Stands of benthic algae occur north and south of Cat Island, and tape grass (*Vallisneria americana*) can be found throughout the Sound.

Marshland is being lost through subsidence, erosion, sediment and freshwater deficits, channelization, and rising mean sea level. Aggravating factors contributing to marshland losses include management for agriculture, flood control, and wildlife habitat. Pollution from agricultural, municipal, and industrial activities (including widespread oil and gas production) produces additional habitat degradation.

Port development and gaming development are two of the most significant factors affecting the loss of EFH and wetlands in the coastal Mississippi (GMFMC, 1998). The gaming industry has stimulated economic and population growth in coastal Mississippi. Pre-Hurricane Katrina, State law required that specific gaming facilities be located in navigable waters or within 800 feet of such; therefore estuarine resources are typically directly and indirectly impacted. Mississippi's major port at Gulfport involves major estuarine resources issues for maintenance and expansion. Maintenance issues

involve open-water and diked disposal, and expansion issues involve impact to bottomland hardwoods, Mississippi Sound bottoms, and wetland fringe areas (GMFMC, 1998).

Between 1981 and 1996, the NMFS received and reviewed 1,653 proposals that could potentially affect EFH in Mississippi, which has a small coastal area relative to the rest of the state. A subsample of 185 of the projects reviewed by the NMFS involved 2,193 acres of various wetland habitat types. Most of the acreage associated with projects received for review involved various industrial developments. The greatest number of projects reviewed involved various shoreline modifications, mainly bulkheading and backfilling. Maintenance dredging of federally maintained navigation channels also involves a substantial amount of acreage.

The major fisheries landed along the Mississippi and Alabama Gulf coast are menhaden (*Brevoortia patronus*), mullet (*Mugil cephalus*), croaker (*Micropogonias undulatus* and *Leiostomus xanthurus*), shrimp (*Penaeus azetecus*, *P. setiferus*, and *P. duorarum*), blue crab (*Callinectes sapidus*), and oyster (*Crassostrea virginica*). In addition, the following would be expected to utilize the project area: red drum (*Sciaenops oellatus*), dolphin (*Coryphaena hippurus*), spanish mackerel (*S. maculatus*), and king mackerel (*Scomberomorus cavalla*).

Table 3.11-1.
Fishery Management Plans and Managed Species for the Gulf of Mexico.
(NMFS 1999)

Shrimp Fishery Management Plan	**Red Drum Fishery Management Plan**
Brown shrimp (*Penaeus aztecus*)	Red drum (*Sciaenops oellatus*)
Pink shrimp (*P. duorarum*)	
Rock shrimp (*Sicyonia brevirostris*)	**Golden Crab Fishery Management Plan**
Royal Red Shrimp (*Pleoticus robustus*)	Golden crab (*Chaceon fenneri*)
White Shrimp (*P. setiferus*)	
Snapper Grouper Fishery Management Plan	
Blackfin snapper (*Lutjanus buccanella*)	Silk snapper (*L.vivanus*)
Blueline tilefish (*Caulolatilus microps*)	Snowy grouper (*E. niveatus*)
Gray snapper (*L.griseus*)	Speckled hind (*E. drummondhayi*)
Greater amberjack (*Seriola dumerili*)	Yellowedge grouper (*E. flavolimbatus*)
Jewfish (*Epinephelus itajara*)	Warsaw grouper (*E. nigritus*)
Mutton snapper (*L.analis*)	White grunt (*Haemulon plumieri*)
Red porgy (*Pargrus pargrus*)	Wreckfish (Polyprion americanus)
Red snapper (*L. campechanus*)	Scamp (*Mycteroperca phenax*)
Vermillion snapper (*Rhomboplites aurorubens*)	
Coastal Migratory Pelagics Fishery Management Plan	
Dolphin (*Coryphaena hippurus*)	
Cobia (*Rachycentron canadum*)	
King mackerel (*Scomberomorus cavalla*)	
Spanish mackerel (*S. maculatus*)	
Spiny Lobster Fishery Management Plan	
Spiny lobster (*Panulirus argus*)	
Calico Scallop Fishery Management Plan	
Calico scallop (*Argopecten gibbus*)	
Coral and Coral Reef Fishery Management Plan	
Varied coral species and coral reed communities	
Comprised of several hundred species	
Sargassum Habitat Fishery Management Plan	
Sargassum (and associated fauna) where it occurs in the EEZ and state waters	

3.12 Cultural Resources

Cultural resources in the project area considered eligible for listing on the National Register of Historic Places include historic standing structures, submerged shipwrecks, historic cemeteries, and prehistoric and historic archaeological sites. Many of the cultural resource sites contain shell middens, which are mounds of discarded shells that offer evidence of the early use of certain shellfish (mollusks). Some of the sites are prehistoric Indian mounds. The sites also include the remains of ancient villages, historic forts, campsites, and cemeteries. The sunken vessels that have been found include schooners, barges, and sailing vessels. Before Hurricane Katrina hit there were approximately 298 known archeological sites within the project area, including submerged shipwrecks and historic cemeteries. Of these, 63 sites or shipwrecks were listed on or eligible for the National Register, 80 have been determined ineligible by the Mississippi State Historic Preservation Officer (SHPO): and the remainder are potentially eligible. The potential for identifying additional buried archaeological sites and submerged historic shipwrecks in the coastal Mississippi project area is considered high, based on the number of known resources (Mississippi SHPO, 2001). The development along the Mississippi coast has affected both archaeological sites and standing structures, including individual structures and historic districts in the project area. Hurricane Katrina caused catastrophic direct and indirect damage to the cultural resources of coastal Mississippi. Several historic properties were destroyed and others significantly damaged. The extent of these damages will take years to assess.

The prehistoric occupation in the Coastal Mississippi region began around 10,000 B.C. and ended in colonial times (the 1600s). Most of the resources from prehistoric times have been found along the rivers, especially the river mouths, and on the barrier islands. Most of these known sites were identified in surveys conducted at only limited locations and, therefore, their locations cannot predict exactly where other (currently unknown) sites might exist.

The historic time periods date from colonial times (1600s) forward. The first contact between the Native Americans that lived in the project area and Europeans occurred during the Protohistoric Period. The first European to arrive was most likely Don Diego Miruelo, who probably sailed into the Mississippi Sound in 1516. Spanish explorers, likely including Cabeza de Vaca and Panfilo de Narvaez, were in the region during the 16th century as well. In the 17th century French explorers began to arrive in the region, and soon French settlers also arrived, cleared the land, and built settlements. Pierre LeMoyne, Sieur d'Iberville, established the first French settlement at Old Biloxi (now Ocean Springs) in 1699. In 1723 Biloxi became the capital of the French colony. With the Treaty of Paris in 1763, the French abandoned the Mississippi coast to the English; in 1779 the English ceded the coast to Spain. With the Louisiana Purchase in 1812 the area became part of the United States; Mississippi became a state in 1817.

Historic Native Americans who lived in the project area region included the Pascagoula, Biloxi, Moctobi, Capinan, and Mobile peoples. The Apalachee also lived along the Pearl River during the 17th century (Pearce and Mikell, 2000). The Native Americans were decimated by disease and warfare associated with European contact, and by the 19th century very few remained in the region.

Apart from archaeological sites, no Native American resources, including traditional cultural properties, have been identified in the project area. In accordance with the mandate of Executive Order 13175, "Consultation and Coordination with Indian Tribal Governments," the Corps initiated consultation with 12 federally recognized Native American tribes that have cultural interests in southern Mississippi. Coordination letters were sent to the tribes in March 2006. To date no responses have been received.

Numerous historic architectural resources are present in the project area. Prior to Hurricane Katrina 62 standing structures, 14 historic districts, and one ship have been listed on the National Register

of Historic Places. Historic districts have been designated in Biloxi, Ocean Springs, and Bay St. Louis.

3.13 Protection of Children

The Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), recognizes a growing body of scientific knowledge demonstrating children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; because children eat, drink, and breathe more in proportion to their body weight; because their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

Data is still being collected on impacts to children relative to post-Hurricane Katrina. Many studies are being conducted on pre- and post-Katrina impacts. Due to the time constraint of this report, this information could not be included.

3.14 Environmental Justice

On February 11, 1994, President Clinton issued EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations*. The EO is designed to focus attention of Federal agencies on the human health and environmental conditions in minority communities and low-income communities. Environmental Justice analyses are performed to identify potential disproportionately high and adverse impacts from proposed actions and to identify alternatives that might mitigate these impacts. Data from the U.S Department of Commerce 2000 Census of Population and Housing were used for this Environmental Justice analysis. Minority populations included in the census are identified as Black or African American, American Indian and Alaska Native, Asian, Native Hawaiian and other Pacific Islander, Hispanic, of two or more races, and other. Poverty status, used in this Coastal Mississippi report to define low-income status, is reported as the number of persons with income below poverty level. The 2000 Census defines the poverty level as $8,794 of annual income, or less, for an individual, and $17,603 of annual income, or less, for a family of four.

Coastal Mississippi has a lower percentage of minority residents than the State of Mississippi and the United States. In 2000, 79.6 percent of the population was white and 16.3 percent was black. All other racial groups combined totaled approximately 4.1 percent of the population, while 2.2 percent were of Hispanic origin. In Mississippi, 61.4 percent of the population was white, 36.3 percent was black, 2.3 percent was of another minority racial group, and 1.4 percent was of Hispanic origin. For the United States, 75.1 percent of the population was white, 12.3 percent was black, and 12.6 percent was of other minority racial groups. Approximately 12.5 percent of the U.S. population was Hispanic.

The Census Bureau bases the poverty status of families and individuals on 48 threshold variables, including income, family size, number of family members under the age of 18 and over the age of 65, and amount spent on food. In 1997, approximately 14.6 percent of the residents were classified as living in poverty, lower than the state of Mississippi but slightly higher than the poverty rate for the United States as a whole.

Hurricane Katrina drew focus on the number of residents unable to flee the Gulf coast due to lack of funds. There is a longstanding legacy of unfair and disproportionate toxic exposures to low income, predominantly African American communities in much of Mississippi. This has resulted from years of industrial activity and waste disposal practices that hit these communities harder than higher income, predominantly white communities. Impacted areas, such as Superfund facilities, are located more often in low-income areas and therefore are at greater risk to post-Katrina exposure. As clean-up proceeds and rebuilding begins, every effort must be made to remedy these environmental injustices through full clean-up, fair rebuilding practices, and full partnership with affected communities. Over 30,000 families are being helped through HHS' Administration on Children and Families Temporary Assistance for Needy Families (TANF) program by the provision of short-term, non-recurrent cash benefits to families who traveled to another State from the disaster designated States. The hurricane-damaged States of MS, LA, and AL also received additional funding for the TANF program to provide assistance and work opportunities to needy families ($69 million for loan forgiveness and $25 million in contingency funds for State Welfare Programs.)

3.15 Hazardous, Radioactive, and Toxic Waste (HRTW)

Statewide, the Mississippi Department of Environmental's (MDEQ's) Office of Pollution Control (OPC) Hazardous Waste Division (HWD) regulates hazardous wastes. The HWD oversees the assessment and remediation of both abandoned and responsible party sites where hazardous or toxic substances have been released to the environment.

Hancock County, as a whole, contains more than 230 underground storage tanks (USTs). Of this number, 24 have been classified as leaking underground storage tanks (LUSTs). There are 182 gasoline USTs (200- to 14,000-gallon tanks), 38 diesel USTs (500- to 12,000-gallon tanks), 7 used oil USTs (150- to 1,000-gallon tanks), 2 kerosene USTs (2,000- and 4,000-gallon tanks), 2 other USTs (8,000- and 10,000-gallon tanks), and 1 gasohol UST (10,000-gallon tanks). Only 91 of the 232 USTs are currently in use, while 2 are temporarily out of use and 139 are permanently out of use.

A total of 21 contaminated sites, owned by various companies, exist in the southern portion of the county, along with two Resource Conservation and Recovery Act (RCRA) sites and two toxic material sites. A list of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Uncontrolled Sites contained 13 contaminated sites for southern Hancock County (MDEQ 2002b).

Harrison County contains more than 1,600 USTs. Approximately 150 of these USTs are classified as LUSTs. There are 1,188 gasoline USTs (120- to 25,000-gallon tanks), 302 diesel USTs (150- to 25,000-gallon tanks), 106 used oil USTs (250- to 12,000-gallon tanks), 17 kerosene USTs (250- and 12,000-gallon tanks), 13 not listed or other USTs, four hazardous substance USTs (500 to 750 gallon tanks), 3 gasohol USTs (1,000 to 2,000 gallon tanks), 3 jet aviation fuel USTs (10,000-gallon tanks), 2 heating oil USTs (20,000-gallon tanks), 1 avgas UST (10,000-gallon tank), and 1 diesel/gasoline UST (15,000-gallon tank).

Southern Harrison County also contains a total of 117 contaminated sites, 19 RCRA sites, and 15 toxic material sites. A list of CERCLA Uncontrolled Sites contained 67 contaminated sites for Harrison County (MDEQ 2002b). In July 1999, the U.S. Environmental Protection Agency (EPA) announced that a Superfund hazardous material removal project has begun at the Chemfax site in Gulfport.

Jackson County contains more than 830 USTs. More than 75 of which are classified as LUSTs. There are 659 gasoline USTs (1,000- to 10,000-gallon tanks), 126 diesel USTs (280- to 20,000-gallon tanks), 30 used oil USTs (250- to 5,000-gallon tanks), 9 not listed USTs, 8 kerosene USTs (1,000 and 6,000 gallon tanks), and 4 gasohol USTs (1,000- to 10,000-gallon tanks). Only 312 of the

1,640 USTs are currently in use, while 11 are temporarily out of use, 3 have registration pending, 1 has permanent closure pending, and 509 are permanently out of use. Jackson County also contains 112 contaminated sites in the southern region of the county, along with 15 RCRA sites and 17 toxic material sites.

4.0 ENVIRONMENTAL EFFECTS

4.1 Introduction

The proposed MsCIP Near Term Improvements would have minor environmental impacts on the existing environment. The proposed projects have been categorized into four environmental divisions consisting of seawalls, beach restoration, marsh creation, and dredging. The projects would provide some measure of hurricane storm damage reduction, flood damage reduction, preservation of fish and wildlife values, prevention of saltwater intrusion, and various other water related resource viability.

The construction activities associated with proposed projects involving construction of seawalls and bulkheads, specifically Shearwater Bridge, Bay St. Louis Downtown, Cowand Point Seawall, and Clermont Harbor Seawall projects, that would create the dominant environmental impacts are those associated with the placement of material along the existing shoreline. The construction activities associated with the proposed projects involving reduction of flooding and improved drainage, specifically Franklin Creek Floodplain, Long Beach Drainage, Upper Bayou Casotte, Hancock County Communities, and Gautier HSDR projects, that would create the dominant environmental impacts are those associated with dredging of sediments and debris in interior drainage ways and along Mississippi Sound and the placement of those materials in upland disposal sites. The construction activities involving marsh creation/restoration, specifically Courthouse Road Restoration and Bayou Caddy, as well as beach reconstruction, specifically Pascagoula Beach Boulevard Restoration and Harrison County Beaches, that would create the dominant environmental impacts are those associated with the placement of sand and sediments in open-water bottoms.

Environmental impacts associated with constructing the near term projects include temporary water quality degradation during construction activities, minor loss of bottom dwelling organisms, temporary avoidance of the project areas by pelagic and benthic fauna, temporary reduction in air quality due to exhaust emissions, esthetic and noise degradation during construction activities, and traffic congestion along the roadways near projects. It is anticipated that environmental benefits resulting from project construction would include reduced coastal erosion, increased interior drainage, creation of aquatic habitat, protection of shoreline, improved water quality, improved habitat for wildlife, improved habitat for T&E species, and prevention of saltwater intrusion. These benefits would offset those impacts associated with construction of the projects. In light of these environmental benefits that are anticipated to occur, the described adverse impacts associated with project construction are minor, short-term, and insignificant and are typical of these type construction activities, all of which have occurred at some time within coastal Mississippi. The environmental impacts associated with the proposed projects are discussed in the following paragraphs.

4.2 Benthos, Motile Invertebrates, and Fishes

There would be temporary disruption of the aquatic community as a result of the proposed projects being constructed. No impacts are anticipated to occur to benthos, motile invertebrates and fishes during the disposal of sediment and debris in approved upland disposal sites because these are actively worked sites which would likely not have any organisms within them. The dredged areas will result in the loss of sessile organisms.

Placement of sands on beaches (beach nourishment) may have negative impacts on intertidal macrofauna through direct burial, increased turbidity in the surf zone, or changes in the sand grain size or beach profile. Literature dating back to the early 1970's along the southeast Atlantic coast

indicate that opportunistic infauna species (ex. *Emerita* and *Donax*) found in the nourished areas are subject to direct mortality from burial, however, recovery often occurs within 1 year (Hayden and Dolan, 1974; Saloman, 1984; Van Dolah *et al*., 1992; Van Dolah *et al*., 1993; Jutte, P.C. *et al*., 1999) especially if compatible material is placed on the beach (Hayden and Dolan, 1974; Reilly and Bellis, 1978; Saloman, 1984; Nelson, 1989; Van Dolah *et al*., 1992; Van Dolah *et al*., 1993; Hackney *et al*., 1996; Jutte, P.C. *et al*., 1999; Peterson *et al*., 2000) . In North Carolina, post-nourishment studies have documented similar reductions in abundance of coquina clams (*Donax* spp.), mole crabs (*Emerita talpoida*), and amphipods (*Haustoriid* spp.) immediately following disposal with recovery times persisting between 1 and 3 seasons after project construction depending on sediment compatibility (Reilly and Bellis 1983 and Peterson *et al*., 2000) . Recoveries for Mississippi Sound intertidal areas and organisms are expected to be similar.

