Chapter 6: Restoring Living Shorelines and Reefs in Mississippi Estuaries Project

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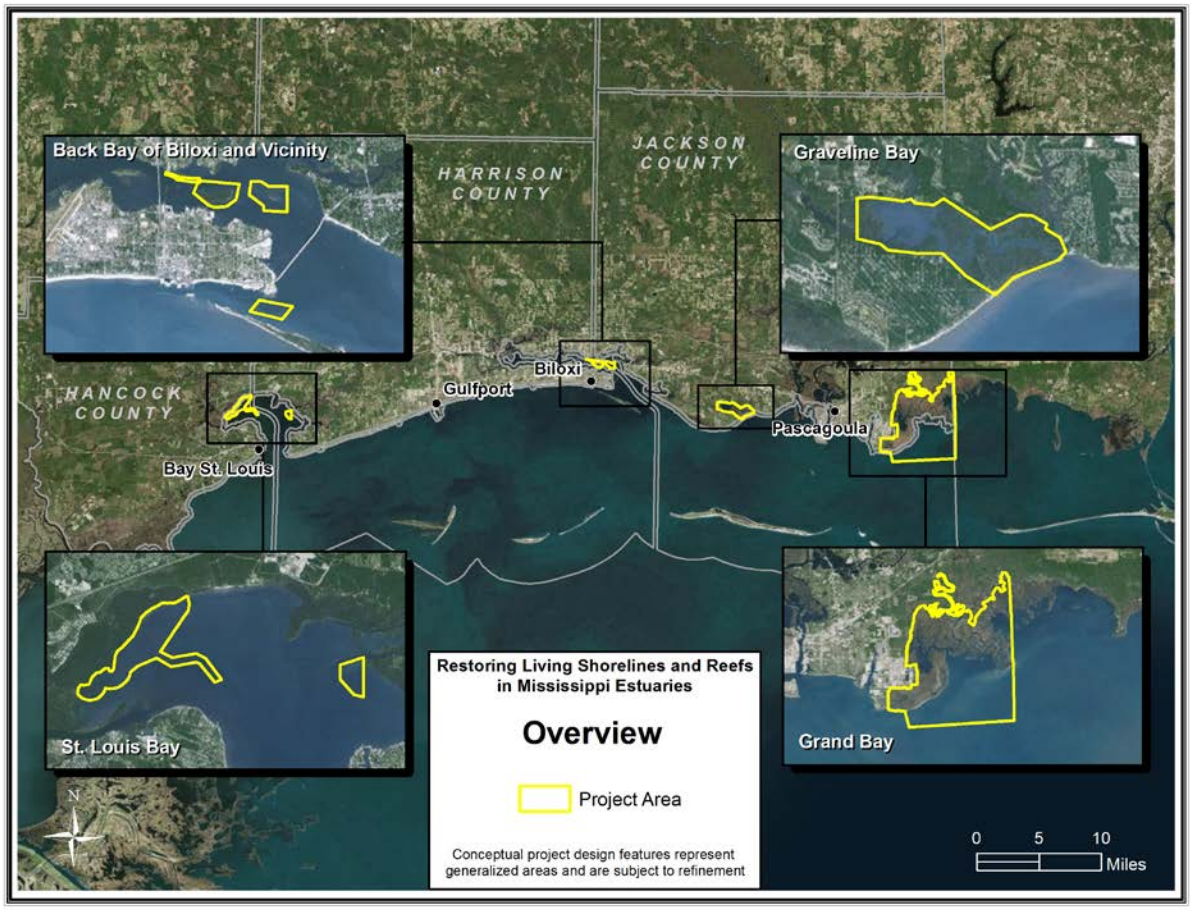
6.1 Restoring Living Shorelines And Reefs In Mississippi Estuaries: Project Description

6.1.1 Project Summary

The Restoring Living Shorelines and Reefs in Mississippi Estuaries includes the restoration of secondary productivity through the placement of intertidal and subtidal reefs and the use of living shoreline techniques including breakwaters. The projects will be implemented at locations in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity, and St. Louis Bay in Jackson, Harrison, and Hancock Counties, Mississippi. The project builds on recent collaborative projects implemented by the Mississippi Department of Marine Resources (MDMR), National Oceanic and Atmospheric Administration, and The Nature Conservancy. When completed at all locations, the project will provide for construction of over four miles of breakwaters, five acres of intertidal reef habitat and 267 acres of subtidal reef habitat at four locations across the Mississippi Gulf Coast (Figure 6-1). For the Grand Bay and Graveline Bay project locations, intertidal and subtidal reefs will be created in a number of sites. Over time, the breakwaters, intertidal and subtidal restoration areas will develop into living reefs that support benthic secondary productivity, including, but not limited to oysters/bivalve mollusks, annelid worms, shrimp, and crabs. Breakwaters will reduce shoreline erosion as well as marsh loss.

Figure 6-1. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Vicinity Map Depicting Project Locations and Project Areas[1]



6.1.2 Background and Project Description

The project components[2] are grouped into four project locations: Grand Bay; Graveline Bay; Back Bay of Biloxi and vicinity; and St. Louis Bay. For this project, the living shoreline approach includes constructing multiple breakwaters made of suitable manufactured and/or natural materials that reduce shoreline erosion by dampening wave energy while encouraging reestablishment of habitat that was once present in the region. Breakwaters will develop into reefs that support secondary productivity (living reefs).

[1] Project areas encompass the project components, the direct restoration measures and potential areas for construction or indirect impacts. Conceptual design features (breakwaters, intertidal reef habitat, subtidal reef habitat, and temporary flotation channels) are subject to refinement and will be sited within respective project areas.

[2] Project components are located in four locations across the Mississippi Gulf Coast and each include some combination of the following restoration measures; intertidal reef habitat restoration; subtidal reef habitat restoration and breakwater construction. Grand Bay and Graveline Bay are each considered a project location with numerous intertidal and subtidal reefs sites.

Subtidal and intertidal reefs will be built using suitable cultch material (e.g. limestone, crushed concrete, oyster shell or a combination thereof). Some sites will be built to complement existing restoration project sites implemented by MDMR, NOAA, and The Nature Conservancy. The early restoration project components are listed in Table 6-1, shown in Figures 6-1 to 6-9, and are described below. The following definitions are to clarify restoration techniques/components which will be implemented for the Restoring Living Shorelines and Reefs in Mississippi Estuaries Early Restoration project:

Living Shoreline Approach: A shoreline management practice that provides erosion control benefits; protects, restores, or enhances natural shoreline habitat; and re-establishes land and water ecological connections and maintains coastal processes through the strategic placement of plants, stone, sand fill, and other structural organic materials (e.g. biologs, oyster reefs, etc) or the natural establishment of organic materials such as sediments and plants. The Mississippi Phase IV Early Restoration living shoreline project may include establishing one or more of the following components:

> **Breakwaters:** Linear structures that may utilize artificial and/or shell-based materials placed parallel to the shore in medium to high energy open-water environments for the purpose of dissipating wave energy to reduce shoreline erosion.
>
> **Reef Habitat:** Large colonial aggregations of living oysters and other bi-valves that can have subtidal as well as intertidal portions, and provide habitat for a community of other species (e.g., tunicates, fish, crabs, worms, mussels, bryozoans, and barnacles).

Living Shorelines Techniques: The Mississippi Phase IV Early Restoration project may use the following techniques to implement a living shorelines approach.

> **Reef Development:** the process of placing breakwaters that are designed to support secondary benthic productivity through colonization by species associated with reefs. Reefs also create calm areas near the shoreline, which can support colonization by submerged aquatic vegetation and marsh grasses to create intertidal and marsh habitat for aquatic organisms. Through this process, a reef can also reduce coastal wave energy and current action to reduce shoreline erosion.
>
> > **Subtidal reefs:** A reef that is constructed so that the structure is always under water or covered by water at all times under average meteorological conditions.
> >
> > **Intertidal reefs:** A reef that is constructed so that a portion of the structure lies within the zone between the mean higher high water and mean lower low water lines.

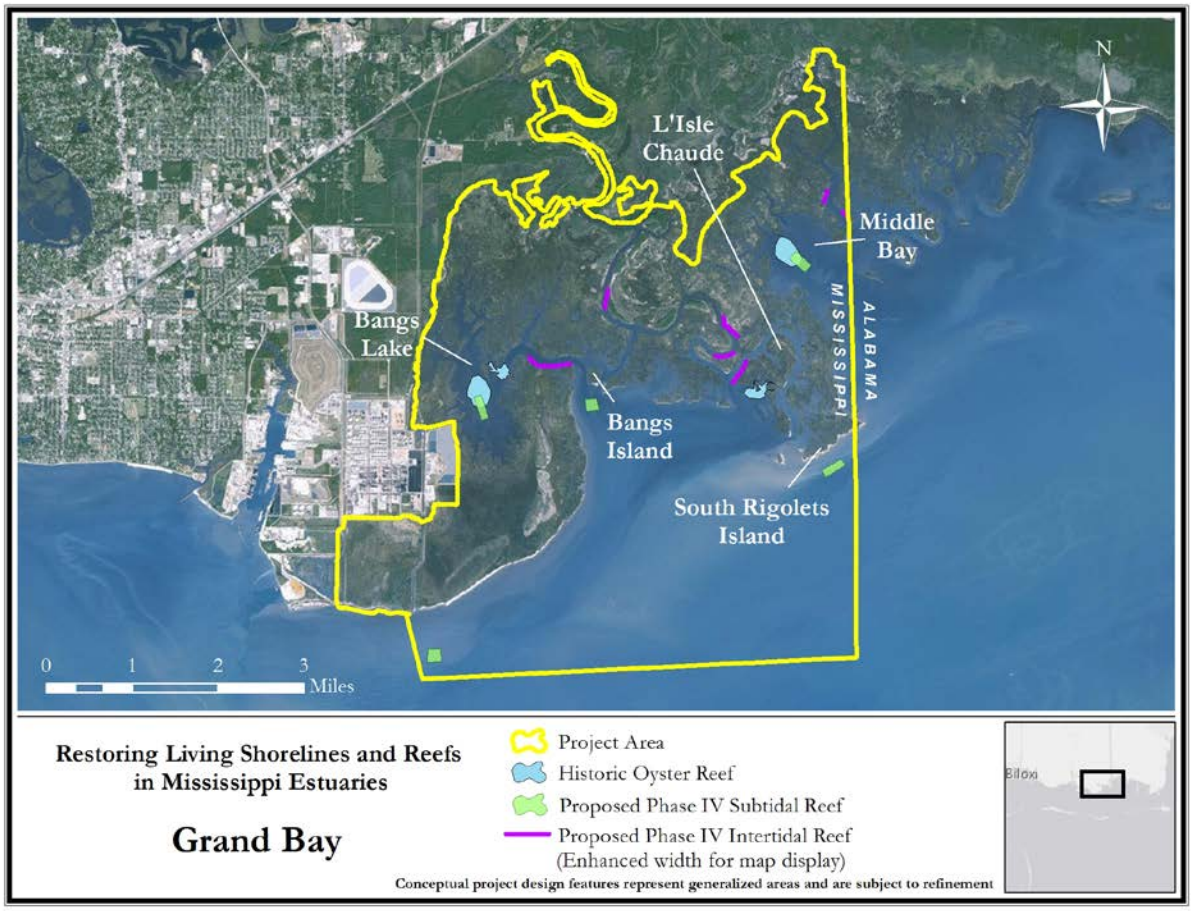
Table 6-1. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Project Components

Project Components	Breakwater Structure Length (feet)	Subtidal Reef Habitat (acres)	Intertidal Reef Habitat (acres)
Grand Bay and Graveline Bayou (Jackson County)			
Grand Bay Intertidal and Subtidal Reefs		77	3
Graveline Bay Intertidal and Subtidal Reefs		70	2
Back Bay of Biloxi and Vicinity (Jackson and Harrison County)			
Channel Island Living Shoreline and Subtidal Reefs	2,385	70	-
Big Island Living Shoreline	5,011	-	-
Little Island Living Shoreline	2,316	-	-
Deer Island Subtidal Reef	-	20	-
St. Louis Bay (Harrison and Hancock County)			
Wolf River Living Shoreline and Subtidal Reef	1,388	30	-
St. Louis Bay Living Shoreline	10,812	-	-
TOTAL	21,912 feet 4.1 miles	267 acres	5 acres

6.1.2.1 Grand Bay Project Component (Jackson County)

Grand Bay Intertidal and Subtidal Reefs (Figure 6-2): The Grand Bay Intertidal and Subtidal Reefs project component will restore approximately 3 acres of intertidal reefs in the intertidal waterways of Grand Bay. Approximately 77 acres of subtidal reef habitat will be restored in the nearshore environment of Grand Bay. Conceptual site locations for the intertidal and subtidal reefs are depicted in Figure 6-2 and are subject to refinement.