Temporary impacts on intertidal macrofauna in the immediate vicinity of the beach nourishment project are expected as a result of discharges of nourishment material on the beach. Any reduction in the numbers and/or biomass of intertidal macrofauna present immediately after beach nourishment may have localized limiting effects on nearshore-feeding fishes and shorebirds due to a reduced food supply. In such instances, these animals may be temporarily displaced to other locations. In some cases the material being placed may have food embedded and draw feeders to the placement area.

Reilly and Bellis (1978) stated, "Beach nourishment virtually destroys existing intertidal macrofauna; however, recovery is rapid once the pumping operation ceases. In most cases, recovery should occur within one or two seasons following the project completion." Similar findings were reached by Van Dolah (1992) in a study of the impacts of a beach nourishment project in South Carolina. A study by Dolan et al. (1992) of the effects of beach fill activities on mole crabs at the Pea Island National Wildlife Refuge, Dare County, North Carolina, indicates that while nourishment has a dramatic impact on mole crabs in the area where beachfill is placed, mole crabs returned to the beach areas that were nourished soon after hydraulic placement (pumping) stopped.

The negative effects on intertidal macrofauna, will be are localized in the vicinity of the nourishment operation. Beach nourishment will be conducted along the beach at a relatively slow rate. Accordingly nearshore-feeding fishes and shorebirds may move to other areas that are not affected by the nourishment operation. As the dredging operation passes by a given section of beach, that area is soon available for recolonization by invertebrates.

In a 1999 Environmental Report on the use of Federal offshore sand resources for beach and coastal restoration, US Department of Interior, Minerals Management Service provided the following assessment of potential impacts to beach fauna from beach nourishment.

> *Because benthic organisms living in beach habitats are adapted to living in high energy environments, they are able to quickly recover to original levels following beach nourishment events; sometimes in as little as three months (Van Dolah et al. 1994; Levisen and Van Dolah, 1996). This is again attributed to the fact that intertidal organisms are living in high energy habitats where disturbances are more common. Because of a lower diversity of species compared to other intertidal and shallow subtidal habitats, the vast majority of beach habitats are re-colonized by the same species that existed before nourishment (Van Dolah et al. 1992; Nelson 1985; Levisen and Van Dolah, 1996; Hackney et al. 1996).*

While the proposed MsCIP Near Term Improvements beach activities may adversely impact intertidal macrofauna, these effects will be localized, short-term, and reversible.

Benthic organisms within the defined borrow areas dredged for construction and periodic nourishment will be lost. However, re-colonization by opportunistic species is expected to begin soon after the dredging activity stops. Rapid recovery is expected from re-colonization from the migration

of benthic organisms from adjacent areas and by larval transport. Monitoring studies of post dredging effects and recovery rates of borrow areas on the Atlantic coast indicate that most borrow areas usually show significant recovery by benthic organisms approximately 1 to 2 years after dredging (Naqvi and Pullen, 1982, Bowen, *et al*. 1988, Johnson and Nelson, 1985, Saloman *et al*., 1982, and, Van Dolah *et al*., 1984, and Van Dolah *et al*. 1992). According to Posey and Alphin (2000), benthic fauna associated with sediment removal from borrow areas off of Carolina Beach in North Carolina recovered quickly with greater inter-annual variability than differences from the effects of direct sediment removal. However, some changes in species composition and population may occur (Johnson and Nelson, 1985, Van Dolah *et al*., 1984). Differences in community structure may occur that may last 2-3 years after initial density and diversity levels recover (Wilber and Stern, 1992). Specifically, large, deeper-burrowing infauna can require as much as 3 years to reach pre-disturbance abundance.

The impacts associated with the construction of seawalls and bulkheads are anticipated to be a permanent loss as the substrate from the base of the existing seawall out approximately two feet and for the total distance of the projects will be removed from potential use by benthos. While this impact is permanent, the impact to benthos is insignificant due to the large amount of available habitats in the remainder of Mississippi Sound, St. Louis Bay, and other associated small water bodies. Sheetpile will also serve as substrate for epifauna, such as barnacles. The overall impacts from these projects (i.e. beach restoration, marsh restoration, seawall and bulkheads) to these organisms are expected to be minimal, insignificant, discountable, and short-term.

4.3 Wildlife/Wildlife Habitat

Hurricane Katrina and the associated storm surge resulted in numerous adverse impacts to existing wildlife and wildlife habitat. The proposed projects should enhance overall wildlife and associated habitats. Construction and disposal activities may result in temporary impacts to existing vegetation in the immediate areas; however, it is expected all impacts would be short-term and minor, and in some cases discountable. No adverse impacts are anticipated to occur as a result of the proposed projects.

4.4 Esthetics

Esthetics will be temporarily reduced in the immediate vicinity of the proposed project sites. Many recreational vessels utilize Mississippi Sound within the project vicinities and it is believed some residents and visitors may be disturbed by the presence of the heavy equipment during construction. However, construction activities are temporary in nature so the disturbance is anticipated to be minimal. Furthermore, upon project completion, the projects should provide residents and visitors with a more esthetically pleasing view. The proposed marsh creation and beach restoration projects would provide additional habitat to numerous marine birds. The sediment and debris removal from interior drainage ways and along Mississippi Sound should provide for enhanced flushing of the systems and less stagnant, clearer waters. It is expected that seawall and bulkhead construction would result in slight changes to the appearance of the shorelines in the project vicinities, primarily as it is viewed from the water, and would slightly improve overall esthetic quality as existing seawalls are crumbling in places and in some cases, destroyed. From an environmental viewpoint, the proposed projects are anticipated to enhance coastal Mississippi and its diverse aquatic habitats while providing a moderate degree of protection.

4.5 Water Quality

Water quality in the immediate vicinity of the proposed projects would be slightly impaired for a short period of time due to construction of the projects. Temporary impacts include reduced water clarity, elevated suspended solids, disturbed water column, and reduced dissolved oxygen. Dredging and construction of the marsh creation and beach restoration projects would have temporary impacts associated with heavy equipment operating in open-water.

In a 1999 Environmental Report on the use of Federal offshore sand resources for beach and coastal restoration, the US Department of Interior Minerals Management Service provided the following assessment of potential turbidity impacts.

> *The impacts from turbidity on benthic organisms during dredging operations were reviewed in detail by Pequegnat et al. (1978) and Stern and Stickle (1978). Both studies concluded that impacts to the benthic populations of the marine ecosystem from turbidity are local and temporary but not permanent. Similarly, recent studies show that benthic impacts may be limited to the immediate vicinity of dredging operations (e.g., Newell et al. 1998; MMS 1999).*

Intertidal marshes function to improve water quality; therefore, adverse impacts associated with constructing these type projects would be short-term and minor compared to the environmental benefits anticipated. The anticipated improvements in water quality due to the infiltration of sediments and nutrients by tidal marsh are expected to provide long-term environmental benefits within Mississippi Sound.

4.6 Sediment Control

Resuspension of sediments will likely occur within the project sites. Silt fences and other Best Management Practices (BMPs) will be used to minimize the adverse impacts to the environment during construction activities to the maximum extent practicable. A containment structure (concrete rubble and earthen material), silt curtains, and/or other BMPs will be used to contain most of the sediment disposed of at the Bayou Caddy marsh creation site and it is expected those solids that remain suspended in the water column would migrate by the littoral drift. This transport of the suspended sediments is not anticipated to have an adverse impact due to the nature of suspended sediments being typically found within the Mississippi Sound's water column. Although these described impacts will likely occur in the project vicinity, the impacts will be typically minor and of short duration.

4.7 Noise

Noise from the engine and other job-related equipment is expected to increase during the proposed operations in the project vicinity. Noise levels will resume to existing conditions once construction activities are complete. Noise is not anticipated to be a significant impact.

4.8 Navigation

General navigation could be temporarily affected on a limited basis due to the associated construction of the proposed projects. Navigation would be restricted from the marsh creation and beach restoration sites; however, navigation in these areas were restricted to primarily recreational boaters and when comparing this small limitation to all other accessible areas within Mississippi Sound, the impacts are insignificant. No adverse impacts are expected to occur to navigation due to construction of the project.

4.9 Air Quality

The project sites have been designated in attainment with the National Ambient Air Quality Standards (NAAQS). Air quality in the immediate vicinity of the heavy equipment would be slightly affected for a short period of time by the fuel combustion and resulting engine exhausts. The standards would not be violated by the implementation of the proposed project.

4.10 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority and Low-Income Populations* (February 11, 1994) requires that Federal agencies conduct their programs, policies, and activities that substantially affect human health or the environment in a manner that ensures that such programs, policies, and activities do not have the effect of excluding persons (including populations) from participation in, denying persons (including populations) the benefits of, or subjecting persons (including populations) to discrimination under such programs, policies, and activities because of their race, color, or national origin. On February 11, 1994, the President also issued a memorandum for heads of all departments and agencies, directing that EPA, whenever reviewing environmental effects of proposed actions pursuant to its authority under Section 309 of the Clean Air Act (CAA), ensure that the involved agency has fully analyzed environmental laws, regulations, and policies.

The proposed projects are not designed to create a benefit for any group or individual. The proposed project does not create disproportionately high or adverse human health or environmental impacts on minority or low-income populations of the surrounding community. Review and evaluation of the proposed project have not disclosed the existence of identifiable minority or low-income communities that would be adversely impacted by the proposed project.

4.11 Protection of Children

The EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (April 21, 1997), recognizes a growing body of scientific knowledge that demonstrates that children may suffer disproportionately from environmental health risks and safety risks. These risks arise because children's bodily systems are not fully developed; because children eat, drink, and breathe more in proportion to their body weight; because their behavior patterns may make them more susceptible to accidents. Based on these factors, the President directed each Federal agency to make it a high priority to identify and assess environmental health risks and safety risks that may disproportionately affect children. The President also directed each Federal agency to ensure that its policies, programs, activities, and standards address disproportionate risks to children that result from environmental health risks or safety risks.

No changes in demographics, housing, or public services would occur as a result of the proposed projects. With respect to the protection of children, the likelihood of disproportionate risk to children is not significant. The proposed projects do not involve activities that would pose any disproportionate environmental health risk or safety risk to children.

4.12 Cultural Resources

The National Historic Preservation Act (NHPA) of 1966 established the federal government's policy on historic preservation, as well as the national historic preservation program through which the act is implemented. The NHPA also established the National Register of Historic Places (NRHP), which

is a list of important resources that experts have identified as significant to our national heritage. There are over eighty properties meeting the criteria of and are listed on the NRHP along the Mississippi coastline including Jefferson Davis' Beauvoir mansion, the wreck of the sidewheeler *Josephine* in Harrison County, the Graveline Mounds in Jackson County, historic districts in Biloxi and Ocean Springs and many others. Most if not all of these properties along the coast were moderately to severely adversely effected by the wind and storm surge of Hurricane Katrina and the total extent of damage is still being assessed. As a result, properties that fall within the Area of Potential Effects (APE) for the undertakings in this Environmental Assessment (EA) can only be assumed to still be intact and will be addressed accordingly until such time as a true assessment can be made.

Each project type: seawalls and bulkheads, flood reduction and beach projects, and marsh creation/restoration will be reviewed and potential effects will be coordinated with the Mississippi State Historic Preservation Officer (MS SHPO), and relevant federally-recognized tribes. A Programmatic Agreement will be sought to ensure that a plan is in place to address any inadvertent discoveries and to ensure there will be no adverse effects to cultural properties as a result of the undertakings discussed in this EA. Areas that require investigation for the presence of cultural resources will be determined from a search of the Mississippi Site Files. Tracts that have not been previously surveyed will be either avoided or will be investigated.

Considerations for all of the proposed projects include the placement and extent of staging areas and any new access routes needed. Specifically, potential effects from seawall rehabilitation and bulkhead placement are estimated to be limited to subsurface impacts on the shore as a result of seawall and bulkhead placement. Dune restoration and sediment removal from existing drainage canals should incur no effects to cultural resources. The beaches of Hancock and Harrison County are man-made and should not contain cultural properties. Existing upland disposal sites have been previously surveyed and cleared by the MS SHPO for cultural resources concerns. To the maximum extent practical, borrow areas for beach sand will be areas previously used and evaluated for that purpose. Marsh creation projects hold the potential to impact cultural properties within the area proposed for creation as do any new (not previously used) borrow areas proposed for dredging of sand material for marsh and beach building. The purchase and removal of residences in the Franklin Creek Floodplain will be reviewed for the existence of historic structures within the proposed removal area. All anticipated and unanticipated impacts will be avoided or mitigated so that ultimately there will be no adverse effects to cultural resources as a result of these projects.

4.13 Endangered and Threatened Species

Federally protected species, such as the Louisiana black bear, gopher tortoise, eastern indigo snake, Mississippi sandhill crane, red-cockaded woodpecker, and the yellow-blotched map turtle, would not be adversely impacted by construction of the proposed projects as it is believed they are not present at the project sites. Furthermore, these motile species would be able to avoid the project areas. The bald eagle and brown pelican are also anticipated to avoid the area during operations.

Adverse impacts to federally protected species, such as the blue whale, finback whale, humpback whale, sei whale, and the sperm whale, as a result of proposed project construction are not anticipated because Mississippi Sound is a shallow area with an average depth of only 9.9 feet. It is unlikely that these protected whales would be in the Sound. Adverse impacts to sea turtles and/or piping plover are not expected because they would avoid the areas during construction activities.

Marsh restoration measures shall be incorporated into the project and shall be compatible with the goals of the Mississippi Coastal Program administered by the Mississippi Department of Marine Resources (MDMR) and the Mississippi Department of Wildlife, Fisheries and Parks. These goals

include protecting, propagating, and conserving the state's seafood and aquatic life, preserving coastal wetlands and ecosystems, and encouraging the preservation of natural scenic qualities in coastal areas.

A portion of the project areas are in Unit 8 of Gulf sturgeon critical habitat. However, due to the small area of habitat affected by the projects, the proposed action is not likely to result in the destruction or adverse modification of Gulf sturgeon critical habitat. A portion of the project areas are located in piping plover critical habitat. However, given the on-shore based nature of the projects and the lack of suitable habitat within the project limits, no adverse impacts on the habitat or the species are anticipated. If in the vicinity, the piping plover is anticipated to avoid the site during construction operations.

4.14 Hazardous, Toxic, and Radioactive Waste (HTRW)

Site inspections are currently being conducted at and adjacent to the various proposed coastal Mississippi projects. These assessments are being conducted per the requirements of ER 1165-2-132 entitled, Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects, and the American Society of Testing and Materials Standard E 1527.

Inspections are being conducted to determine the presence or evidence of landfills, surface areas unable to support vegetation, visible sheens of petroleum product, nearby contaminated industrial facilities, or any type of visible indication that HTRW concerns exist that may impact the proposed projects. Site inspections of adjacent properties, reviews of historic aerial photographs, and on site interviews are also being conducted to determine if HTRW concerns impact any of the proposed project areas. Additionally, environmental database record searches are being conducted to determine if they reveal any evidence of HTRW concerns within or adjacent to the areas of the proposed projects. Based on the findings of the HTRW site assessment, any specific or unusual environmental concerns that are identified that would affect the construction of the proposed project will need to be addressed appropriately. It should be noted that all environmental evaluations made during the above described site visits are limited due to the fact that subsurface conditions were not field investigated as part of the HTRW assessment. Subsurface evaluations may provide information different from the conditions implied by the stated observations.

These proposed project areas have been severely impacted by hurricane driven stormwater and winds. The potential for contamination resulting from the deposition of chemicals or petroleum products from hurricane damaged area businesses and industrial operations exist. Any such chemicals or petroleum products would likely have found their way to area canals, creeks, rivers and drainage ways. Prior to removal, sediment from these drainage ways would need to be tested for contamination before being placed in designated disposal areas.

4.15 Essential Fish Habitat

The proposed project is not anticipated to adversely alter the present EFH. The Gulf of Mexico Fishery Management Plans (1999) identifies EFH in the project area to be non-vegetated bottoms, shell reefs, and the estuarine water column. The Gulf of Mexico Fishery Management Council in accordance with the MSFCMA has developed management plans for the following fisheries: shrimp, red drum, reef fish, stone crab, spiny lobster, coral and coral reef and coastal migratory pelagic. Based on the extent of habitat in the general vicinity of the projects, the proposed projects will not significantly affect the coastal habitat identified as EFH or the species present.

The marsh creation projects would benefit many of the juvenile and larval stages listed by NMFS as managed species. As a result, it is anticipated that providing a nursery ground for juvenile fish and

crustaceans would enhance EFH. In addition, the marsh portion of the project is anticipated to increase nutrient processing through plant detrital mass influx. Transfer of this nutrient supply to higher trophic levels would further benefit the described managed species. Although, there would be temporary disruption of the aquatic community due to construction and disposal activities, non-motile benthic fauna within the area should repopulate within several months after the completion of the activities. Some of the motile benthic and pelagic fauna, such as crab, shrimp, and fish, are able to avoid the disturbed area and should return shortly after the activity is completed. The long-term impact of benefits gained by these organisms is anticipated to outweigh the short-term impact. The tidal marsh habitat would provide protection to larvae and juvenile species and offset erosion.

4.16 Implementation of Mitigation Action

No mitigation would be required as a result of implementing the proposed projects.