Figure 6-2. Grand Bay Intertidal and Subtidal Reefs Project Area[3]



6.1.2.2 Graveline Bay Project Component (Jackson County)

Graveline Bay Intertidal and Subtidal Reefs (Figure 6-3): The Graveline Bay Intertidal and Subtidal Reefs project component will restore approximately two acres of intertidal reefs along the intertidal waterways of Graveline Bay. Approximately 70 acres of subtidal reef habitat will be restored in the nearshore environment of Graveline Bay. Conceptual site locations for the intertidal and subtidal reefs are depicted in Figure 6-3 and are subject to refinement.

[3] Project areas encompass the project components, the direct restoration measures and potential areas for construction or indirect impacts. Conceptual design features (breakwaters, intertidal reef habitat, subtidal reef habitat, and temporary flotation channels) are subject to refinement and will be sited within respective project areas.

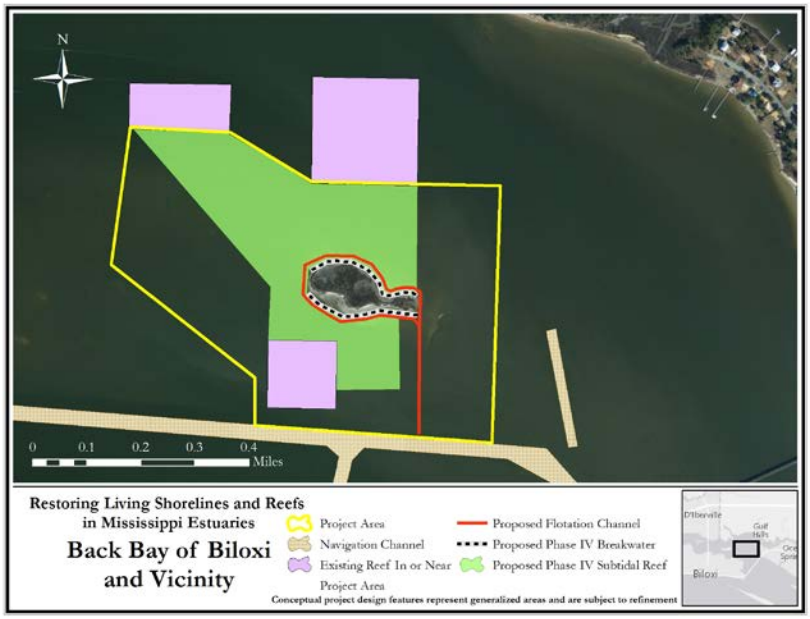
Figure 6-3. Graveline Bay Intertidal and Subtidal Reefs Project Area

6.1.2.3 Back Bay of Biloxi and Vicinity Project Components (Jackson and Harrison County)

Back Bay of Biloxi and vicinity will have four project components located along islands within Back Bay of Biloxi, which currently experience erosion, and along Deer Island to the south of Back Bay of Biloxi. Using living shoreline techniques, such as construction of breakwaters or other intertidal shoreline stabilization, erosion rates will be reduced along approximately 1.8 miles of marsh island shoreline in Back Bay of Biloxi. Approximately 90 acres of subtidal reef habitat will be restored at locations in Back Bay of Biloxi and in the vicinity on the north side of Deer Island, adjacent to existing reef projects.

Channel Island Living Shoreline and Subtidal Reefs (Figure 6-4): Will include construction of approximately 2,385 ft. of breakwater along the shoreline. Approximately 70 acres of subtidal reef habitat will be created and will connect the breakwater structure to an existing subtidal reef on the north and south sides of the island. The conceptual site location for the breakwater, subtidal reefs and temporary flotation channels are depicted in Figure 6-4 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 6-4. Channel Island Living Shoreline and Subtidal Reefs Project Area



Big Island Living Shoreline (Figure 6-5): Will include construction of approximately 5,011 ft. of breakwater along the southern facing shoreline directly adjacent to the navigation channel. The conceptual site location for the breakwater and temporary flotation channels are depicted in Figure 6-5 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 6-5. Big Island Living Shoreline Project Area

Little Island Living Shoreline (Figure 6-6): Will include construction of approximately 2,316 ft. of breakwater along the southern facing shoreline directly adjacent to the navigation channel. The conceptual site location for the breakwater and temporary flotation channels are depicted in Figure 6-6 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 6-6. Little Island Living Shoreline Project Area

Deer Island Subtidal Reef (Figure 6-7): Will expand an existing MDMR nearshore reef at Deer Island to create approximately 20 acres of subtidal reef habitat. The conceptual site location for the subtidal reef is depicted in Figure 6-7 and is subject to refinement.

Figure 6-7. Deer Island Subtidal Reef Project Area

6.1.2.4 St. Louis Bay Project Components (Harrison and Hancock County)

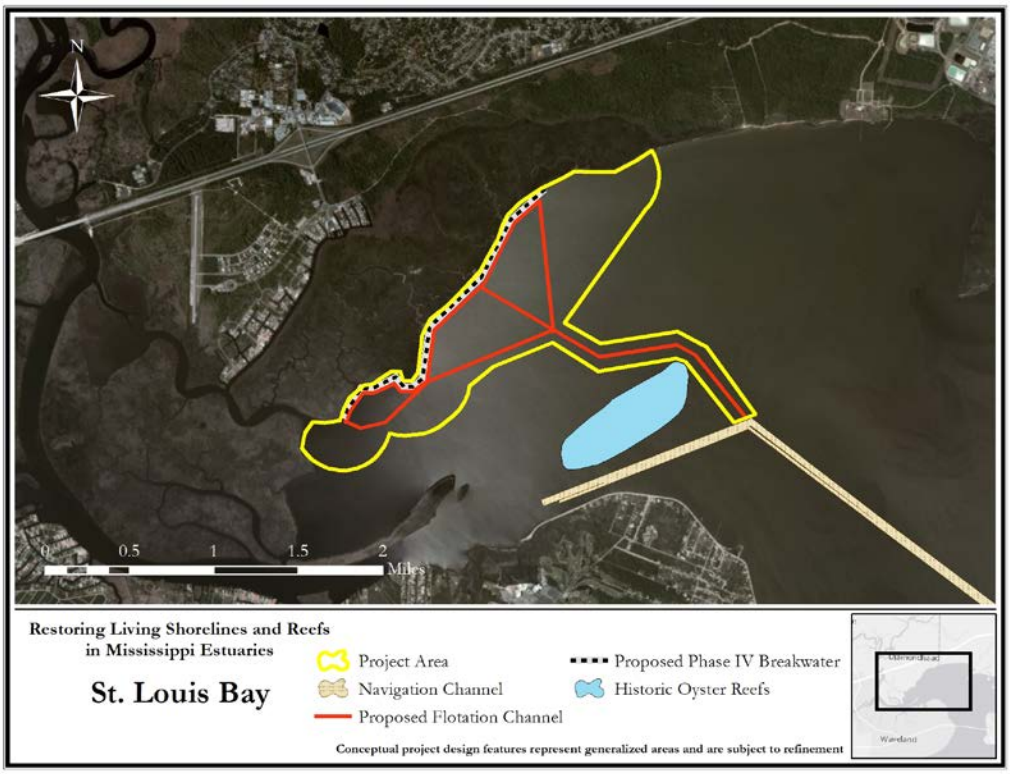
St. Louis Bay will have two project components including approximately 2.3 miles of breakwater and approximately 30 acres of subtidal reef habitat restoration at two locations.

Wolf River Living Shoreline and Subtidal Reef (Figure 6-8): Will include construction of approximately 1,388 ft. of breakwater along the island at the mouth of the Wolf River in St. Louis Bay. This will also include construction of approximately 30 acres of subtidal reef habitat in St. Louis Bay, adjacent to existing reef projects at the mouth of the Wolf River. Conceptual site locations for the breakwater, subtidal reefs and temporary flotation channels are depicted in Figure 6-8 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 6-8. Wolf River Living Shoreline and Subtidal Reef Project Area

St. Louis Bay Living Shoreline (Figure 6-9): Will include the construction of approximately 10,812 ft. of breakwater in St. Louis Bay. Conceptual site locations for the breakwater and temporary flotation channels are depicted in Figure 6-9 and are subject to refinement. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum impact, but may be avoided depending on project design and/or construction timing.

Figure 6-9. St. Louis Bay Living Shoreline Project Area



6.1.3 Construction Methodology and Timing

Construction methods and activities are included to assess the environmental impacts from the project. Actual construction methods and activities will be determined after final design and will be comparable to activities described below.

Breakwaters: The breakwater design selected at each site represent the maximum footprint that will be impacted by placement of the structure (see Table 6-2). Any adjustments to the project scale during final design will be no greater than the parameters in Table 6-2. The breakwater will have gaps ranging from three to 25 feet wide throughout the length of the structure. During final design every effort will be made to reduce environmental impacts associated with the project. Construction will take place within the maximum bottom width identified in Table 6-2. Construction will include the placement of linear structures that will utilize appropriate manufactured and/or natural materials. The alignment and limits of the breakwaters will be sited within the project study area shown in Figures 6-4, 6-5, 6-6, 6-8 and 6-9. Navigation signs are anticipated to be required by the USCG Private Aids to Navigation Office. The numbers of navigation signs are estimated in Table 6-2, below. Navigation signs will consist of a 12-inch treated piling with a plywood or aluminum day board sign and a lighted beacon, if required. A vibratory hammer from a barge will be used to push piles to a depth ranging from 10 to 30 feet below the substrate. This will put the day board sign at approximately +10.0 Mean Lower Low Water (MLLW).

The materials will be stockpiled at an existing staging area near the project area, which has water access. Mechanical equipment will be utilized to load the materials onto a material handling barge. The materials will be transported to the work area to be deployed by a crane and/or long armed track hoe located on the equipment barge. Placement of the breakwater structure will be monitored to ensure the breakwater dimensions, slopes, and crest elevations are achieved.

Subtidal Reef Habitat: The subtidal reef habitat will be constructed using appropriate cultch material (limestone, crushed concrete, oyster shells or a combination thereof). The cultch materials will be stockpiled at an existing upland staging area, which has water access to the project area. The cultch materials will be inspected at the existing upland staging area prior to being loaded onto a barge to ensure the materials are clean and free of all debris, including but not limited to, trash, steel reinforcement, and asphalt. Mechanical equipment will be utilized to load the materials onto shallow draft barges or shallow draft self-powered marine vessels. The material will be deployed using a high pressure water jet or using a clam-shell bucket mounted on a crane or a long armed track hoe located on a separate equipment barge. The cultch material will be deployed in water depths ranging from 0 to -10 MLLW. The cultch material thickness will range from 1 to 12 inches (Table 6-3).

Table 6-2. Restoring Living Shorelines and Reefs in Mississippi Estuaries Preliminary Design Parameters and Construction Techniques for Breakwater Structures

Project Component		Maximum Structure Width (ft.)	Structure Length (ft.)	Footprint (acres)	Navigation Signs (each)*	Estimated in-water Construction Time (months)
Back Bay of Biloxi	Channel Island Living Shoreline and Subtidal Reef	30	2,385	1.6	0 to 14	8
	Big Island Living Shoreline	30	5,011	3.5	0 to 27	12
	Little Island Living Shoreline	30	2,316	1.6	0 to 14	8
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	40	1,388	1.3	0 to 9	6
	St. Louis Bay Living Shoreline	40	10,812	9.9	0 to 56	12
Total			**21,912**	**17.9**	**0 to 120**	**6 – 12**

***Represents preliminary estimate of number of signs; Consultation with the US Coast Guard Private Aids to Navigation Division will be coordinated to determine the required type and spacing of navigation signs.