4.17 Cumulative Impacts

The CEQ regulations to implement the National Environmental Policy Act require the assessment of cumulative impacts in the decision-making process for federal projects assessment of cumulative impacts in the decision-making process for federal projects. Cumulative impacts are defined as “the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Cumulative impacts are considered for project alternatives, including the no-action alternative.

The impacts of Hurricane Katrina on coastal Mississippi were massive. Significant damages to the all environmental landscapes in the project area, such as, human, land and water morphology, and environmental resources occurred. Discussions about what types of landscape changes should and will take place in the months and years ahead in coastal Mississippi are currently being debated by society. The Governor of Mississippi’s Commission on Recovery, Rebuilding, and Renewal is seeking to give local leaders access to ideas and information on what their will look like in 5 to 30 years from now. It is likely a safe assumption that many parts of coastal Mississippi will continue to be coastal urban centers. It is also a safe assumption that development will likely have Katrina induced changes. Impacts attributed to potential future development in the project area will be a cumulative impact of the recommended MsCIP Near Term Improvements. How this development will affect the environment of coastal Mississippi depends on the nature of that development. The proposed MsCIP Near Term Improvements are not expected to add significant adverse cumulative impacts to Coastal Mississippi.

No Action. Implementing the no action alternative, over time, would have the potential to cause adverse impacts to coastal Mississippi. Damages caused by Hurricane Katrina would not be mitigated and would take many years if ever to be restored to the pre-Katrina conditions.

The proposed actions do not preclude any future actions for coastal Mississippi. Future projects that may occur within the project area would be evaluated in accordance with local, State and Federal environmental laws, regulations, and ordinances.

NEPA.

5.0 COASTAL ZONE MANAGEMENT

The MsCIP Near Term Improvements have been coordinated with Mississippi Department of Marine Resources (MDMR). The agency is fully aware of the proposed projects (near term and long-term) and has indicated informally indicated support these efforts. A determination of coastal zone consistency will be supplied to the MDMR along with a request for their concurrence. Concurrence by MDMR for the proposed projects being consistent with Mississippi Coastal Program is anticipated and action will not be taken until concurrence is received.

6.0 STATE WATER QUALITY CERTIFICATION

The proposed MsCIP Near Term Improvements have been coordinated with the Mississippi Department of Environmental Quality, Office of Pollution Control (MDEQ-OPC) during the MsCIP public and agency involvement process described in this EA. Pursuant to Section 401 of the Clean Water Act, a water quality certification will be requested. Issuance of the Water quality Certification from MDEQ-OPC for the propose projects is anticipated.

7.0 CONCLUSION

The proposed action presented in this EA is not expected to have any significant cumulative or secondary adverse impacts. The implementation of the proposed action would not have a significant adverse impact on the quality of the environment and an EIS is not required.

8.0 PUBLIC INVOLVEMENT, AGENCIES, INTERESTED GROUPS AND PUBLIC CONSULTED

Soon after Katrina struck coastal Mississippi, the Corps made and received contacts with local government officials, agencies, and the public regarding the impacts of the storm and conditions on the coast. These contacts were fostered by the working relationships established during the normal water resources activities conducted by Corps and the state and local governments. After the MSCIP authorization, the Corps sent multi-discipline project teams to each coastal Mississippi county and municipal area to assess damages and needs first hand and to discuss needs with local constituents. This coordination was a productive means for identifying needs and the brainstorming of ideas and opportunities.

To further solicit public input and collaborate with State, Federal, and local officials in gathering ideas, a facilitated two-step agency and public involvement process was used. Ten regional and public workshops were held between April 7 and May 4, 2006. A web-site, *www.MSCIP.usace.army.mil* was maintained as a repository of information and a vehicle to allow input to those who were displaced from there homes or could not attend the workshop opportunities. In addition, 2 webcasts were provided as an online alternative for participating in the project. The web-site was continually up and running for public information during the short project planning period. The dates and purposes of the workshops are outlined in Figure 8.1.

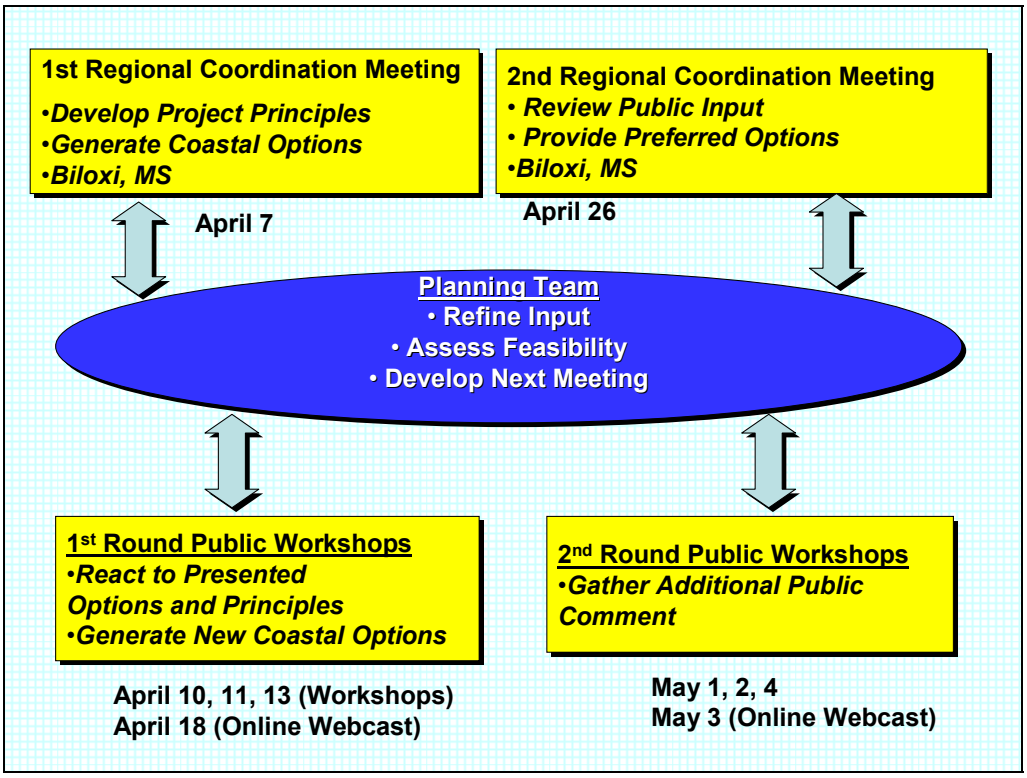


Figure 8.1. Schematic of the MsCIP public involvement process. The initial outreach by Mobile District staff is not shown but was a critical part of the process.

As a result of these public involvement actions, over 180 potential projects were identified. These were screened with evaluation criteria to select those areas that best met the requirements of being attributed to the storms of 2005, easily engineered and designed, consistent with regulatory and environmental standards, publicly acceptable, complimentary with local, state, and other Federal agency actions and cost effective. The near-term recommendations identified to date focus largely on improvements needed to assist with ongoing recovery and protection of critical infrastructure, residential and commercial properties, evacuation routes, and environmental resources while the comprehensive plan for increased levels of protection is being developed.

The *Environmental Assessment, Mississippi Coastal Improvements Program (MsCIP), Near Term Improvements, Hancock, Harrison, and Jackson Counties, Mississippi*, dated May, 2004 was mailed to Federal, State, local governments, and the interested public on May 19 for a 30-day review and comment period.

The comments received will be considered in the decision whether or not to prepare a Finding of No Significant Impact (FONSI).

9.0 ACRONYMS

BMP	Best Management Plan
CAA	Clean Air Act
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMIR	Coastal Mississippi Interim Report
CPICM	Comprehensive Plan for Improvements in Coastal Mississippi
Corps	U.S. Army Corps of Engineers
cys	cubic yards
DO	Dissolved oxygen
EA	Environmental Assessment
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
EPA	U.S. Environmental Protection Agency
ER	Engineer Regulation
EFH	Essential Fish Habitat
EPA	U.S. Environmental Protection Agency
ESA	Endangered Species Act
F	Fahrenheit
FEMA	Federal Emergency Management Agency
FMCs	Fisheries Management Councils
FONSI	Finding of No Significant Impact
fps	feet per second
HSDR	Hurricane Storm Damage Reduction
HTRW	Hazardous, Toxic, and Radioactive Waste
HWD	Hazardous Waste Division
LUST	Leaking underground Storage Tank
MDEQ	Mississippi Department of Environmental Quality

MDMR	Mississippi Department of Marine Resources
mg/l	milligrams per liter
MLLW	mean lower low water
mph	miles per hour
MSFCMA	Magnuson-Stevens Fishery Conservation and Management Act
MSNHP	Mississippi Natural Heritage Program
MS SHPO	Mississippi State Historic Preservation Officer
NAAQS	National Ambient Air Quality Standard
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NMFS	National Marine Fisheries Service
NOAA	National Oceanic Atmospheric Administration
OPC	Office of Pollution Control
ppt	part per thousands
RCRA	Resources Conservation and Recovery Act
SAV	submerged aquatic vegetation
TANF	Temporary Assistance for Needy Families
T&E	threatened and endangered
TED	Turtle Excluder Device
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USTs	Underground Storage Tanks
WRDA	Water Resources Development Act

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11.0 LIST OF PREPARERS

The following individuals listed below participated in the preparation of this EA.

US Army Corps of Engineers, Mobile District

Linda Brown, Biologist

Jennifer Jacobson, Biologist

Philip M. Payonk, Biologist

Larry Parson, Biologist

Dr. Susan I. Rees, Oceanographer

APPENDIX A

Section 404(B)(1) Evaluation Report for the Mississippi Coastal Improvements Program (MsCIP) Near Term Improvements

Hancock, Harrison, and Jackson Counties, Mississippi

I. Project Description

A. Location

Hurricane Katrina made landfall on August 29, 2005 near Buras-Triumph, Louisiana. Hurricane force winds extended outward 120 statute miles. Landfall of this storm placed coastal Mississippi in the northeast quadrant, the most destructive quadrant. Destruction spans along all three coastal counties – Hancock, Harrison, and Jackson. Most, if not all, of the infrastructure was destroyed by the hurricane south of Highway 90. South of Interstate-10 had massive flooding and infrastructure damage. Hurricane Katrina destroyed coastal regions of Louisiana, Mississippi, and Alabama making it the most destructive and costliest natural disaster in the history of the United States.

B. General Description

There are 15 projects included in the MsCIP Interim Report and Environmental Assessment as recommendations to Congress for Near Term Improvements to coastal Mississippi. They are listed in Table A-1. These Near Term Improvements can be categorized in the following groups:

- Seawalls and Bulkheads
- Beach Nourishment
- Marsh Creation/Restoration
- Purchase and Removal of Properties from Flood-Prone Areas
- Dredging.

Other projects or actions not recommended for the Interim Report to Congress will be reviewed for potential inclusion in the Final Report to Congress which will be submitted on December 30, 2007. An Environmental Impact Statement (EIS) will accompany the MsCIP Final Report. Further opportunity for public and agency review will occur during the environmental compliance process for the Final Report projects.

Table A-1.
Mississippi Coastal Improvements Program – Near Term Improvements

Project #	Project Name	Mission	County
2.3.1	Bayou Caddy	Ecosystem Restoration	Hancock
2.3.2	Hancock County Beaches	Hurricane &Storm Damage Reduction	Hancock
2.3.3	Hancock County Streams	Flood Damage Reduction & Ecosystem Restoration	Hancock
2.3.4	Jackson Marsh	Ecosystem Restoration	Hancock
2.3.5	Clermont Harbor	Hurricane & Storm Damage Reduction	Hancock
2.3.6	Downtown Bay St. Louis	Hurricane & Storm Damage Reduction	Hancock
2.3.7	Cowand Point	Hurricane & Storm Damage Reduction	Hancock
2.3.8	Long Beach Canals	Flood Damage Reduction	Harrison
2.3.9	Harrison County Beaches	Hurricane & Storm Damage Reduction& Ecosystem Restoration	Harrison
2.3.10	Courthouse Road	Flood Damage Reduction& Ecosystem Restoration	Harrison
2.3.11	Shearwater Bridge	Hurricane & Storm Damage Reduction	Jackson
2.3.12	Gautier Coastal Streams	Flood Damage Reduction& Ecosystem Restoration	Jackson
2.3.13	Pascagoula Beach Boulevard	Hurricane & Storm Damage Reduction & Ecosystem Restoration	Jackson
2.3.14	Upper Bayou Casotte	Flood Damage Reduction	Jackson
2.3.15	Franklin Creek Floodway	Flood Damage Reduction	Jackson

Note: The Project # refers to the section in this EA which describes the project.

These projects are addressed in the MsCIP Near Term Improvements Environmental Assessment (EA). The Corps will coordinate with Federal and State of Mississippi resource agencies during the required environmental compliance process. This report addresses potential water quality impacts that would potentially result from constructing the MsCIP Near Term Improvements projects in coastal Mississippi. For brevity, the project descriptions are not repeated but the reference is made to the appropriate section in the MsCIP Mear Term Improvements EA to which this Section 404(b)1 Evaluation is appended.

C. General Description of Dredged or Fill Material

(1) General Characteristics of Material. For the construction of the proposed seawalls, bulkheads, retaining walls, etc. some excavation of materials will be required to anchor the structures. The excavated materials will be used for backfilling the structures. Such materials will consist of fine sandy materials with a mixture of some silts. Other materials proposed for construction of these structures consists of vinyl sheetpile, gravel, and clean concrete rubble. Materials used for the beach restoration actions will consist of fine to medium grained sand that is compatible with existing beach sediments. Sandy material with a small silty component will be used where sediment is required for marsh restoration. Materials dredged from drainage channels and canals will likely contain soft, fine-grained, organic silts and clays with some fraction of sand. This material will be disposed in approved upland sites.

(2) Quantity of Material. For the beach restoration efforts it is estimated that a total of approximately 875,000 cubic yards will be required for the beach and dune construction at both the Pascagoula Beach Boulevard and Harrison County Beaches. Material will be required for the marsh restorations at both Bayou Caddy and Courthouse Road. Construction of the earthen containment dike Bayou Caddy will require about 120,000 cubic yards of material likely from an upland source. This material must have geotechnical properties suitable for dike construction. Local dredged materials are likely unacceptable for this dike construction. Fill within the containment structure will come from dredging of the Cadet Bayou Federal navigation channel. Approximately 120,000 cubic yards of dredged material fill will be required to fill to elevations suitable for the marsh creation.

Maintenance dredging of the Bayou Caddy navigation channel occurs approximately every 5 to 6 years. The amount of material dredged has varied from 123,739 CY to 234,877 CY. Under the proposed restoration project, maintenance dredging of the navigation project would be accomplished as scheduled under the next normal maintenance dredging. Approximately 50,000 cubic yards of clean concrete rubble will be placed at a breakwater adjacent to the earthen containment dike at the Bayou Caddy marsh restoration project. The rubble would be processed to remove all reinforcing steel. The marsh restoration at Courthouse Road will require approximately 1,500 cubic yards of fill material.

Volumes of materials dredged and excavated in association with the remaining MsCIP Near Term Improvement seawalls, bulkheads, and drainage channels are not yet to be determined. The materials excavated for these projects will used in construction as backfill or placed in an appropriate, existing, upland disposal area.

(3) Source of Material. Sand used for the Harrison County Beaches will borrowed from an existing offshore borrow area. The beach compatible sand has already been certified as compatible with the existing beach material. Sand required for the Pascagoula Beach Boulevard project will be trucked into place from an upland source yet to be determined. Material will be required for the marsh restorations at both Bayou Caddy and Courthouse Road. Sediment for Bayou Caddy will come from dredging of the adjacent Cadet Bayou Federal navigation channel. Sediment for Courthouse Road will come from removal of sandy material from the adjacent drainage outfall.

D. Description of the Proposed Discharge Site

(1) Location. The locations of any discharge areas associated with the projects described herein are addressed in Section B (General Description) of this report.

(2) Size. The discharge for the beach restoration projects range from 125 acres of dune for the 26-mile Harrison County Beaches project to a 7,700 stretch of beach for Pascagoula Beach Boulevard. The discharge area for the marsh restoration at Bayou Caddy is approximately 18 acres. The discharge area for the marsh restoration at the Courthouse Road project will be approximately 1/3 acres.

(3) Type of Site. Site types for the variety of projects described herein consist of beach, upland, and semi-contained marsh areas.

(4) Type of Habitat. Habitats exhibited in the proposed project areas include beach, marsh, and upland areas.

(5) Timing and Duration of Discharge. Timing and duration of the proposed action are dependent upon approval and funding of the projects and are yet to be determined.

E. Description of Disposal Method

Methods of placement and disposal for these projects will utilize hydraulic pipeline dredges, dump trucks, bucket dredges, and backhoes.

II. Factual Determinations (Section 230.11)

A. Physical Substrate Determinations.

(1) Substrate Elevation and Slope. Beach restoration projects will be designed to sustain elevations and slopes consistent with similar beaches in the vicinity that has been sustained under the typical energy climate. Beach elevations will be constructed to a 3.5-foot elevation with a 1:10 slope on the foreshore. Dune elevations will be constructed to a maximum elevation of 10 feet with 1:3 slope. Elevations of materials used for marsh restoration will be placed at elevation conducive to the growth and survival of native marsh vegetation.