Intertidal Reef Habitat: The Intertidal reef habitat will be constructed using loose or bagged oyster shells. Oyster shells will be bagged and stockpiled at an existing upland staging area, which has water access to the project area. The bagged oyster shells will be loaded by hand onto shallow draft marine

vessels. The shallow draft vessels will transport the bagged oyster shells to the project location where they will be unloaded and placed by hand. The intertidal reef habitat will be constructed along the water's edge between MLLW and Mean Higher High Water (MHHW). Tide surveys will be conducted prior to beginning construction and PVC poles will be placed in the ground to mark the high and low tide elevations (Table 6-3).

Table 6-3. Restoring Living Shorelines and Reefs in Mississippi Estuaries Intertidal and Subtidal Reef Habitats

Project Components		Subtidal Reef Habitat Area (acres)	Intertidal Reef Habitat Area (acres)	Estimated Construction Time (months)
Grand Bay	Grand Bay Intertidal and Subtidal Reefs	77	3	4
Graveline Bay	Graveline Bay Intertidal and Subtidal Reefs	70	2	4
Back Bay Biloxi and Vicinity	Channel Island Living Shoreline and Subtidal Reefs	70	-	4
	Deer Island Subtidal Reef	20	-	2
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	30	-	2
Total		**267**	**5**	**2 – 4**

Temporary Flotation Channels*:* Temporary flotation channels may be required to facilitate access for work barges in shallow project areas. If required, the channels will be excavated perpendicular to the breakwater for access from navigation channels and parallel to the alignments of the breakwater for construction of the breakwater. The channels will be excavated to a maximum of 6 ft. below MLLW to accommodate barge draft. The bottom width of the channels will be approximately 80 ft. with 3H:1V side slopes. The footprint of channels will be minimized to the extent practicable. The temporary flotation channels will be filled in mechanically using a clam-shell bucket or long-arm excavator or comparable methodology after installation of the structures is completed. Best Management Practices (BMPs) will be followed during excavation and backfilling to minimize environmental impacts. The preliminary temporary flotation channel footprint was calculated based on a heavily loaded barge in order to estimate the maximum potential impact. Selected temporary flotation channel dimensions are summarized in Table 6-4. Temporary flotation channels may be avoided depending on project design and/or construction timing.

Table 6-4. Restoring Living Shorelines and Reefs in Mississippi EstuariesTemporary Flotation Channel

Project Components		Channel Length (ft.)	Channel Depth Below MLLW (ft.)	Channel Width (ft.)	Temporarily Impacted Area (acres)
Back Bay of Biloxi	Channel Island Living Shoreline and Subtidal Reef	4,282	6	80	7.9
	Big Island Living Shoreline	5,060	6	80	9.3
	Little Island Living Shoreline	2,450	6	80	4.5
St. Louis Bay	Wolf River Living Shoreline and Subtidal Reef	2,916	6	80	5.4
	St. Louis Bay Living Shoreline	31,766	6	80	58.3
Total					**85.4**

Construction Footprint Summary: The maximum construction footprint of the 1) breakwater structures is 17.9 acres; 2) subtidal reefs is 267 acres; 3) intertidal reefs is 5 acres; and 4) flotation channels is 85.4 acres. The total maximum construction footprint of all breakwater structures, reefs, and flotation channels is 375.3 acres. Actual construction methods and activities will be determined after final design and will be comparable to activities described above. Any adjustments to the project during final design are anticipated to reduce the environmental impacts associated with the project.

6.1.4 Evaluation Criteria

This project meets the evaluation criteria for the Framework Agreement and OPA. The project will restore injured salt marsh and lost benthic secondary productivity resulting from the Spill in an effort to make the environment whole by restoring, rehabilitating, replacing, or acquiring comparable natural resources injured by the Spill. The nexus to resources injured by the Spill is clear; (see C.F.R. § 990.54(a)(2) and Sections 6(a)-(c) of the Early Restoration Framework Agreement). The project is technically feasible and utilizes proven techniques with established methods and documented results. Government agencies have successfully implemented similar projects in the region. For these reasons, the project has a high likelihood of success. Further, cost estimates are based on similar past projects, and the project can be conducted at a reasonable cost (see C.F.R. § 990.54(a)(1) and (3) and Section 6e of the Early Restoration Framework Agreement). A thorough environmental assessment, including review under applicable environmental statutes and regulations, is described in Section 6.2.8, indicates that adverse effects from the project will largely be minor, localized, and often of short duration. In addition, the best management practices and measures to avoid or minimize adverse effects described in 6.2.8

will be implemented. As a result, collateral injury will be avoided and minimized during project implementation (construction and installation and operations and maintenance) (15 C.F.R. § 990.54(a)(4)). The project is not inconsistent with long-term restoration needs (see Section 6d of the Early Restoration Framework Agreement). The project will not adversely affect public health and safety; see Section 6.2.7.3.4 of this document.

6.1.5 Performance Criteria and Monitoring

Monitoring will be used to evaluate the restoration goals of the project: 1) construct breakwater structures to protect shoreline from erosion, to facilitate reef development, and to support secondary production; and 2) restore subtidal reef habitat and intertidal reef habitat to support secondary production. Post-construction performance monitoring will be for five years following completion of the project and will evaluate the project's performance over time with respect to the production and support of organisms on the living shoreline (e.g., secondary productivity). Components of this monitoring may include collecting information with respect to:

- Structural integrity of breakwater structure;
- Shoreline profile and position;
- Spatial footprint of breakwaters, intertidal reefs and subtidal reefs;
- Biological monitoring.