(2) Sediment Type. For the construction of the proposed seawalls, bulkheads, retaining walls, etc. some excavation of materials will be required to anchor the structures. The excavated materials will be used for backfilling the structures. Such materials will consist of fine sandy materials with a mixture of some silts. Other materials proposed for construction of these structures consists of vinyl sheetpile, gravel, and concrete. Materials used for the beach restoration actions will consist of fine to medium grained sand that is compatible with existing beach sediments. Sandy material with a small silty component will be used where sediment is required for marsh restoration. Materials dredged from drainage channels and canals will likely contain soft, fine-grained, organic silts and clays with some fraction of sand. This material will be disposed in approved upland sites.

(3) Dredged/Fill Material Movement. Fill material would be pumped or trucked directly onto the beach sites. It is expected that a readjustment phase will occur and sand materials redistributed to form a more natural profile. Marsh restoration areas will utilize material that may contain a higher percentage of fine grained materials. Silt fences/curtains and other best management plans (BMPs) will be utilized to reduce material movement during heavy equipment operations. A large quantity of material would be used to create marsh habitat at the Bayou Caddy site. Material placed for the earthen containment dike will be placed using BMPs to reduce losses of material. The containment dike and associated weirs will contain the dredged material discharged to the interior of those structures with minimal transport into the immediate environment. It is believed that no adverse impacts would occur from movement of materials.

Physical Effects on Benthos. There would be temporary disruption of the aquatic community as a result of the proposed projects being constructed. Areas where sand and sediments are laid directly upon the bottom open-water habitat to create marsh or restore beaches may result in destruction of sessile benthic fauna. Non-motile benthic fauna within the project sites would be lost as a result of the organisms not being able to penetrate through the thick layer of dredged material that will be used to construct the tidal marsh and sand placement for beach restoration. This loss of sessile benthic fauna would be minor due to the tidal marsh area beach restoration area encompassing only a small percentage of the entire Mississippi Sound (approximately 750,000 acres). Benthic fauna, such as crabs, are anticipated to re-colonize the area upon marsh construction and in addition, should provide aquatic habitat for various motile and non-motile benthic fauna. The inter-tidal zone and sub-tidal zones along the restored beach should provide rapid recovery of and recruitment of benthos. The marsh would provide additional nursery area along the outer fringes suitable for fishes following the proposed activities. Non-motile benthic fauna within the project area may be destroyed by the proposed dredging operations, but should repopulate within several months after dredging is complete and due to the size of the overall dredging projects, should be discountable. The impacts associated with the construction of seawalls and bulkheads are anticipated to be a permanent loss as the substrate from the base of the existing seawall out approximately two feet and for the total distance of the projects will be removed from potential use by benthos. While this impact is permanent, the impact to benthos is insignificant due to the large amount of available habitats in the remainder of Mississippi Sound, St. Louis Bay, and other associated small water bodies.

Other effects. No other effects are anticipated.

Actions Taken to Minimize Impacts (Subpart H). Actions will be taken to minimize impacts to all project areas during the construction and maintenance activities. Silt curtains will be used at this disposal sites, where applicable, to minimize turbidity and curtail migration of disposed material during maintenance activities. Borrow material used in construction will utilized in such a manner to minimize impacts to surrounding areas. BMPs, such as silt fences, will be implement to minimize impacts where possible. No other actions to minimize impacts to the physical substrate are deemed appropriate for these projects.

B. Water Column Determinations

(1) Salinity. Salinity would not be adversely impacted as a result of the identified projects.

(2) Water Chemistry (pH, etc.). All sediment and material used in the construction of the identified projects will be clean materials removed from sources of contamination and considered contaminant free. Such material will have no effect on surrounding water chemistry.

(3) Clarity. Construction of the beaches and tidal marshes will reduce water clarity due to elevated suspended sediments in the water column; however, silt curtains will be used, where applicable, to minimize impacts to the project area. Minor increases in turbidity may be experienced in the immediate vicinity of the project areas during construction and disposal operations. However, these increases will be temporary and would return to pre-project conditions shortly after completion. In fact, the proposed project may improve water clarity because particles tend to settle out of the water column at tidal marsh areas.

(4) Color. No effect.

(5) Odor. No effect.

(6) Taste. No effect

(7) Dissolved Gas Levels. Temporary decreases in dissolved oxygen will likely result from some of the construction operations, but this will only be of a short duration. No long-term effect to the water column is anticipated. The construction activities and the return water from the upland sites are not anticipated to adversely impact dissolved gas levels.

(8) Nutrients. Slight increases in nutrient concentrations may occur from the proposed operations; however, these concentrations would be rapidly dispersed. These described increases would have no significant effect to the water column.

(9) Eutrophication. Many of the projects will improve water circulation, drainage, and tidal exchange which will act to prevent and/or minimize eutrophication effects.

C. Water Circulation, Fluctuation, and Salinity Gradient Determinations

(1) Current Patterns and Circulation.

(a) Current Patterns and Flow. Expansion, haul out, and placement of fill material in association with the proposed projects are not anticipated to impede flows. Those project involving improved drainage and tidal exchange will restore water flow, thus preventing flooding and improving marsh habitat. The subsequent return water flow is also not anticipated to affect current patterns and flow in the vicinity of the beach and seawall projects. No adverse impacts are anticipated to occur at any of the project sites.

(**b) Velocity.** Improved flow velocities are intended within the various outfalls and drainage channels. The improved flow will have beneficial affects and act to prevent flooding as well as increasing tidal exchange between Mississippi Sound and adjacent marshes. No adverse impacts are anticipated due to velocity.

(2) Stratification. No effect.

(3) Hydrologic Regime. No effect.

(4) Normal Water Level Fluctuations. Improved drainage capability will prevent the build up and subsequent flooding caused by storms and extreme rain events. No negative effect.

(5) Salinity Gradient. Salinity in Mississippi Sound is highly variable due to the inflow of freshwater from surrounding rivers and the tidal influence from the Gulf of Mexico. The proposed project and associated return water flows would have no significant effect on salinity gradient.

D. Suspended Particulate/Turbidity Determination

(1) Expected Changes in Suspended Particulates and Turbidity Levels in Vicinity of Placement Site. The placement of dredged material at the proposed marsh creation project will reduce light penetration through the water column, thereby reducing photosynthesis and surface water temperatures. These conditions could potentially alter visual predator-prey relations in the immediate project vicinity. In addition, sediment adheres to fish gills, resulting in respiratory stresses, and natural movement of eggs and larvae could be potentially altered as a result of the sediment adherence. These are minor, short-term impacts due to the short duration of construction activities. Construction of seawalls and bulkheads would reduce sediment movement and turbidity resulting from the failure of existing seawalls and bulkheads. Changes in substrate are not expected nor will any deleterious materials be added to the sediment during construction activities. A reduction of wave-induced erosion associated with seawall and bulkhead projects is expected. Although it is expected an initial high volume loss of sand from the beach restoration project would occur, it is expected that sand movement would decrease once equilibrium is naturally achieved. It is expected that distinct bars would develop nearshore by the nature of the waves and depths within the project vicinity and could potentially result in a seaward expansion.

(2) Effects on Chemical and Physical Properties of the Water Column.

(a) Light Penetration. Light penetration through the water column at the proposed sites may be temporarily affected but is anticipated to return to previous conditions upon completion of operation activities. At the tidal marsh creation sites, light will be obstructed from penetrating through the existing water column. Upon establishment of this tidal marshes, water clarity is anticipated to increase. As a result, light penetration through the water column will be increased in the project vicinity. Light penetration may also be temporarily impeded in areas immediately adjacent to the beach restoration and seawall restoration sites due to an increase in turbidity levels. These increases are considered to be minor and no impact to light penetration is anticipated by the proposed projects.

(b) Dissolved Oxygen. No effect.

(c) Toxic Metals and Organics. Site inspections are currently being conducted by the U. S. Army Corps of Engineers, Mobile District, Environmental and Hazardous and Toxic Waste and Support Section, at and adjacent to the various proposed Coastal Mississippi Projects. These assessments are being conducted per the requirements of Engineer Regulation (ER) 1165-2-132 entitled, Hazardous, Toxic, and Radioactive Waste (HTRW) Guidance for Civil Works Projects, and the American Society of Testing and Materials Standard E 1527.

Inspections are being conducted to determine the presence or evidence of landfills, surface areas unable to support vegetation, visible sheens of petroleum product, nearby contaminated industrial facilities, or any type of visible indication that HTRW concerns exist that may impact the proposed projects.

Site inspections of adjacent properties, reviews of historic aerial photographs, and on site interviews are also being conducted to determine if HTRW concerns impact any of the proposed project areas.

Additionally, environmental database record searches are being conducted to determine if they reveal any evidence of HTRW concerns within or adjacent to the areas of the proposed projects.

Based on the findings of the HTRW site assessment, any specific or unusual environmental concerns that are identified that would affect the construction of the proposed project will need to be addressed appropriately.

It should be noted that all surficial environmental evaluations made during the above described site visits are limited due to the fact that subsurface conditions were not field investigated as part of the HTRW assessment and may differ from the conditions implied by the surficial observations.

These proposed project areas have been severely impacted by hurricane driven storm water and winds. The potential for contamination resulting from the deposition of chemicals or petroleum products from hurricane damaged area businesses and industrial operations exist. Any such chemicals or petroleum products would likely have found their way to area canals, creeks, rivers and drainage ways.

Prior to removal, sediment from these drainage ways would need to be tested for contamination before being placed in designated disposal areas.

(d) Pathogens. No effect.

(e) Esthetics. No effect.

(3) Effects on Biota. The proposed beach and marsh restoration projects are designed to enhance the ecosystems. These actions will increase valuable habitat resulting in an overall improvement and continued health of the local wildlife.

(a) Primary Production Photosynthesis. No effect.

(b) Suspension/Filter Feeders. No effect.

(c) Sight Feeders. Shorebirds tend to be attracted to established beach/dune systems. Other disposal sites and placement activities are attractive to many sight feeders due to the presence of food items in the dredged material. Impact of these operations at the upland, beach, and marsh sites on sight feeders is expected to be a beneficial, short-term effect. No adverse impacts are anticipated to occur to sight feeders resulting from the proposed projects.

(4) Actions Taken to Minimize Impacts (Subpart H). No further actions are deemed appropriate.

E. Contaminant Determinations

The dredged material used in the construction of the proposed projects consists of marine sand and sediments, gravel, and concrete from sources removed from contamination. Previous operations and water quality certifications of similar project in this region has found that the material are free of contaminants.

F. Aquatic Ecosystem and Organism Determinations

No effect.

(1) Effects on Plankton. No effect.

(2) Effects on Benthos. Temporary disruption of the aquatic community is anticipated at the beach and marsh restoration sites. Non-motile benthos at areas where materials will directly covering water bottom would be destroyed. Non-motile benthic fauna within these areas will be lost as a result of the organisms not being able to penetrate through the thick layer of fill material that will be used to construct the tidal marsh and beaches. This loss would be minor due to the tidal marsh area encompassing only a small percentage of the entire Mississippi Sound (approximately 750,000 acres). Benthic fauna, such as crabs, are anticipated to rapidly re-colonize these areas upon construction of the marsh. Non-motile benthic fauna within other construction and disposal areas may be destroyed by the proposed operations, but should repopulated within several months after completion. Motile benthic and pelagic fauna, such as crabs, shrimp, and fishes, are able to avoid the disturbed area and should return shortly after the activity is completed. Larval and juvenile stages of these forms may not be able to avoid the activity due to limited mobility. Construction and maintenance activities at the proposed sites are anticipated to have no significant effects to the benthos.

(3) Effects on Nekton. Nekton will be able to avoid the construction and disposal activities; therefore, no adverse impacts are anticipated.

(4) Effects on Aquatic Food Web. No effect.

(5) Effects on Special Aquatic Sites. Not applicable.

(a) Sanctuaries and Refuges. Not applicable.

(b) Wetlands. The marsh restoration sites will result in numerous positive benefits.

(c) Mud Flats. Not applicable.

(d) Vegetated Shallows. Not applicable.

(e) Coral Reefs. Not applicable.

(f) Riffle and Pool Complexes. Not applicable.

(6) Effects on Threatened and Endangered Species. Federally protected species, such as the Louisiana black bear, gopher tortoise, eastern indigo snake, Mississippi sandhill crane, red-cockaded woodpecker, and the yellow-blotched map turtle, would not be adversely impacted by construction of the proposed projects as it is believed they are not present at the project sites. Furthermore, these motile species would be able to avoid the project areas. The bald eagle and brown pelican are also anticipated to avoid the area during operations.

The Mobile District does not anticipate any adverse impacts to Federally protected species, such as the blue whale, finback whale, humpback whale, sei whale, and the sperm whale, as a result of project construction because Mississippi Sound is a shallow area with an average depth of only 9.9 feet. It is unlikely that these protected whales would be in the Sound. The Mobile District does not anticipate any adverse impacts to occur to sea turtles and/or piping plover because they would avoid the areas during construction activities.

Marsh creation measures shall be incorporated into the project and shall be compatible with the goals of the Mississippi Coastal Program administered by the Mississippi Department of Marine

Resources and the Mississippi Department of Wildlife, Fisheries and Parks. These goals include protecting, propagating, and conserving the state's seafood and aquatic life, preserving coastal wetlands and ecosystems, and encouraging the preservation of natural scenic qualities in coastal areas. The marsh creation sites would be monitored for a minimum of five years and compared to healthy aquatic vegetation sites to determine success.

(7) Effects on Other Wildlife. Hurricane Katrina and the associated storm surge resulted in numerous adverse impacts to existing wildlife and wildlife habitat. The proposed projects should enhance overall wildlife and associated habitats. Construction activities may result in temporary impacts to existing vegetation in the immediate areas; however it is expected all impacts would be short term and minor, and in some cases discountable. No adverse impacts are anticipated to occur as a result of the proposed projects.

(8) Actions to Minimize Impacts. No further action anticipated.

G. Proposed Disposal Site Determinations

(1) Mixing Zone Determination. The State of Mississippi will specify a mixing zone not to exceed ambient turbidity by more than 50 nephelometric turbidity units at the outer limits of 750 feet for turbidity compliance. Turbidity from material placed in or near the water is anticipated to quickly settle out of the water column. Thus, not exceeding the proposed water quality criteria issued. No adverse impacts are anticipated from disposing of material at upland sites. Thus, no mixing violations are expected.

(a) Depth of water at the disposal site. Placement of material associated with beach and marsh restorations will be along the shoreline or nearshore waters

(b) Current velocity, direction, and variability at disposal sites. No effect.

(c) Degree of turbulence. No effect.

(d) Stratification attributable to causes such as obstructions, salinity or density profiles at the disposal site. No effect.

(e) Discharge vessel speed and direction, if appropriate. No effect.

(f) Rate of discharge. Rate of discharge will vary according to the particular type of equipment placing materials and will have no effect.

(g) Ambient concentrations of constituents of interest. Not applicable.

(h) Dredged material characteristics, particularly concentrations of constituents, amount of material, type of material (sand, silt, clay, etc.) and settling velocities. For the construction of the proposed seawalls, bulkheads, retaining walls, etc. some excavation of materials will be required to anchor the structures. The excavated materials will be used for backfilling the structures. Such materials will consist of fine sandy materials with a mixture of some silts. Other materials proposed for construction of these structures consists of vinyl sheetpile, gravel, and concrete. Materials used for the beach restoration actions will consist of fine to medium grained sand that is compatible with existing beach sediments. Sandy material with a small silty component will be used where sediment is required for marsh restoration. Materials dredged from drainage channels and canals will likely contain soft, fine-grained, organic silts and clays with some fraction of sand. This material will be disposed in approved upland sites.

(i) Number of discharge actions per unit of time. The number of discharge actions per unit of time will vary depending upon particular project activity.

(2) Determination of Compliance with Applicable Water Quality Standards. Coordination will be conducted with the appropriate regulating agencies to be in compliance with all applicable water quality standards.

(3) Potential Effects on Human Use Characteristics.

(a) Municipal and Private Water Supply. Not applicable.

(b) Recreational and Commercial Fisheries. Recreational and commercial fishing would be temporarily impacted primarily as a result of the physical presence of heavy equipment during operation activities. Limited navigation would occur at the offshore borrow site and the Bayou Cadet navigation channel during dredging operations. However, navigation in this area was restricted to primarily to recreational boaters and when comparing this small limitation to all other accessible areas within Mississippi Sound, the impacts are insignificant.

(c) Water Related Recreation. No effect.

(d) Esthetics. Esthetics will be temporarily reduced in the immediate vicinity of the proposed project sites. Many recreational vessels utilize Mississippi Sound within the project vicinities and it is believed some residents and visitors may be disturbed by the presence of the heavy equipment during construction. However, construction activities are temporary in nature so the disturbance is anticipated to be minimal. Furthermore, upon project completion, the projects should provide residents and visitors with a more esthetically pleasing view. The proposed marsh creation and beach restoration projects would provide additional habitat to numerous marine birds. The sediment and debris removal from interior drainage ways and along Mississippi Sound should provide for enhanced flushing of the systems and less stagnant, clearer waters. It is expected that seawall and bulkhead construction would result in slight changes to the appearance of the shorelines in the project vicinities, primarily as it is viewed from the water, and would slightly improve overall esthetic quality as existing seawalls are crumbling in places and in some cases, destroyed. From an environmental viewpoint, the proposed projects are anticipated to enhance Coastal Mississippi and its diverse aquatic habitats while providing a moderate degree of protection.

(e) Parks, National and Historical Monuments, National Seashores, Wilderness Areas, Research Sites, and Similar Preserves. No effect.

(4) Other Effects. No effect.

H. Determination of Cumulative Effects on the Aquatic Ecosystem

The proposed actions are not expected to have significant cumulative adverse impacts

I. Determination of Secondary Effects of the Aquatic Ecosystem.

The proposed actions are not expected to have any significant secondary adverse effects on the aquatic ecosystem

III. Finding of Compliance with the Restrictions on Discharge

A. No significant adaptations of the Section 404(b)(1) guidelines were made relative to this evaluation.

B. The proposed project represents the least environmentally damaging practicable alternative.

C. The planned construction activities and placement of dredged materials would not violate any applicable State water quality standards; nor will it violate the Toxic Effluent Standard of Section 307 of the Clean Water Act (CWA). Appropriate evaluation of analytical and ecotoxicological testing of sediments, site water, and elutriates results revealed that no adverse impacts would result from the proposed disposal actions.

D. Use of the proposed disposal sites will not jeopardize the continued existence of any Federally-listed endangered or threatened species or their critical habitat.

E. The proposed placement of dredged material will not contribute to significant degradation of waters of the United States. Nor will it result in significant adverse effects on human health and welfare, including municipal and private water supplies; recreation and commercial fishing; life stages of organisms dependent upon the aquatic ecosystem; ecosystem diversity, productivity and stability; or recreational, aesthetic or economic values.

F. Appropriate and practicable steps will be taken to minimize potential adverse impacts of the discharge on the aquatic ecosystem.

DATE: 26 June 06

Peter F. Taylor, Jr.

Colonel, Corps of Engineers

District Commander

APPENDIX B
PUBLIC AND AGENCY REVIEW AND COMMENT OF THE ENVIRONMENTAL ASSESSMENT

The *Environmental Assessment, Mississippi Coastal Improvements Program (MsCIP), Near Term Improvements, Hancock, Harrison, and Jackson Counties, Mississippi,* dated May, 2004 was mailed to Federal, State, local governments, and the interested public on May 19 for a 30-day review and comment period. The distribution of the EA to the public also included the MsCIP Interim Report, Project Implementation Reports for each Near Term Improvement, and Engineering, Economics, Cost, and Real Estate Appendices.

Comments on the EA and other MsCIP report documents were received from the following. Copies of the comment letters are attached at the end of this section:

Federal Agencies
U.S. Environmental Protection Agency
U.S. Department of Commerce
    National Marine Fisheries Service (2 comments)
U.S. Department of the Interior
    National Park Service
    Fish and Wildlife Service
    U.S. Geological Survey (2 comments)

Local Government
Hancock County, Board of Supervisors

The following sections summarize comments made and Corps responses to those comments. These comments were considered in the preparation of the Finding of No Significant Impact (FONSI).

1. U. S. Environmental Protection Agency, Region 4, Water Management Division, letter dated June 19, 2006.

1a. Comment:
The U.S. Environmental Protection Agency, Region 4 (EPA) appreciates the opportunity to review and provide comments on the U.S. Army Corps of Engineers' (USACE) Environmental Assessment, Mississippi Coastal Improvements Program, Near-Term Improvements, for Hancock, Harrison, and Jackson Counties, Mississippi dated May 2006. This document was in response to Congress' directive for USACE to:

> *"conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion and other related water resources…"*

Response:
Noted. We thank EPA Region 4 for their review.

1b. Comment:

It was encouraging to see USACE embrace the concept that the natural coastal environment was "an existing improvement." The Congressional directive focused on "existing improvements." The concept of an "existing improvement" was defined by the breadth of 15 Near Term Project Development (NTPD) projects selected in the draft interim report. These projects included manmade alterations to the natural environment (repair of seawalls, scour protection to seawalls (rip-rap), cleaning out drainage canals, and removal of house pads and mobile homes) and the pre-hurricane natural environment landscape (marsh re-establishment, re-establishment of sand dunes, and hydraulic connections to interior estuarine habitats).

Response:

The people of coastal Mississippi identified what was important to them and the natural environment landscape was high on their list. This facilitated focus on the environmental restoration measures.

1c. Comment:

The USACE is to be congratulated for the development of the draft interim report in such a short time frame. The EPA was notified of this activity in late March and received the draft document less than three weeks ago. We understand the short review period necessary to meet the Congressional deadlines. Therefore, EPA would like make the following observations and suggestions.

Response:

We appreciate the EPA efforts and response in light of the short review period.

1d. Comment:

The existing NTPDs include projects that protect the existing evacuation routes and heavily used coastal roadways, restore flow to major channels that drain the coastal communities, and restore marsh and sand dune habitat. The NTPDs appear to simply replace the pre-hurricane and storm damaged features. EPA would like to suggest improvements to these pre-2005 features. It was Einstein who said "We can't solve problems by using the same kind of thinking we used when we created them." The manmade structures for Hurricane and Storm Damage Reduction, Flood Control and Ecosystem Restoration should include more than what was put into them before the 2005 storms hit or the same result should be expected.

Response:

We understand the comment. It is a similar theme we have heard from other sources, such as can't you do more or do it better. The schedule imposed by Congress and the wish to actually implement recovery actions in the near term limited what could be recommended. Careful thought was given to find improvements that were meaningful and implementable within the mandated constraints. The goal of the MsCIP Comprehensive Plan is to develop broader more open recommendations. Recommendations which are not limited by the same constraints as the Near Term Improvements.

As a result of the MsCIP public and agency process, over 190 potential recovery and restoration improvements or ideas for coastal Mississippi were identified. As a management tool, the improvements were divided in terms of near term (otherwise known as 'low hanging fruit') and long-term improvements. The near term improvements are those activities which contribute to the recovery of coastal Mississippi and can be implemented in the near term without significant engineering, economic, and environmental impacts and controversy. The Near Term Improvements and those to be evaluated and recommended in the Final Report are all part of the same MsCIP authorization. Accordingly, proposed Near Term Improvements have been screened using criteria that they would not preclude other future options that may have a higher level of contribution, and/or that would take a longer timeframe to study and construct. MsCIP Near Term Improvements should contribute to both the short-term and longer-term recovery of coastal Mississippi. Near Term

Improvements should contribute to an overall comprehensive plan for hurricane storm damage reduction of the coast of Mississippi as identified in the State's long-term recovery plan.

1e. Comment:

To this end, the EPA suggests the NTPRs Ecosystem Restoration component should be expanded to include (1) re-establishment of off-shore barrier islands; and (2) the Hurricane and Storm Damage and Flood Control components should include comprehensive watershed management measures that would restore a more natural hydrologic flow to the managed channels, rivers and bayous.

Response:

We concur that the items mentioned are important. However, they could simply not be implemented as Near Term Improvements for many reasons. These will be considered in the MsCIP Comprehensive Plan.

1f. Comment:

The NTPRs should include re-establishment of the off-shore barrier islands off the Mississippi coastline that existed prior to hurricane Katrina. There are aerial photographs that can show the location and shapes of these important natural improvements. Sands from outside the immediate coastal system could be tapped and brought into the coastal system. These barrier islands provide very important energy dissipation and protection of the near shore, shore and terrestrial shore areas. These systems are also important habitats for aquatic dependent wildlife for spawning and feeding habitats. The loss of these off-shore barrier island were due to the 2005 storms; should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective. These natural features would be in the interest of hurricane and storm damage reduction, preservation of fish and wildlife, and prevention of erosion.

Response:

We concur that the Mississippi Barrier Islands are important natural systems. Barrier Island "restoration or improvements" will be evaluated for the MsCIP Comprehensive Plan. These barrier islands are all located within the boundaries of Gulf Islands National Seashore, and two of the islands, Horn and Petit Bois, have been designated as Wilderness Areas. These barrier islands are administered under NPS laws such as the Organic Act of 1916, Wilderness Act of 1962, and the park's Enabling Legislation as well as NPS Policies such as Directors Order 41 and the 2001 NPS Management Policies. Large-scale manipulation of the barrier islands will be a major deviation of management policy described in these documents.

Accordingly, these actions will require significant coordination with the NPS as well as other agencies and could not be implemented as Near Term Improvements.

1g. Comment:

Near shore sand volumes could be increased with the addition of sand covering with dune vegetation planting over the scour protection along the seawalls to project such as Downtown Bay St. Louis, Clarmont Harbor, Cowand Point, Shearwater Bridge, and Pascagoula Beach, were applicable. Near shore sand volumes are critical to the dynamics of coastal systems. These sand volumes with sand dune vegetation are the first line of defense to erosion. When the water is carrying sediment, especially sand, its energy is partially tied up in the transportation of the sand and has less energy available for erosion or scouring. The additional sand and dune vegetation would provide limited habitat opportunities for the shore-terrestrial edge fauna. The replacement of the scour protection lost to the 2005 storms; and the replacement or additional scour protection along the seawalls should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective.

Response:
Noted. The Near Term beach projects proposed are the most that could be expected to be accomplished within the existing regulatory and environmental standards. A review of sediment budgets for the barrier islands is planned for the MsCIP Comprehensive Plan.

1h. Comment:
Several of the projects including Hancock County Streams, Downtown Bay St. Louis, Long Beach, Courthouse Road, Gautier Coastal Streams, and Upper Bayou Casotte, should have their scope expanded to include watershed restoration to reduce flood damage through comprehensive improvements or modifications of existing conditions. This should include watershed plan implementations increasing natural ground cover, decreasing impervious cover, vegetating open channels, construction of wetland areas, retention and detention ponds and vaults, reduction of hydraulic connectivity of impervious surfaces, rooftop greening, rain barrels, vegetated filter strips, and street surface and subsurface storage. Reductions in future flood damage could come from re-establishment of a more nature hydrology from storm water. These practices should significantly decrease storm water run-off, increase water quality, provide much needed marsh communities along the conveyance system and provide habitat for many coastal fauna. These activities would result in comprehensive improvements to the watershed in the interest of storm damage reduction, prevention of saltwater intrusion, preservation and enhancement of fish and wildlife resources, prevention of erosion, and improve water quality. The flooding was due to the 2005 storms; the improvement and/or modifications to the stormwater management within these watersheds should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective.

Response:
Noted. We concur with the need to evaluate coastal Mississippi watersheds from a watershed systems approach. However, for the Near Term Improvements, there was not enough time to acquire and analyze the information needed for a watershed approach. Accordingly, these considerations had to be deferred for evaluation in the longer-term MsCIP Comprehensive Plan.

1i. Comment:
Longer bridges, more and/or larger culverts, and flatter channel side slopes should be considered for the restoration of Downtown Bay St. Louis, Long Beach Canals, Courthouse Road, Shearwater Bridge, Gautier Coastal Streams, and Upper Bayou Casotte. Increased water conveyance should be created along these drainage features where it counts the most, in the floodplain area. Increased conveyance reduces flooding potential upstream. Larger conveyance in the flood plain provides for more sediment transport through the system. Culverts and bridges with causeways narrow waterways resulting in hydrological bottle necks. These bottle necks slow water down. The water drops its sediment load as the water speeds slow down. This new bedload reduces conveyance cross-sections of the drainage feature. This results in more frequent maintenance expenses and flooding potentials. Such modifications should be consistent with a comprehensive improvement or modification to the existing conditions that resulted from the hurricane and storm damage. These modifications should result in the reduction of future hurricane and storm damage from flooding. All of these projects had impacts from the 2005 storms. All these recommended modifications should be seriously considered for engineering and design. These recommended modifications should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions and cost effective.

Response:
Noted. Please see the response to the previous comment. However, for the Near Term Improvements, there was not enough time to acquire and analyze the information needed for

adequate design of these features. Accordingly, these considerations had to be deferred for evaluation in the longer-term MsCIP Comprehensive Plan.

1j. Comment:
And finally, when considering an analysis and design for "comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, …., preservation of fish and wildlife, prevention of erosion, and other related water resource purposes…" there should be a comprehensive analysis of the sand budget along the Mississippi near shore area. The natural migration of sand westward along the Gulf coast has been disrupted by the deep water channels that are Federally maintained for marine transportation needs. This sand is important for forming off-shore barrier islands, replenishing beaches and sand dunes are very important for hurricane and storm damage protection. A comprehensive plan for the entire Mississippi shore line would fill this need. From a comprehensive view all these Near-Term projects and existing Federal projects should be analyzed and maintained with a more holistic perspective.

Response:
Concur. The Comprehensive Plan will consider a regional sediment management plan to the extent possible within the time frame given for the MsCIP Comprehensive Plan.

1k. Comment:
Thank you again for the opportunity to comment on this very important activity.

Response:
We appreciate EPA's review and comments.

2. U.S. Department of the Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, FL, letter dated June 21, 2006.

2a. Comment:
This letter is to confirm receipt of materials regarding the Mississippi Coastal Improvements Program (MsCIP) received by the National Marine Fisheries Service (NMFS) Protected Resources Division on June 16, 2006. Your letter requested comments no later than June 19, 2006.

Response:
We do not understand why the Protected Resources Division did not receive the MsCIP Interim Report (IR) and Environmental Assessment (EA) until June 16, 2006. Hard copies of the MsCIP IR and EA were provided to Dr. Crabtree, NMFS, Southeast Regional Administrator and Mr. Miles Croom also of the Southeast Regional Office. In addition, the MsCIP Interim Report and the EA were made available on May 20 via the MsCIP website. We informed the NMFS Southeast Regional Office, Protected Resources Division of the availability of these documents via the website on May 22, 2006.

2b. Comment:
Enclosed is a list of federally-protected species and designated critical habitat under NMFS' jurisdiction that may occur with the MsCIP project area. Our preliminary analysis has determined that significant impacts to federally-listed species and/or designated critical habitat may result from the proposed action.

Given the delay in receiving the materials and the comment deadline, NMFS is requesting a 30-day-extension in order to provide comments pursuant to Section 7 of the Endangered Species Act.

Response:
All species provided in the list of federally-protected species are included and addressed in the MsCIP Near Term Improvements Environmental Assessment.

The MsCIP Near Term Improvements EA contains a determination of no effect on federally-listed endangered species. The Near Term Improvements were selected on the basis of projects either having previous endangered species coordination or having no adverse effects on federally-listed species. It is our understanding that written concurrence from the NMFS is not required that the proposed actions will have no effect on listed species or critical habitat. Accordingly, the Corps is preparing a Finding of No Significant Impact for the MsCIP Near Term Improvements. The MsCIP mandate from Congress is to prepare an Interim Report including the EA and FONSI by June 30, 2006. The Corps of Engineers will complete that mission.

As the MsCIP Near Term Improvements are currently only recommendations and not yet Congressionally authorized projects, there exists opportunity for NMFS to provide comments and input into regarding these important actions. If you have questions regarding the MsCIP Near Term Improvements or the development of a Comprehensive Plan please contact the Mobile District, U.S. Army Corps of Engineers.

3. U.S. Department of the Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Habitat Conservation Division, Panama City Office, e-mail dated June 22, 2006.

3a. Comment:
NOAA's National Marine Fisheries Service, Habitat Conservation Division (NMFS-HCD), has reviewed the Draft Interim Report (DIR) dated May 2006, for the Mississippi Coastal Improvement Program Hancock, Harrison, and Jackson Counties, Mississippi. Generally, we support the Near Term Project Recommendations for the 15 projects identified in the DIR and, pursuant to the essential fish habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act, have no specific EFH conservation recommendations to provide at this time. We appreciate the opportunity to review the DIR and should there be any changes or as more specific details become available please coordinate with Mark Thompson at our NMFS-HCD Panama City Office.

Response:
Noted. We thank NMFS-HCD for their review. Should there be any changes in these projects we will coordinate as requested.

4. U.S. Department of the Interior, National Park Service, Southeast Regional Office, Atlanta, GA, letter dated June 19, 2006.

4a. Comment:
The National Park Service, Southeast Region has read and reviewed the Mississippi Coastal Improvements Program (MsCIP) Draft Interim Report and Environmental Assessment (EA). In as much as we understand the near term improvements will have no impact on National Park lands or waters based on available information, we have no comments to make on the near term recommendations at this time.

Response:
Noted. The near term improvements will not impact National Park lands or waters.

4b. Comment:
However, we have concerns relative to the comprehensive study plans.

This Interim Report lists on page 70 (and pages vi-vii) several plans of study for long term comprehensive improvements to coastal Mississippi. One of these study plans is an analysis of barrier islands as a hurricane and storm damage reduction feature. These barrier islands are all located within the boundaries of Gulf Islands National Seashore, and two of the islands, Horn and Petit Bois, have been designated as Wilderness Areas. These barrier islands are administered under NPS laws such as the Organic Act of 1916, Wilderness Act of 1962, and the park's Enabling Legislation as well as NPS Policies such as Directors Order 41 and the 2001 NPS Management Policies. Large-scale manipulation of the barrier islands will be a major deviation of management policy described in these documents.

Superintendent Eubanks from Gulf Islands National Seashore and park staff have met with Mississippi state officials and U.S. Army Corps of Engineers representatives on several occasions and expressed NPS concerns regarding plans for long-term improvements for the Mississippi barrier Islands. A copy of his February 3 letter is attached.

Response:
Noted. Analysis or evaluation of the Barrier Islands as Hurricane Storm Damage Reduction features will be conducted as a part of the MsCIP. As indicated in the comment, the Corps and the Gulf Island National Seashore staff have met on several occasions to discuss this issue. We understand the NPS "concerns" regarding this issue. We plan continued interagency coordination during the analysis period and before recommendations are formulated.

The MsCIP did not invent the idea of barrier islands as hurricane storm damage protection for mainland coasts. "Restoration" of the Mississippi barrier islands has been a consistent theme within the public's thoughts and State's plans for recovery and rebuilding following Katrina. Accordingly, we will evaluate those protection concepts using numerical models of storms and surge.