This project will incorporate a mix of monitoring efforts to ensure project designs are correctly implemented during construction and will allow for corrective actions to be taken where necessary. The monitoring plan is attached in Appendix B. The monitoring plan is based on the current conceptual design for the project and will be refined as the project siting and design is finalized.

6.1.6 Maintenance

Maintenance activities for various project components may include adding suitable manufactured and/or natural materials. The breakwaters are anticipated to experience the greatest consolidation of the subgrade in the first year following construction. Additional placement of manufactured and/or natural materials on the breakwaters will be assessed during the regular monitoring and may be implemented as project funds allow. Subtidal and intertidal reefs may require short-term maintenance to ensure proper elevations are maintained to promote secondary productivity (e.g., add more material).

6.1.7 Offsets

For the purposes of negotiation of Offsets with BP in accordance with the Framework Agreement, the Trustees used Resource Equivalency Analysis and Habitat Equivalency Analysis to estimate appropriate biological and habitat Offsets for the Restoring Living Shorelines and Reefs in Mississippi Estuaries.

Habitat Offsets (expressed in DSAYs[4]) were estimated for salt marsh habitat protected by this restoration, based on the expected spatial extent and duration of improvements attributable to the project. In estimating DSAYs, the Trustees considered a number of factors, including, but not limited to, anticipated protection of existing marsh provided by the project, and the time period over which the project will continue to provide benefits. The Trustees and BP agreed that if this restoration project is selected for implementation, BP will receive Offsets of 34 DSAYs of Salt Marsh Habitat[5], applicable to Salt Marsh Habitat injuries in Mississippi, as determined by the Trustees' total assessment of injury for the Spill.

If the combination of Offsets for Salt Marsh Habitat injuries from the Phase I and Phase III early restoration projects in Mississippi and from the Restoring Living Shorelines and Reefs in Mississippi Estuaries exceeds the Salt Marsh Habitat injuries in Mississippi, then the remaining unused Salt Marsh Habitat DSAYs from this project will be converted to Secondary Productivity[6], (at a rate of 1,000 Dkg-Ys of Secondary Productivity per Salt Marsh Habitat DSAY) and applied to Estuarine Dependent Aquatic Biomass[7] injuries first in Mississippi waters and then, if that category of injury is exhausted in Mississippi waters, to such injury in Federal Waters on the Continental Shelf[8]. These NRD Offsets for Salt Marsh Habitat (and, if applicable, Secondary Productivity) shall not apply to injuries in Texas, Louisiana, Alabama and/or Florida.

Benthic Secondary Productivity Offsets (expressed in Dkg-Ys[9]) were estimated for expected increases in invertebrate infaunal and epifaunal biomass attributable to the project. In estimating Dkg-Ys, the Trustees considered a number of factors, including, but not limited to, typical productivity in the project area, estimated project lifespan, and project size. The Trustees and BP agreed that if this restoration is selected for implementation, BP will receive Offsets of 1,933,164 Dkg-Ys of benthic Secondary Productivity, applicable to benthic Secondary Productivity injuries in Mississippi, as determined by the Trustees' total assessment of injury for the Spill.

If the combination of Offsets for benthic Secondary Productivity from the Phase I and Phase III early restoration projects in Mississippi and from this Restoring Living Shorelines and Reefs in Mississippi Estuaries exceeds the injury to benthic Secondary Productivity in Mississippi waters then the remaining unused Offsets for benthic Secondary Productivity from this project will be applicable to injuries to Estuarine Obligate Fishes and Mobile Crustaceans Dependent on Oyster Reefs and Other Estuarine Hard

[4] **Discounted Service Acre-Years (DSAYs)** is defined in Appendix C.

[5] **Salt Marsh Habitat** is defined in Appendix C.

[6] **Secondary Productivity** is defined in Appendix C.

[7] **Estuarine Dependent Aquatic Biomass** is defined in Appendix C.

[8] **Continental Shelf** is defined in Appendix C

[9] **Discounted kilogram-years** is defined in Appendix C.

Bottom/Structural Habitat[10] at a rate of 5 Dkg-Ys of Estuarine Obligate Fishes and Mobile Crustaceans Dependent on Oyster Reefs and Other Estuarine Hard Bottom/Structural Habitat per 100 Dkg-Ys benthic Secondary Productivity (up to a maximum of 96,658 Dkg-Ys of Estuarine Obligate Fishes and Mobile Crustaceans Dependent on Oyster Reefs and Other Estuarine Hard Bottom/Structural Habitat). These remaining Offsets will be applied first to offset such injuries in Mississippi waters and then, if that category of injury is exhausted in Mississippi waters, to such injuries in Federal Waters on the Continental Shelf. These NRD Offsets for benthic Secondary Productivity (and, if applicable, Estuarine Obligate Fishes and Mobile Crustaceans Dependent on Oyster Reefs and Other Estuarine Hard Bottom/Structural Habitat) shall not apply to injuries in Texas, Louisiana, Alabama and/or Florida.

These Offset types and amounts are reasonable for this project.

6.1.8 Estimated Cost

The estimated cost to implement this project is $30,000,000. This cost reflects current cost estimates developed from the most current information available to the Trustees at the time of the project negotiation. The cost includes provisions for planning, engineering and design, construction, and monitoring.

[10] **Estuarine Obligate Fishes and Mobile Crustaceans Dependent on Oyster Reefs and Other Estuarine Hard Bottom/Structural Habitat** is defined in Appendix C.

6.2 Restoring Living Shorelines and Reefs in Mississippi Estuaries Environmental Assessment

6.2.1 Introduction and Background, Purpose and Need

CEQ encourages federal agencies to "tier" their NEPA analyses from other applicable NEPA documents to create efficiency and reduce redundancy, and has issued new guidance on the use of programmatic NEPA documents for tiering.

Tiering has the advantage of not repeating information that has already been considered at the programmatic level so as to focus and expedite the preparation of the tiered NEPA review(s). When a PEIS has been prepared and an action is one anticipated in, consistent with, and sufficiently explored within the programmatic NEPA review, the agency need only summarize the issues discussed in the broader statement and incorporate discussion from the broader statement by reference and concentrate on the issues specific to the subsequent tiered proposal (CEQ 2014).