In addition, to the concept of the Mississippi barrier islands as protection for the mainland coast, the MsCIP authorization can evaluate other opportunities that may beneficial to the Mississippi barrier island area. For example, opportunities to restore coastal forest, wetlands, and submerged aquatic vegetation will be considered. We look forward to continued coordination with the NPS. The relationship of whatever recommendations are made to existing laws and policies including NPS policies should not come as a surprise and must be addressed.

4c. Comment:
A copy of a February 3 letter to Dr. William Walker, Executive Director Mississippi Department of Marine Resources, is attached.

This letter provides copies of NPS policies and guidelines and a copy of the Wilderness Act, all of which would be relevant to the proposal to restore the Mississippi barrier islands to pre-hurricane Camille conditions. Manipulation of this magnitude to offset the effects of natural events is a major deviation from NPS policy. The Gulf Island National Seashore was established in January 1971 "to preserve for public use and enjoyment certain areas possessing outstanding natural, historic, and recreational values." The enabling legislation further stated the seashore would be administered in accordance with the Act of August 25, 1916, as amended, which created and then clarified the mission of the NPS. The Act and amendments created an organization with a mission to preserve and protect to the greatest extent possible the natural systems and the forces that shape them.

Response:
Noted.

4d. Comment:
The National Park Service plans to work closely with the U.S. Army Corps of Engineers to address our concerns as the Mississippi Coastal Improvements projects proceed.

Response:
We note that the NPS does not have any objections to the MsCIP Near Term Improvements as they will not impact NPS lands or waters.

As discussed previously, close coordination during the analysis and formulation period will be needed due to the policy and regulatory issues involved. The U.S. Army Corps of Engineers plans to continue to work closely with the NPS particularly regarding the Mississippi barrier islands.

5. U.S. Fish and Wildlife Service (USFWS), Mississippi Field Office, Jackson, MS, letter dated June 20, 2006.

5a. Comment:
The U.S. Fish and Wildlife Service (Service) has reviewed this Draft Interim Report (Draft IR) for the Mississippi Coastal Improvements Program (MsCIP) dated May 20, 2006. The Draft IR describes 15 potential improvement projects located in Hancock, Harrison, and Jackson Counties, Mississippi. These projects are intended to improve fish and wildlife resources and/or minimize storm damage on the Mississippi Gulf coast. Our comments are submitted in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) and the Endangered Species Act (87 Stat. 884, as amended 16 U.S.C. 1531 et seq.).

Response:
Noted.

5b. Comment:
Based on the information found in the Draft IR, it is the Service's opinion that these projects could have a positive impact on fish and wildlife resources and/or minimize storm damage to the Mississippi coast. Therefore, the Service has no objection to any of the proposed projects.

Response:
Noted.

5c. Comment:
However, regarding potential impacts to federally listed species, the Service does recommend close coordination with our agency in planning the projects involving restoration/modification of the sand beaches, sand dunes, or shallow water bottoms. Specifically:

1. Most of the sand beach habitats along coastal Mississippi are listed as Critical Habitat for the threatened Piping plover (*Charadrius melodus*). The projects involving the sand beaches or shallow waterbottoms along the coast, if planned properly, could have a positive impact on the Piping plover and other shore birds.

2. Although no adverse impacts are anticipated, it should be noted that the Shearwater Bridge Hurricane Storm Damage Reduction Project is located near a documented bird rookery and a relatively high number of federally listed endangered brown pelicans (*Pelecanus occidentalis*). However, the viability of the rookery, post-hurricane Katrina is unknown.

3. The National Marine Fisheries Service (NMFS) has responsibility for consultation on some Federally listed species found in the Gulf and on associated islands. Therefore NMFS should be contacted regarding the species and habitats located in their area of jurisdiction.

Response:
Noted. The purpose of the MsCIP Interim Report is to document an analysis and design for near term improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, **preservation of fish and wildlife**, prevention of erosion, and other related water resource purposes (emphasis added). Accordingly, it is appropriate that positive impacts result from these efforts. The Corps will continue to work closely with the Service during project planning to ensure that these projects continue to have positive impact on fish and wildlife resources.

The NMFS has been contacted regarding the MsCIP Near Term Improvements and species and habitats located in their area of jurisdiction.

5d. Comment:
The Service looks forward to working closely with the Corps in planning the near term and long term projects associated with the MsCIP.

Response:
Noted. Service's time and attention to these MsCIP reports is appreciated. We also look forward to working with the Service on the MsCIP.

6. United States Department of the Interior, U.S. Geological Survey, Regional Hydrologist, Norcross GA, letter dated June 21.

6a. Comment:
FEMA and the COE are typically involved in assessment/documentation of the tidal surge soon after landfall in order to expedite recovery processes. This is normally done by developing a scope of work and then contracting to flag and survey high water marks. Finding reliable high water marks, vertical datum benchmarks, surveying them, and plotting them on suitable maps often takes weeks or even months. Some "recovery" funds in addition to those specified in this document could be used for a network of pre-established (surveyed) points to which submersible recording pressure transducers are deployed in advance of an impending storm. Recovery and downloading the data would provide reliable storm surge information in a matter of a few days, allowing quicker decisions associated with recovery efforts. The U.S. Geological Survey has plans to conduct this type of work in a few locations this hurricane season. We would be pleased to brief you regarding our plans.

Response:
Noted. These comments will be forwarded to the MsCIP Comprehensive Plan Team.

6b. Comment:
Some planned project titles include the words "ecosystem restoration" while others do not. One that does not (but perhaps should) is simply titled Long Beach Canals Flood Damage Reduction. The 8th section of part B, which is entitled Near-Term Problem Area Evaluation, Screening and Plan Selection Report – Long Beach Canals Flood damage Reduction, Harrison County, does not outline any environmental benefits. However, the short description of that project on page iv (part A, executive summary) and in part A, section 5.1.4.9 (page 67), both mention that "increased circulation would provide better water quality and fish habitat conditions." So, in this case, it would appear that the words, "…and ecosystem restoration" should be added to the title. Similarly, other section titles do contain the words "ecosystem restoration," but descriptions of those projects do not mention any environmental or habitat conditions that would be remedied. For example, part A, section 5.1.4.3 entitled Hancock County Streams Flood Damage Reduction and Ecosystem Restoration and part A, section 5.1.5.14 Pascagoula Beach Boulevard Hurricane and Storm Damage Reduction and Ecosystem Restoration both have no explicit environmental benefits described in part A which would

justify those titles. Those same projects in Part B may have descriptions which weakly allude to environmental recovery opportunities. My point is that the brief descriptions should reflect the project titles.

Response:

Noted: The format of the MsCIP Interim Report is being revised. The individual Near Term Improvement Reports are being incorporated directly into the Interim Report. During this action the titles and descriptions will be reviewed for clarity.

6c. Comment:

Environmental Assessment, page 131, section B.1. – Currently it states that salinity would not be impacted by the projects. Don't you really mean it won't be adversely impacted? Certainly restoring the connectivity of some of these coastal creeks with the ocean would increase (impact) salinities, albeit in a positive way by restoring the streams to pre-hurricane conditions.

Response:

Noted: The suggested change will be made. This section of the Environmental Assessment contains the evaluation pursuant to the Section 404(b)(1) of the Clean Water Act. This requirement deals specifically with the discharge of dredged or fill material and not the Near Term Improvements generally. However, the comment regarding impacts on salinity is correct and the document will be revised.

6d. Comment:

In some cases figures are provided with no apparent corresponding discussion in the text. For example, figure 2 of the part B section entitled Near-Term Problem Area Evaluation, Screening and Plan Selection Report – Long Beach Canals Flood damage Reduction, Harrison County, depicts existing flood conditions for a 100 year event, but the figure is not cited anywhere in that write-up.

Response:

Noted: The MsCIP Interim Report is being revised. These comments will assist those revisions.

6e. Comment:

Would some of the projects mentioned benefit by temporary water quality monitoring or sampling to be certain that intended [or unintended] consequences do [or do not] occur?

Response:

Water quality monitoring is not planned. The Near Term Improvements were screened during their evolution so that they are non-controversial. Beneficial effects are expected while adverse effects are not.

6f. Comment:

I believe it might be casually mentioned as a goal somewhere, but do any of the State strategies duplicate, overlap with, or compromise the projects outlined by the COE in these documents?

Response:

A criteria for the recommended Near Term Improvements as well as the Comprehensive Improvements being developed is that those improvements contribute to the State's long-term, overall, comprehensive plan for recovery.

6g Comment:

Thanks again for allowing us to review this draft report.

Response:

We thank USGS for their review of the MsCIP documents and their comments.

7. U.S Department of the Interior, U.S. Geological Survey, memorandum dated June 20, 2006 from: Dawn Lavoie, Science Coordinator, Gulf Coast, New Orleans, LA

7a. Comment:

This Interim Report contains an impressive compilation of background material collected over the past six months on Mississippi coastal communities including evacuation routes, geology, ecology, and climate conditions. The authors have done an excellent job of identifying a number of engineering projects, all of which are sorely needed; however I don't see the comprehensive study that predicts the environmental consequences of any of these individual engineering projects. I assume such a comprehensive analysis will be done prior to the submission of the final report and prior to actual construction.

Response:

The environmental consequences of the recommended near term projects were discussed in the MsCIP Near Term Improvements, Environmental Assessment distributed to the public on May 19, 2006.

7b. Comment:

I would caution you about the implied correlation in this report between severe hurricanes and subsequent population growth. The dramatic increase in population you refer to in the 70's after Hurricane Camille was more a function of the development of Stennis Space Center (then called the NASA Space Technology Laboratory or NSTL) and the decision by the Navy to relocate its oceanographic survey and research capabilities (NAVOCEANO and NORDA (now NRL) to the Test Site rather than a result of rebuilding after Camille. Along with those employees came families, support contractors and subsequent relocations to the Test Site by a number of other Federal Agencies. Most of this influx in the mid to late 70's settled on the Mississippi Gulf Coast and Slidell, LA with a smaller number going to Picayune, MS. The other increase in population you refer to in the 90's was most likely a function of the gaming industry being allowed to locate on the Mississippi Gulf Coast and the related influx of workers and tourists associated with the new casinos. To predict similar increased growth after Hurricane Katrina may based on these two past growth spurts is problematic without an external driver such as occurred in the 70's and 90's. The scope of devastation caused by Hurricane Katrina is greater than past coastal hurricanes and the scale of rebuilding will need massive federal aid to occur. Population growth along the Gulf Coast is going to depend in large part on the availability of external aid since the reduction in tax base along the coast since Hurricane Katrina will make any rehabilitation dependent on local resources very slow.

Response:

The comment is noted. The population forecasting has been made with caution and any predictive effort will have error associated with it. However, prediction of future population status is needed for planning. Using both recent and historical hurricanes, such as Ivan and Georges and Camille, we anticipate the population of Coastal Mississippi will increase within the next decade. Since Katrina was such a catastrophic storm, change may be slowed significantly.

There is a strong movement towards developing coastal Mississippi with residential condominiums. While most residents oppose this transition, it may be inevitable, as high-rise condominiums are both more resistant to the destruction that accompanies storm surge, and may also be the only type of residential option that will meet future Flood Insurance Program requirements for increased first floor elevations. Both the cities of Gulf Shores and Pensacola have seen population increases since Hurricane Ivan and Hurricane Georges, and both experienced significant shoreline re-development which also was accompanied by increased population density due to the replacement of traditional single family dwellings with multi-family condominium complexes in that area. Neither of those two communities was host to gambling industry facilities, so rebuilding of damaged facilities, and the

addition of new gambling facilities along the coast of Mississippi may have an additional impact on population growth in the area. There are many "improvements" being proposed to casino developments and many upscale condominium and casino developments are already in early planning stages. Some of these developments are being proposed in areas where the lower valued homes have been completely obliterated, i.e. East Biloxi. The existing constraints of the past, such as local zoning ordinances and lack of available land have been removed as a result of the storm event. An example is cited in Long Beach where the residences have been destroyed south of CSX Railroad and may become open for casino development. Gaming was never considered before in Long Beach due to the lack of available land but is now being proposed for voters to decide.

Already, the influx of workers to the Mississippi coast has created a high demand for places to live resulting in higher property values. With the influx of workers there is a high demand for places to live resulting in higher property values. Also, empty waterfront lots property values have rebounded to at least what they were prior to the storm and in many cases, they have greatly increased especially in areas which before the storm were comprised of much lower valued homes. In these areas, the waterfront lots are attractive to developers for high-end development proposals.

7c. Comment:

Hancock County (beaches) are all man made and in my experience, have required renourishing every 10 years more or less. As these beaches disappeared due to sediment transport, storms, etc. small pockets of grasses and marsh appeared prior to being covered over by beach renourishing. Fishing and crabbing improved in these small areas. Has anyone discussed the pros and cons of maintaining long narrow strip of beach at such great expense, particularly in light of all the marsh and wetlands that are disappearing as a function of development and population pressure? Can we entertain the idea of letting some of these small areas revert to grasses and maintain smaller man-made beach areas with the proposed dunes, sand fences and seawalls for surge protection? We've allowed portions of the beach to be put aside for the least tern nesting activities without adverse effect on tourism or local complaints. Let's think a bit more broadly about multiple uses for the Mississippi coast beaches.

Response:

Concur. The recommended project for the Hancock County beaches involves placement of a dune on the existing beaches. This does not preclude future evaluations of creation of marsh or wetland along this shore.

A feature of the MsCIP Comprehensive Plan is wetland restoration. As a part of the Comprehensive Plan, an evaluation will be conducted regarding where restoration opportunities exist and where it would be most beneficial to restore wetlands within coastal Mississippi. Restoration of wetland areas along the shore will be considered.

7d. Comment:

I am a bit concerned about the 10' seawall proposed in front of Bay St. Louis. Once such a seawall is built, the beach pictured in your illustration will cease to exist due to wave action unless very frequent and expensive renourishment is planned. An example of the consequences of such a seawall can be seen along the south shore of Lake Pontchartrain (Lakeshore Drive) where there are no more beaches or marsh – just waves lapping against the concrete seawall. Perhaps Bay St. Louis is an area where seagrasses rather than beach, could be encouraged seaward of the seawall. I think a serious study of the benefits of such a seawall perhaps with regeneration of marsh in front versus beach and potential dune construction should be completed before construction of the seawall is initiated.

Response:
The recommended seawall project will replace (heighten) an existing seawall that was constructed between 1915 and 1928. Construction will be along the alignment of the existing seawall structure. Therefore the required maintenance of the beach in-front of the seawall is a known and accepted by the community. The Lake Pontchartrain comparison to Bay St. Louis was not accurate before Katrina. Before Katrina, there were significant areas of wetland vegetation on the shore in-front of the seawall.

7e. Comment:
One of the hopes of the State is that the USACE group preparing this Interim Report would look at the possibility of restoring historical water flow along the coast and watersheds such that water of sufficient quality and quantity becomes available to estuarine and marine habitats. I think the idea was to coordinate with the Louisiana Coastal Area restoration activities such that more fresh water can be diverted to the Mississippi Sound. However, freshwater variability (salinity) in the Mississippi Sound is dependent to a very large extent on rainfall amounts and when we try to control the hydrology, we need to seriously study the consequences of such alterations. Large swings in salinity (for example, when the Bonnet Care spillway was opened) resulted in significant change in the short term ecosystems (the oysters suffered from a drilling predator). Is the effort intended to stabilize salinities in the Sound or are we talking about the sources of fresh drinking water? Further, part of the problem of degraded water quality has resulted from coastal development and the attendant construction of numerous drainage canals. I recommend a serious study of the local hydrology be done prior to the Final report.

Response:
Restoration of historical water flow to coastal watersheds, including diverting freshwater from Louisiana is not a MsCIP Near Term Interim Improvement addressed in the Environmental Assessment. We agree that the assessment of changing freshwater inflows is very complex and will require significant study and balancing of multiple resource interest. Appropriate effort have been scoped and are underway for the Comprehensive Plan.

7f. Comment:
My overall impression of this interim report, and I realize it has been created under severe time constraints, is that it doesn't address the need for a comprehensive investigation of shore protection but is an analysis of a number of existing structures (e.g., seawalls) that are in need of repair. I was pleased to see a proposal to buy up 30 homes in the Franklin Creek Floodway and convert the area to conservation lands to help restore natural floodway conditions and habitat values. I would actually like to see this type of proposal be expanded to include several areas along the Jourdan River and Diamondhead south of I10. These areas were marshland as little as 20 years ago. With dredging, building permits granted and marsh filled in, numerous homes were built (and now destroyed) that should never have been allowed had a serious study of the value of the wetlands and the consequences of such building been undertaken at the time. A comprehensive study of this area should be undertaken before encouragement for rebuilding is given.

Response:
The Interim Report and Environmental Assessment were prepared with two purposes as directed by Congress: 1) To recommend near term improvements to assist in the post- Katrina recovery of coastal Mississippi; and 2) outline a plan of action for development of a comprehensive plan of improvements. The recommendations for comprehensive improvements are to be provided to Congress by December 31, 2007.

The near term improvements recommended were screened with evaluation criteria to select those areas that best met the requirements of being attributed to the storms of 2005, easily engineered

and designed, consistent with regulatory and environmental standards, publicly acceptable, complimentary with local, state, and other Federal agency actions and cost effective. The near-term recommendations identified to date focus largely on improvements needed to assist with ongoing recovery and protection of critical infrastructure, residential and commercial properties, evacuation routes, and environmental resources while the comprehensive plan is being developed.

The comprehensive investigation and issues discussed in the comment will be considered and evaluated during the development of the comprehensive plan.