A federal agency may prepare a programmatic EIS (PEIS) to evaluate broad actions (40 C.F.R. §1502.4(b); see Forty Most Asked Questions Concerning CEQ's National Environmental Policy Act Regulations, 46 Fed. Reg. 18026 (1981)). When a federal agency prepares a PEIS, the agency may "tier" subsequent narrower environmental analyses on site-specific plans or projects from the PEIS (40 C.F.R. § 1502.4(b); 40 C.F.R. §1508.28). Federal agencies are encouraged to tier subsequent narrower analyses from a PEIS to eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental assessment (40 C.F.R. § 1502.20). The 2014 Final Programmatic and Phase III Early Restoration Plan and Programmatic Environmental Impact Statement (Final Phase III ERP/PEIS) was prepared for use in tiering subsequent early restoration plans and projects, such as Phase IV.

This project is proposed as part of Phase IV of the Early Restoration program. This EA tiers from the programmatic portions of the Final Phase III ERP/PEIS. This EA qualifies for tiering from the Final Phase III ERP/PEIS in accordance with Department of the Interior regulations (43 CFR 46.140, Using tiered documents) under "b" and "c".

This project is consistent with the Final Phase III ERP/PEIS' Preferred Alternative as described in the 2014 Record of Decision (79 *FR* 64831-64832 (October 31, 2014)) and the Trustees find that the conditions and environmental effects described in the broader NEPA document (with updates as described in Chapter 2) are valid. This project tiers to the analyses found in sections of the PEIS that describe Alternatives 2 (Contribute to Restoring Habitats and Living Coastal and Marine Resources) and 4 (Preferred Alternative: Contribute to Restoring Habitats, Living Coastal and Marine Resources and Recreational Opportunities). Specifically, alternatives and analyses are found in:

- Chapter 5: Early Restoration Programmatic Plan: Development and Evaluation of Alternatives, Section 5.3.3.2; 5.3.3.6

- Chapter 6: Environmental Consequences, Section 6.3.2, and Project Type 2: Protect Shorelines and Reduce Erosion; and Section 6.3.6 Project Type 6: Restore Oysters.

This EA incorporates by reference the analysis found in the PEIS in those sections.

This EA also incorporates by reference all Early Restoration introductory, process, background, and Affected Environment information and discussion provided in the PEIS (Chapters 1 through 6).

6.2.2 Purpose and Need

The purpose and need for this action falls within the scope of the purpose and need for the programmatic portions of the Final Phase III ERP/PEIS because it would accelerate meaningful restoration of injured natural resources and their services resulting from the Spill. The project would restore injured salt marsh and lost benthic secondary productivity in Mississippi resulting from the Spill in an effort to make the environment whole by restoring, rehabilitating, replacing, or acquiring comparable natural resources injured by the Spill. The proposed project would include shoreline erosion reduction using breakwaters and creation of habitat for secondary productivity including breakwaters, intertidal reef habitat and subtidal reef habitat restoration. The project would provide for construction of over four miles of breakwaters, five acres of intertidal reef habitat and 267 acres of subtidal reef habitat at four locations (Figure 6-1). For the Grand Bay and Graveline Bay project locations, intertidal and subtidal reefs would be created at a number of sites. Over time, the breakwater, intertidal and subtidal reef areas would develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs.

6.2.3 Scope of Environmental Assessment

This project is proposed as part of Phase IV of the Early Restoration program. This EA tiers from the programmatic portions of the Final Phase III ERP/PEIS. The broader environmental analyses of these types of actions as a whole are discussed in the Final Phase III ERP/PEIS from which this EA is tiered. This EA provides NEPA analysis for potential impacts for site specific issues and concerns anticipated from implementation of the proposed action and the no action alternative.

6.2.4 Project Scope

The proposed project would construct approximately four miles of breakwaters, five acres of intertidal reef habitat, and 267 acres of subtidal reef habitat in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity and St. Louis Bay. In addition, 85.4 acres of temporary flotation channel could be required for the construction of breakwaters in shallower estuarine sites in Back Bay of Biloxi and St. Louis Bay. The siting of breakwaters, intertidal and subtidal reefs for the Restoring Living Shorelines and Reefs in Mississippi Estuaries components are conceptual and subject to refinement. For the purposes of impact analysis, the Trustees have conservatively estimated the maximum footprint for permanent and temporary impacts resulting from the deployment of breakwaters, subtidal reefs, and intertidal reefs, as well as the excavation of temporary construction channels. Additionally, an estimated project area in which the total impacts would occur is also provided. Temporary flotation channel conceptual locations

and footprints have been included for the purpose of estimating the maximum temporary impacts, but these impacts may be avoided depending on final project design, construction techniques and/or construction timing. To the extent practicable, submerged aquatic vegetation (SAVs) would be avoided; no SAV impacts are anticipated. To the extent practicable, subtidal reef would be sited on or adjacent to existing or historic hard bottom habitat. Intertidal oyster surveys inventories would be completed as part of siting intertidal reef. Other reasons for refinement in project location include but are not limited to:

- Avoidance of natural or cultural resources (e.g. oysters, SAVs or archaeological sites);
- Natural resource inventory (e.g., locating subtidal reefs on or near existing or historic hard bottom habitat);
- Engineering considerations including but not limited to geotechnical, hydrological, navigational; construction materials, construction techniques or bathymetric design constraints; regulatory permitting constraints; and
- Input received during the public comment period.

Detailed description of project components and construction methodologies are provided in Section 6.1 and Figures 6-2 to 6-9 of this chapter.

6.2.5 Project Alternatives

6.2.5.1 No Action

Both OPA and NEPA require consideration of the No Action alternative. For this section, there are two alternatives, the No Action alternative and the Proposed Action, the Restoring Living Shorelines and Reefs in Mississippi Estuaries. Under the No Action alternative, the existing conditions described in Chapter 2, Affected Environment would prevail. Restoration benefits associated with this project would not be achieved at this time.

Under the No Action alternative, this project, which includes the construction of breakwaters, intertidal reef habitat and subtidal reef habitat in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity and St. Louis Bay would not be implemented at this time. There would be no reduction of erosion to those shorelines or development of breakwaters, intertidal and subtidal habitat into living reefs that would support benthic secondary productivity.