7g. Comment:
The oyster industry has been destroyed in Mississippi as a result of Katrina. I am hoping that in the Final report, more emphasis will be placed on habitat and marine ecosystems than you had time for in the Interim Report. I am also looking forward to reading (and participating if possible) in the study related to the value and rebuilding of the offshore barrier islands as part of storm protection and ecosystem enhancement.

Response:
Noted. Evaluation of opportunities for oyster reef restoration and enhancement will be a component of the Comprehensive Plan.

8. Harrison County (Mississippi), Board of Supervisors, letter dated June 13, 2006.

8a. Comment:
This letter is in response to the May 2006 Draft Report for the Mississippi Coastal Improvements Program (MsCIP), Hancock, Harrison, and Jackson Counties, Mississippi. The Draft Interim Report does not include the Near Term Project Recommendations for Coastal Mississippi in an area of concern for Harrison County. The area of concern is flooding along Turkey Creek, which the Corps of Engineers and Harrison County have partnered together over the past years seeking a solution.

Response:
The Near Term Report does contain a project associated with flooding along Turkey Creek, the Long Beach Canals recommendation. The Long Beach Canals action is expected to increase floodwater conveyance to the west to Bayou Portage. This is expected to benefit Turkey Creek flooding concerns.

The evaluation criteria through which the Near Term Improvements were selected were developed to only result in those projects which were not controversial in nature, resulted in no significant negative environmental impacts, or required additional engineering analysis. A comprehensive watershed approach within the MsCIP Comprehensive Plan was considered the best approach for Turkey Creek.

A section has been added to the MsCIP Interim report which indicates projects that may be considered which while similar in scope to the recommended Near Term Improvements for various reasons would require additional engineering, environmental, or economic work to be implemented. With authorization and completion of required work, these projects may be able to be accomplished in a time frame similar to that of the near term improvements. These projects do not have the same scope as MSCIP Comprehensive Plan projects.

8b. Comment:
Unfortunately, as a result of Hurricane Katrina, the County is presently unable to be financially responsible for its 35 percent cost of any joint project with the Corps of Engineers.

Response:
Noted. No construction authorizations have been made by Congress. The cost sharing formulas for this work have not been established.

8c. Comment:
The inclusion in this Interim Report of the recommendations of reconstructing the eroded levee around Forrest Heights Subdivision, and the de-snagging of the creek channel while maintaining vegetated banks should be considered. The inclusion of these recommendations will make progress in remedying flooding problems in the interest of hurricane and storm damage reduction and further a related water resource purpose – part of the mission assigned under P.L.109-148.

Response:
A section has been added to the MsCIP Interim Report which discusses projects that may be considered which while similar in scope to the recommended Near Term Improvements for various reasons would require additional engineering, environmental, or economic work to be implemented. With authorization and completion of required work, these projects may be able to be accomplished in a time frame similar to that of the near term improvements. These projects do not have the same scope as MSCIP Comprehensive Plan projects. The projects recommended in this comment will be included in this added section to the MsCIP Interim Report.

8d. Comment:
Please add in the "Near Term Project Recommendations" the important solution of Turkey Creek Flood Control to help reduce future flooding (and it's associated damage to homes) in the communities along the banks of this natural drainage basin, if this can be done without removing or deleting any of the existing Harrison County projects.

Response:
A watershed approach within the MsCIP Comprehensive Plan is considered the best approach for finding solutions for Turkey Creek and the communities adjacent to it.

8e. Comment:
Thank you for your assistance in this matter.

Response:
We thank Harrison County for their review and comment.

Correspondence Received

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 4
ATLANTA FEDERAL CENTER
61 FORSYTH STREET
ATLANTA, GEORGIA 30303-8960

DATED: June 19, 2006

Dr. Susan Ivester Rees
U.S. Army Corps of Engineers
Mobile District
Planning and Environmental Division
P.O. Box 2288
Mobile, Alabama 36628-0001

Subject: Mississippi Coastal Improvements Program Environmental Assessment

Dear Dr. Rees:

The U.S. Environmental Protection Agency, Region 4 (EPA) appreciates the opportunity to review and provide comments on the U.S. Army Corps of Engineers' (USACE) *Environmental Assessment, Mississippi Coastal Improvements Program, Near-Term Improvements, for Hancock, Harrison, and Jackson Counties, Mississippi* dated May 2006. This document was in response to Congress' directive for USACE to:

> "*conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention of erosion and other related water resources….*[1]"

It was encouraging to see USACE embrace the concept that the natural coastal environment was "an existing improvement." The Congressional directive focused on "existing improvements." The concept of an "existing improvement" was defined by the breadth of 15 Near Term Project Development (NTPD) projects selected in the draft interim report. These projects included manmade alterations to the natural environment (repair of seawalls, scour protection to seawalls (rip-rap), cleaning out drainage canals, and removal of house pads and mobile homes) and the pre-hurricane natural environment landscape (marsh re-establishment, re-establishment of sand dunes, and hydraulic connections to interior estuarine habitats).

The USACE is to be congratulated for the development of the draft interim report in such a short time frame. The EPA was notified of this activity in late March and received the draft

[1] Pubic Law 109-148; Department of Defense Appropriations Act, 2006, dated 30 December 2005.

document less than three weeks ago. We understand the short review period necessary to meet the Congressional deadlines. Therefore, EPA would like make the following observations and suggestions.

The existing NTPDs include projects that protect the existing evacuation routes and heavily used coastal roadways, restore flow to major channels that drain the coastal communities, and restore marsh and sand dune habitat. The NTPDs appear to simply replace the pre-hurricane and storm damaged features. EPA would like to suggest improvements to these pre-2005 features. It was Einstein who said "We can't solve problems by using the same kind of thinking we used when we created them." The manmade structures for Hurricane and Storm Damage Reduction, Flood Control and Ecosystem Restoration should include more than what was put into them before the 2005 storms hit or the same result should be expected.

To this end, the EPA suggests the NTPRs Ecosystem Restoration component should be expanded to include (1) re-establishment of off-shore barrier islands; and (2) the Hurricane and Storm Damage and Flood Control components should include comprehensive watershed management measures that would restore a more natural hydrologic flow to the managed channels, rivers and bayous.

The NTPRs should include re-establishment of the off-shore barrier islands off the Mississippi coastline that existed prior to hurricane Katrina. There are aerial photographs that can show the location and shapes of these important natural improvements. Sands from outside the immediate coastal system could be tapped and brought into the coastal system. These barrier islands provide very important energy dissipation and protection of the near shore, shore and terrestrial shore areas. These systems are also important habitats for aquatic dependent wildlife for spawning and feeding habitats. The loss of these off-shore barrier island were due to the 2005 storms; should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective. These natural features would be in the interest of hurricane and storm damage reduction, preservation of fish and wildlife, and prevention of erosion.

Near shore sand volumes could be increased with the addition of sand covering with dune vegetation planting over the scour protection along the seawalls to project such as Downtown Bay St. Louis, Clarmont Harbor, Cowand Point, Shearwater Bridge, and Pascagoula Beach, were applicable. Near shore sand volumes are critical to the dynamics of coastal systems. These sand volumes with sand dune vegetation are the first line of defense to erosion. When the water is carrying sediment, especially sand, its energy is partially tied up in the transportation of the sand and has less energy available for erosion or scouring. The additional sand and dune vegetation would provide limited habitat opportunities for the shore-terrestrial edge fauna. The replacement of the scour protection lost to the 2005 storms; and the replacement or additional scour protection along the seawalls should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective.

Several of the projects including Hancock County Streams, Downtown Bay St. Louis, Long Beach, Courthouse Road, Gautier Coastal Streams, and Upper Bayou Casotte, should have their scope expanded to include watershed restoration to reduce flood damage through comprehensive improvements or modifications of existing conditions. This should include watershed plan implementations increasing natural ground cover, decreasing impervious cover, vegetating open channels, construction of wetland areas, retention and detention ponds and vaults, reduction of hydraulic connectivity of impervious surfaces, rooftop greening, rain barrels, vegetated filter strips, and street surface and subsurface storage. Reductions in future flood damage could come from re-establishment of a more nature hydrology from storm water. These practices should significantly decrease storm water run-off, increase water quality, provide much needed marsh communities along the conveyance system and provide habitat for many coastal fauna. These activities would result in comprehensive improvements to the watershed in the interest of storm damage reduction, prevention of saltwater intrusion, preservation and enhancement of fish and wildlife resources, prevention of erosion, and improve water quality. The flooding was due to the 2005 storms; the improvement and/or modifications to the stormwater management within these watersheds should be seriously considered for engineering and design; and should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions; and be cost effective.

Longer bridges, more and/or larger culverts, and flatter channel side slopes should be considered for the restoration of Downtown Bay St. Louis, Long Beach Canals, Courthouse Road, Shearwater Bridge, Gautier Coastal Streams, and Upper Bayou Casotte. Increased water conveyance should be created along these drainage features where it counts the most, in the floodplain area. Increased conveyance reduces flooding potential upstream. Larger conveyance in the flood plain provides for more sediment transport through the system. Culverts and bridges with causeways narrow waterways resulting in hydrological bottle necks. These bottle necks slow water down. The water drops its sediment load as the water speeds slow down. This new bedload reduces conveyance cross-sections of the drainage feature. This results in more frequent maintenance expenses and flooding potentials. Such modifications should be consistent with a comprehensive improvement or modification to the existing conditions that resulted from the hurricane and storm damage. These modifications should result in the reduction of future hurricane and storm damage from flooding. All of these projects had impacts from the 2005 storms. All these recommended modifications should be seriously considered for engineering and design. These recommended modifications should be consistent with regulatory and environment standards, publicly acceptable, complimentary with local, stated and other Federal agency actions and cost effective.

And finally, when considering an analysis and design for “comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, …., preservation of fish and wildlife, prevention of erosion, and other related water resource purposes…” there should be a comprehensive analysis of the sand budget along the Mississippi near shore area. The natural migration of sand westward along the Gulf coast has been disrupted by the deep water channels that are Federally maintained for marine transportation needs. This sand is important for forming off-shore barrier islands, replenishing beaches and sand dunes are very important for hurricane and storm damage

protection. A comprehensive plan for the entire Mississippi shore line would fill this need. From a comprehensive view all these Near-Term projects and existing Federal projects should be analyzed and maintained with a more holistic perspective.

Thank you again for the opportunity to comment on this very important activity. Should you have any questions regarding this response please contact Duncan Powell of my staff at (404)562-9258 or powell.duncan@epa.gov.

Sincerely,

Scott Gordon for JG/*On File*

James D. Giattina, Director
Water Management Division

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE

Southeast Regional Office
263 13th Ave. South
St. Petersburg, FL 33701
(727) 824-5321; FAX 824-5309
http://sero.nmfs.noaa.gov

JUN 21 2006

F/SER31:SKB

Susan Ivester Rees, Ph.D.
Leader, Coastal Environmental Team
U.S. Army Corps of Engineers
Mobile District
P.O. Box 2288
Mobile, AL 36628-0001

Dear Dr. Rees:

This letter is to confirm receipt of materials regarding the Mississippi Coastal Improvements Program (MsCIP) received by the National Marine Fisheries Service (NMFS) Protected Resources Division on June 16, 2006. Your letter requested comments no later than June 19, 2006.

Enclosed is a list of federally-protected species and designated critical habitat under NMFS' jurisdiction that may occur with the MsCIP project area. Our preliminary analysis has determined that significant impacts to federally-listed species and/or designated critical habitat may result from the proposed action.

Given the delay in receiving materials and the comment deadline, NMFS is requesting a 30-day extension in order to provide comments pursuant to section 7 of the Endangered Species Act. If you have any questions, please contact Dr. Stephania Bolden at (727) 824-5312 or by email at stephania.bolden@noaa.gov.

Sincerely yours,

David Bernhart
Assistant Regional Administrator
for Protected Resources

Enclosure

cc: F/SER43 – Mark Thompson

File: 1514-22.f.1.MS
Ref: T/SER/2006/02695

Mississippi

Candidate Species[2]	Scientific Name
none	

Species of Concern[3]	Scientific Name
Fish	
dusky shark	*Carcharhinus obscurus*
night shark	*Carcharinus signatus*
saltmarsh topminnow	*Fundulus jenkinsi*
sand tiger shark	*Carcharias taurus*
speckled hind	*Epinephelus drummondhayi*
Warsaw grouper	*Epinephelus nigritus*
white marlin	*Tetrapturus albidus*
Invertebrates	
ivory bush coral	*Oculina varicosa*

[2] The Candidate Species List has been renamed the Species of Concern List. The term "candidate species" is limited to species that are the subject of a petition to list and for which NOAA Fisheries Service has determined that listing may be warranted (69 FR 19975).
[3] Species of Concern are not protected under the Endangered Species Act, but concerns about their status indicate that they may warrant listing in the future. Federal agencies and the public are encouraged to consider these species during project planning so that future listings may be avoided.

Endangered and Threatened Species and Critical Habitats
under the Jurisdiction of the NOAA Fisheries Service

Mississippi

Listed Species	Scientific Name	Status	Date Listed
Marine Mammals			
blue whale	*Balaenoptera musculus*	Endangered	12/02/70
finback whale	*Balaenoptera physalus*	Endangered	12/02/70
humpback whale	*Megaptera novaengliae*	Endangered	12/02/70
sei whale	*Balaenoptera borealis*	Endangered	12/02/70
sperm whale	*Physeter macrocephalus*	Endangered	12/02/70
Turtles			
green sea turtle	*Chelonia mydas*	Threatened[1]	07/28/78
hawksbill sea turtle	*Eretmochelys imbricata*	Endangered	06/02/70
Kemp's ridley sea turtle	*Lepidochelys kempii*	Endangered	12/02/70
leatherback sea turtle	*Dermochelys coriacea*	Endangered	06/02/70
loggerhead sea turtle	*Caretta caretta*	Threatened	07/28/78
Fish			
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	09/30/91

Designated Critical Habitat
Gulf Sturgeon: A final rule designating Gulf sturgeon critical habitat was published on March 19, 2003 (68 FR 13370) and 14 geographic areas (units) among the Gulf of Mexico rivers and tributaries were identified. Maps and details regarding the final rule can be found at alabama.fws.gov/gs

Species Proposed for Listing
None

Proposed Critical Habitat
None

[1] Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

From: habitat [NMFS.HCDPC@noaa.gov]
Sent: Thursday, June 22, 2006 12:14 PM
To: Rees, Susan I SAM
Cc: Miles Croom; Bernhart, David; Thompson, Mark
Subject: Draft Interim Report dated May 2006, for the Mississippi Coastal Improvement Program

NOAA's National Marine Fisheries Service, Habitat Conservation Division (NMFS-HCD), has reviewed the Draft Interim Report (DIR) dated May 2006, for the Mississippi Coastal Improvement Program Hancock, Harrison, and Jackson Counties, Mississippi. Generally, we support the Near Term Project Recommendations for the 15 projects identified in the DIR and, pursuant to the essential fish habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation and Management Act, have no specific EFH conservation recommendations to provide at this time. We appreciate the opportunity to review the DIR and should there be any changes or as more specific details become available, please coordinate with Mark Thompson at our NMFS-HCD Panama City Office.

United States Department of the Interior

NATIONAL PARK SERVICE
Southeast Regional Office
Atlanta Federal Center
1924 Building
100 Alabama St., S.W.
Atlanta, Georgia 30303

IN REPLY REFER TO:
(SER-D)

JUN 19 2006

Dr. Susan Ivester Rees
U.S. Army Corps of Engineers, Mobile District
Planning and Environmental Division
Post Office Box 2288
Mobile, Alabama 36628-0001

Dr. Rees:

The National Park Service, Southeast Region, has read and reviewed the Mississippi Coastal Improvements Program (MsCIP) Draft Interim Report and Environmental Assessment (EA). In as much as we understand the near-term improvements will have no impact on National Park lands or waters based on available information, we have no comments to make on the near-term recommendations at this time. However, we have concerns relative to the comprehensive study plans.

This Interim Report lists on page 70 (and pages vi-vii) several plans of study for long-term comprehensive improvements to coastal Mississippi. One of these study plans is an analysis of barrier islands as a hurricane and storm damage reduction feature. These barrier islands are all located within the boundaries of Gulf Islands National Seashore, and two of the islands, Horn and Petit Bois, have been designated as Wilderness Areas. These barrier islands are administered under NPS laws such as the Organic Act of 1916, Wilderness Act of 1962 and the park's Enabling Legislation as well as NPS Policies such as Director's Order 41 and the 2001 NPS Management Policies. Large-scale manipulation of the barrier islands will be a major deviation of management policy described in these documents.

Superintendent Eubanks from Gulf Islands National Seashore and park staff have met with Mississippi state officials and U.S. Army Corps of Engineers representatives on several occasions and expressed NPS concerns regarding plans for long-term improvements for the Mississippi barrier islands. A copy of his February 3 letter is attached (without enclosures; reference recommendation to consider information from park as official comments from NPS).

The National Park Service plans to work closely with the U. S. Army Corps of Engineers to address our concerns as the Mississippi Coastal Improvements projects proceed.

Sincerely,

John H. Yancy
Associate Regional Director
Natural Resources
Southeast Region

United States Department of the Interior
National Park Service
Gulf Islands National Seashore
1801 Gulf Breeze Parkway
Gulf Breeze, Florida 32563

IN REPLY REFER TO:

N16 (GUIS-S)

February 3, 2006

Dr. William Walker, Executive Director
Mississippi Department of Marine Resources
1141 Bayview Avenue, Suite 101
Biloxi, Mississippi 39530

Dear Dr. Walker:

Per our discussion on February 1, please find enclosed copies of National Park Service (NPS) policies and guidelines and a copy of the Wilderness Act, all of which would be relevant to the proposal to restore the Mississippi barrier islands to pre-Hurricane Camille conditions. As I indicated to you, it appears that manipulation of this magnitude to offset the effects of natural events is a major deviation from NPS policy. In addition, Horn and Petit Bois Islands are designated wilderness, which affords an extra measure of protection.

Gulf Islands National Seashore was established in January 1971 "to preserve for public use and enjoyment certain areas possessing outstanding natural, historic, and recreational values." The enabling legislation further stated the seashore would be administered in accordance with the Act of August 25, 1916, as amended, which created and then further clarified the mission of the NPS. The Act and amendments created an organization with a mission to preserve and protect to the greatest extent possible the natural systems and the forces that shape them.

It was a pleasure meeting with you and Dr. Rees. I have asked our Chief of Resources Management to meet with me and Dr. Rees next week as a follow up to our discussion regarding the upcoming studies for this proposed project. Please let me know if we can provide additional information.

Sincerely,

Jerry A. Eubanks
Superintendent.

Enclosures

cc: Dr. Susan Rees, COE w/enclosures

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Mississippi Field Office
6578 Dogwood View Parkway, Suite A
Jackson, Mississippi 39213

June 20, 2006

Colonel Peter F. Taylor
District Engineer
U.S. Army Corps of Engineers
Post Office Box 2288
Mobile, Alabama 36628-0001

Dear Colonel Taylor:

The U.S. Fish and Wildlife Service (Service) has reviewed the Draft Interim Report (Draft IR) for the Mississippi Coastal Improvements Program (MsCIP) dated May 2006. The Draft IR describes 15 potential improvement projects located in Hancock, Harrison and Jackson Counties, Mississippi. These projects are intended to improve fish and wildlife resources and/or minimize storm damage on the Mississippi Gulf coast. Our comments are submitted in accordance with the Fish and Wildlife Coordination Act (16 U.S.C. 661-667e) and the Endangered Species Act (87 Stat. 884, as amended 16 U.S.C. 1531 et seq.).

Based on the information found in the Draft IR, it is the Service's opinion that these projects could have a positive impact on fish and wildlife resources and/or minimize storm damage to the Mississippi coast. Therefore, the Service has no objection to any of the proposed the projects.

However, regarding potential impacts to federally listed species, the Service does recommend close coordination with our agency in planning the projects involving restoration/modification of the sand beaches, sand dunes, or shallow water bottoms. Specifically:

1. Most of the sand beach habitats along coastal Mississippi are listed as Critical Habitat for the threatened Piping Plover *(Charadrius melodus)*. The projects involving the sand beaches or shallow waterbottoms along the coast, if planned properly, could have a positive impact on the Piping Plover and other shore birds.

2. Although no adverse impacts are anticipated, it should be noted that the Shearwater Bridge Hurricane Storm Damage Reduction Project is located near a documented bird rookery and a relatively high number of federally listed endangered Brown Pelicans *(Pelecanus occidentalis)*. However, the viability of the rookery, post-Hurricane Katrina, is unknown.

3. The National Marine Fisheries Service (NMFS) has responsibility for consultation on some federally listed species found in the Gulf and on associated islands. Therefore, NMFS should also be contacted regarding the species and habitats located in their area of jurisdiction.

The Service looks forward to working closely with the Corps in planning the near term and long term projects associated with the MsCIP. If you have any questions or would like to discuss any of these recommendations, please contact Paul Necaise in our office, telephone: (228) 493-6631.

Sincerely,

Ray Aycock
Field Supervisor

United States Department of the Interior

U.S. GEOLOGICAL SURVEY

SPALDING WOODS OFFICE PARK - SUITE 160
3850 Holcomb Bridge Road
Norcross, Georgia 30092

June 21, 2006

Dr. Susan Ivester Rees
U.S. Army Corps of Engineers, Mobile District
Planning and Environmental Division
P.O. Box 2288
Mobile, Alabama 36628-0001

Dear Dr. Rees:

The U.S. Geological Survey thanks you for the opportunity to review the ***Mississippi Coastal Improvements Program Environmental Assessment***. The document we were supplied contained three parts:

A. Draft Interim Report (May 2006) – Mississippi Coastal Improvements Program (MsCIP) Hancock, Harrison, and Jackson Counties, Mississippi.

B. Interim Report (May 2006) – Near Term Improvements Reports: Mississippi Coastal Improvements Program (MsCIP) Hancock, Harrison, and Jackson Counties, Mississippi.

C. Environmental Assessment (May 2006): Coastal Improvements Program (MsCIP): Near Term Improvements – Hancock, Harrison, and Jackson Counties, Mississippi.

Comments, from my abbreviated review, are provided below for your consideration.

1. FEMA and the COE are typically involved in assessment/documentation of the tidal surge soon after landfall in order to expedite recovery processes. This is normally done by developing a scope of work and then contracting to flag and survey high water marks. Finding reliable high water marks, vertical datum benchmarks, surveying them, and plotting them on suitable maps often takes weeks or even months. Some “recovery” funds in addition to those specified in this document could

be used for a network of pre-established (surveyed) points to which submersible recording pressure transducers are deployed in advance of an impending storm. Recovery and downloading the data would provide reliable storm surge information in a matter of a few days, allowing quicker decisions associated with recovery efforts. The U.S. Geological Survey has plans to conduct this type of work in a few locations this hurricane season. We would be pleased to brief you regarding our plans.

2. Some planned project titles include the words "***ecosystem restoration***" while others do not. One that does not (but perhaps should) is simply titled ***Long Beach Canals Flood Damage Reduction***. The 8th section of part B, which is entitled ***Near-Term Problem Area Evaluation, Screening and Plan Selection Report – Long Beach Canals Flood damage Reduction, Harrison County***, does not outline any environmental benefits. However, the short description of that project on page iv (part A, executive summary) and in part A, section 5.1.4.9 (page 67), both mention that "increased circulation would provide better water quality and fish habitat conditions." So, in this case, it would appear that the words, "…***and ecosystem restoration***" should be added to the title. Similarly, other section titles do contain the words "***ecosystem restoration***," but descriptions of those projects do not mention any environmental or habitat conditions that would be remedied. For example, part A, section 5.1.4.3 entitled ***Hancock County Streams Flood Damage Reduction and Ecosystem Restoration*** and part A, section 5.1.5.14 ***Pascagoula Beach Boulevard Hurricane and Storm Damage Reduction and Ecosystem Restoration*** both have no explicit environmental benefits described in part A which would justify those titles. Those same projects in Part B may have descriptions which weakly allude to environmental recovery opportunities. My point is that the brief descriptions should reflect the project titles.

3. Environmental Assessment, page 131, section B.1. – Currently it states that salinity would not be impacted by the projects. Don't you really mean it won't be adversely impacted? Certainly restoring the connectivity of some of these coastal creeks with the ocean would increase (impact) salinities, albeit in a positive way by restoring the streams to pre-hurricane conditions.

4. In some cases figures are provided with no apparent corresponding discussion in the text. For example, figure 2 of the part B section entitled ***Near-Term Problem Area Evaluation, Screening and Plan Selection Report – Long Beach Canals Flood damage Reduction, Harrison County***, depicts existing flood conditions for a 100 year event, but the figure is not cited anywhere in that write-up.

5. Would some of the projects mentioned benefit by temporary water quality monitoring or sampling to be certain that intended [or unintended] consequences do [or do not] occur?

6. I believe it might be casually mentioned as a goal somewhere, but do any of the State strategies duplicate, overlap with, or compromise the projects outlined by the COE in these documents?

Thanks again for allowing us to review this draft report.

Sincerely,

/s/ Jess D. Weaver

Jess D. Weaver
Regional Hydrologist

To: USACE Mobile District, Curtis Flakes
From: USGS, Dawn Lavoie

Date: June 20, 2006
Subj: Comments on the Mississippi Coastal Improvements Program (MsCIP), Hancock, Harrison and Jackson Counties, Mississippi

Thank you for giving me the opportunity to comment on the Mississippi Coastal Improvements Program (MsCIP) Interim Report. The charge given to the USACE was to "conduct an analysis and design for comprehensive improvements or modifications to existing improvements in the coastal area of Mississippi in the interest of hurricane and storm damage reduction, prevention of saltwater intrusion, preservation of fish and wildlife, prevention and erosion and other related water resource purposes…"

This Interim Report contains an impressive compilation of background material collected over the past six months on Mississippi coastal communities including evacuation routes, geology, ecology, and climate conditions. The authors have done an excellent job of identifying a number of engineering projects, all of which are sorely needed; however I don't see the comprehensive study that predicts the environmental consequences of any of these individual engineering projects. I assume such a comprehensive analysis will be done prior to the submission of the final report and prior to actual construction.

I would caution you about the implied correlation in this report between severe hurricanes and subsequent population growth. The dramatic increase in population you refer to in the 70's after Hurricane Camille was more a function of the development of Stennis Space Center (then called the NASA Space Technology Laboratory or NSTL) and the decision by the Navy to relocate its oceanographic survey and research capabilities (NAVOCEANO and NORDA (now NRL) to the Test Site rather than a result of rebuilding after Camille. Along with those employees came families, support contractors and subsequent relocations to the Test Site by a number of other Federal Agencies. Most of this influx in the mid to late 70's settled on the Mississippi Gulf Coast and Slidell, LA with a smaller number going to Picayune, MS. The other increase in population you refer to in the 90's was most likely a function of the gaming industry being allowed to locate on the Mississippi Gulf Coast and the related influx of workers and tourists associated with the new casinos. To predict similar increased growth after Hurricane Katrina may based on these two past growth spurts is problematic without an external driver such as occurred in the 70's and 90's. The scope of devastation caused by Hurricane Katrina is greater than past coastal hurricanes and the scale of rebuilding will need massive federal aid to occur. Population growth along the Gulf Coast is going to depend in large part on the availability of external aid since the reduction in tax base along the coast since Hurricane Katrina will make any rehabilitation dependent on local resources very slow.

Hancock County are all man made and in my experience, have required renourishing every 10 years more or less. As these beaches disappeared due to sediment transport,

storms, etc. small pockets of grasses and marsh appeared prior to being covered over by beach renourishing. Fishing and crabbing improved in these small areas. Has anyone discussed the pros and cons of maintaining long narrow strip of beach at such great expense, particularly in light of all the marsh and wetlands that are disappearing as a function of development and population pressure? Can we entertain the idea of letting some of these small areas revert to grasses and maintain smaller man-made beach areas with the proposed dunes, sand fences and seawalls for surge protection? We've allowed portions of the beach to be put aside for the Least Tern nesting activities without adverse effect on tourism or local complaints. Let's think a bit more broadly about multiple uses for the Mississippi coast beaches.

I am a bit concerned about the 10' seawall proposed in front of Bay St. Louis. Once such a seawall is built, the beach pictured in your illustration will cease to exist due to wave action unless very frequent and expensive renourishment is planned. An example of the consequences of such a seawall can be seen along the south shore of Lake Pontchartrain (Lakeshore Drive) where there are no more beaches or marsh – just waves lapping against the concrete seawall. Perhaps Bay St. Louis is an area where seagrasses rather than beach, could be encouraged seaward of the seawall. I think a serious study of the benefits of such a seawall perhaps with regeneration of marsh in front versus beach and potential dune construction should be completed before construction of the seawall is initiated.

One of the hopes of the State is that the USACE group preparing this Interim Report would look at the possibility of restoring historical water flow along the coast and watersheds such that water of sufficient quality and quantity becomes available to estuarine and marine habitats. I think the idea was to coordinate with the Louisiana Coastal Area restoration activities such that more fresh water can be diverted to the Mississippi Sound. However, freshwater variability (salinity) in the Mississippi Sound is dependent to a very large extent on rainfall amounts and when we try to control the hydrology, we need to seriously study the consequences of such alterations. Large swings in salinity (for example, when the Bonnet Care spillway was opened) resulted in significant change in the short term ecosystems (the oysters suffered from a drilling predator). Is the effort intended to stabilize salinities in the Sound or are we talking about the sources of fresh drinking water? Further, part of the problem of degraded water quality has resulted from coastal development and the attendant construction of numerous drainage canals. I recommend a serious study of the local hydrology be done prior to the Final report.

My overall impression of this interim report, and I realize it has been created under severe time constraints, is that it doesn't address the need for a comprehensive investigation of shore protection but is an analysis of a number of existing structures (e.g., seawalls) that are in need of repair. I was pleased to see a proposal to buy up 30 homes in the Franklin Creek Floodway and convert the area to conservation lands to help restore natural floodway conditions and habitat values. I would actually like to see this type of proposal be expanded to include several areas along the Jourdan River and Diamondhead south of I10. These areas were marshland as little as 20 years ago. With

dredging, building permits granted and marsh filled in, numerous homes were built (and now destroyed) that should never have been allowed had a serious study of the value of the wetlands and the consequences of such building been undertaken at the time. A comprehensive study of this area should be undertaken before encouragement for rebuilding is given.

The oyster industry has been destroyed in Mississippi as a result of Katrina. I am hoping that in the Final report, more emphasis will be placed on habitat and marine ecosystems than you had time for in the Interim Report. I am also looking forward to reading (and participating if possible) in the study related to the value and rebuilding of the offshore barrier islands as part of storm protection and ecosystem enhancement.

Sincerely,

Dawn Lavoie
Science Coordinator, Gulf Coast
USGS, New Orleans, LA

HARRISON COUNTY
BOARD OF SUPERVISORS
1801 23RD AVENUE • P.O. DRAWER CC • GULFPORT, MISSISSIPPI 39502-0860
(228) 865-4123 / FAX (228) 865-4206

June 13, 2006

Dr. Susan Ivester Rees
U.S. Army Corps of Engineers
Mobile District
Planning and Environmental Division
P.O. Box 2288
Mobile, AL 36628-0001

Subject: Mississippi Coastal Improvements Program (MsCIP) Draft Interim Report

Dear Dr. Rees:

This letter is in response to the May 2006 Draft Interim Report for the Mississippi Coastal Improvements Program (MsCIP) – Hancock, Harrison, and Jackson Counties, Mississippi. The Draft Interim Report does not include in the Near-Term Project Recommendations for Coastal Mississippi, an area of concern for Harrison County. The area of concern is flood control along Turkey Creek, which the Corps of Engineers and Harrison County have partnered together over the past years in seeking a solution.

Unfortunately, as a result of Hurricane Katrina, the County is presently unable to be financially responsible for its 35 percent cost of any joint project with the Corps of Engineers.

The inclusion in this Interim Report of the recommendations of reconstructing the eroded levee around Forrest Heights Subdivision, and the de-snagging of the creek channel while maintaining vegetated banks, should be considered. The inclusion of these recommendations will make progress in remedying flooding problems in the interest of hurricane and storm damage reduction and further a related water resource purpose – part of the mission assigned under P.L. 109-148.

Please add in the "Near Term Project Recommendations" the important solution of Turkey Creek Flood Control to help reduce future flooding (and its associated damage to

Constance McCain Rockco
Supervisor, District 5

homes) in the communities along the banks of this natural drainage basin, if this can be done without removing/deleting any of the existing Harrison County projects.

Thank you for your assistance in this matter.

Cordially yours,

Connie Rockco

Connie Rockco, President
Harrison County Board of Supervisors

CMR/et

STATE OF MISSISSIPPI
HALEY BARBOUR
GOVERNOR
MISSISSIPPI DEPARTMENT OF ENVIRONMENTAL QUALITY
CHARLES H. CHISOLM, EXECUTIVE DIRECTOR

June 29, 2006

Dr. Susan Ivester Rees
U.S. Army Corps of Engineers
Mobile District
Planning and Environmental Division
Post Office Box 2288
Mobile, Alabama 36628-0001

Re: Mississippi Coastal Improvement Program
Environmental Assessment

Dear Dr. Rees:

The Mississippi Department of Environmental Quality, Office of Pollution Control, has reviewed the proposed Mississippi Coastal Improvements Program (MsCIP), Near Term Improvements as described in the May 2006 MsCIP Interim Report and Environmental Assessment. We concur with the findings and do not anticipate problems in issuing water quality certifications for the proposed work, pending completion of the certification review process. We appreciate the efforts of the Corps to collaboratively develop the proposed Near Term Improvements. We look forward to our continued cooperation in developing the MsCIP Comprehensive Plan.

Please let me know if we can be of any additional assistance.

Sincerely,

Robert H. Seyfarth, P.E., DEE
Chief, Water Quality Certification Branch

STATE OF MISSISSIPPI
Haley Barbour
Governor

MISSISSIPPI DEPARTMENT OF MARINE RESOURCES
William W. Walker, Ph.D., Executive Director

June 28, 2006

Dr. Susan Rees
U.S. Army Corps of Engineers, Mobile District
Planning and Environmental Division,
Coastal Environment Team
109 St. Joseph Street
Mobile, Alabama 36602

Dear Dr. Rees:

The Department of Marine Resources has reviewed the Mississippi Coastal Improvement Program (MsCIP) Interim Report and Environmental Assessment provided for review on May 20, 2006. We concur that the projects discussed in the MsCIP Near Term Improvements are consistent with the approved Mississippi Coastal Program and that these actions will not have adverse environmental effects on Mississippi's coastal resources. We agree that the projects will have beneficial effects on the natural and human environment of coastal Mississippi. We appreciate the efforts of the Army Corps of Engineers to expeditiously develop this action plan, and we look forward to our continued partnership with the Corps as we implement the MsCIP Comprehensive Plan.

Sincerely,

William W. Walker, Ph.D.
Executive Director