6.2.5.2 Proposed Action

The Proposed Action is to implement the Restoring Living Shorelines and Reefs in Mississippi Estuaries as described:

- Approximately four miles of breakwaters, five acres of intertidal reef habitat, and 267 acres of subtidal reef habitat;
- Restoration measures located in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity, and St. Louis Bay;

- Temporary flotation channels could be required for the construction of breakwaters in shallower estuarine sites in Back Bay of Biloxi and St. Louis Bay, approximately 85.4 acres. Temporary flotation channel conceptual locations and footprints have been included for the purpose of estimating the maximum temporary impacts, but these impacts may be avoided depending on final project design, construction techniques and/or construction timing.

Under the proposed action, there would be reduction of erosion to shorelines and development of breakwaters, intertidal and subtidal habitat into living reefs that would support benthic secondary productivity in four bays across the Mississippi Gulf Coast.

6.2.6 Project Location

The proposed project is located in Hancock County, Harrison County, and Jackson County Mississippi. The project components would be located in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity, and St. Louis Bay. The siting of breakwaters, intertidal and subtidal reefs for the Restoring Living Shorelines and Reefs in Mississippi Estuaries components are conceptual and subject to refinement as described in Section 6.2.4.

6.2.6.1 Grand Bay Project Component (Jackson County)

Grand Bay Intertidal and Subtidal Reefs (Figure 6-2): The proposed project component would be located in open water areas in Grand Bay that have substrate suitable for subtidal and intertidal reef habitat creation. The project component would be located in Jackson County. Currently, five subtidal reef habitats and seven intertidal reef habitats are proposed (Table 6-5).

6.2.6.2 Graveline Bay Project Component (Jackson County)

Graveline Bay Intertidal and Subtidal Reefs (Figure 6-3): The proposed project component would be located in open water areas in Graveline Bay that have substrate suitable for subtidal reef habitat and intertidal reef creation within the Graveline Bay Preserve. Currently, two habitats are proposed, one on the eastern shore of Graveline Bay and one on the western shore of Graveline Bay (Table 6-5). The project component would be located in Jackson County.

6.2.6.3 Back Bay of Biloxi and Vicinity-Project Components (Jackson and Harrison County)

There are four components proposed in the Back Bay of Biloxi and vicinity. Project components and corresponding figures are listed here; locations are summarized in Table 6-5.

- Channel Island Living Shoreline and Subtidal Reef (Figure 6-4)
- Big Island Living Shoreline (Figure 6-5)
- Little Island Living Shoreline (Figure 6-6)
- Deer Island Subtidal Reef (Figure 6-7)

6.2.6.4 St. Louis Bay Project Components (Harrison and Hancock County)

There are two components proposed in St. Louis Bay. Project components and corresponding figures are listed here; locations are summarized in Table 6-5.

- Wolf River Living Shoreline and Subtidal Reef (Figure 6-8)
- St. Louis Bay Living Shoreline (Figure 6-9)

Table 6-5. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Project Components Coordinates

Project Components/Site Location Description[1]	Latitude	Longitude
Grand Bay Proposed Substidal Reefs (Jackson County)		
near the northeast corner of Grand Bay and the Mississippi state line in Middle Bay	30.379088 N	-88.405168 W
near the southeast corner of Grand Bay and the Mississippi state line south of South Rigolets Island	30.344300 N	-88.398240 W
southwest of Grand Bay	30.311702 N	-88.475662 W
northwest of Grand Bay in Bangs Lake	30.353720 N	-88.467059 W
south of Bangs Island	30.354469 N	-88.445520 W
Grand Bay Proposed Intertidal Reefs (Jackson County)		
near the northeast corner of Grand Bay and the Mississippi state line in north of Middle Bay	30.390190 N	-88.400275 W
near the northeast corner of Grand Bay and the Mississippi state line in north of Middle Bay	30.386984 N	-88.396350 W
north of L'Isle Chaude	30.367902 N	-88.418862 W
north of L'Isle Chaude	30.363088 N	-88.419837 W
north of L'Isle Chaude	30.360232 N	-88.416810 W
north of Bangs Island	30.372462 N	-88.442846 W
north of Bangs Island	30.361225 N	-88.453838 W
Graveline Bayou (Jackson County)		
Graveline Bay Intertidal and Subtidal Reefs (eastern shore)	30.371037 N	-88.698404 W
Graveline Bay Intertidal and Subtidal Reefs (western shore)	30.371667 N	-88.709095 W
Back Bay of Biloxi and Vicinity (Jackson and Harrison County)		
Channel Island Living Shoreline and Subtidal Reefs	30.416960 N	-88.859612 W
Big Island Living Shoreline	30.415435 N	-88.875274 W
Little Island Living Shoreline	30.420870 N	-88.885460 W
Deer Island Subtidal Reef	30.385273 N	-88.857752 W
St. Louis Bay (Harrison and Hancock County)		
Wolf River Living Shoreline and Subtidal Reef	30.350533 N	-88.291888 W
St. Louis Bay Living Shoreline	30.358623 N	-89.362785 W

[1] The siting of breakwaters, intertidal and subtidal reefs for the Restoring Living Shorelines and Reefs in Mississippi Estuaries components are conceptual and subject to refinement.

6.2.7 Affected Environment and Environmental Consequences

Under the NEPA, federal agencies must consider environmental effects of their actions that include, among others, impacts on social, cultural, and economic resources, as well as natural resources. The following sections describe the affected resources and environmental consequences of the project.

In order to determine whether an action has the potential to result in significant impacts, the **context and intensity** of the action must be considered. **Context** refers to area of impacts (local, state-wide, etc.) and their duration (e.g., whether they are short- or long-term impacts). **Intensity** refers to the severity of impact and could include the timing of the action (e.g., more intense impacts would occur during critical periods like high visitation or wildlife breeding/rearing, etc.). Intensity is also described in terms of whether the impact would be beneficial or adverse. For purposes of this document, impacts are characterized as minor, moderate or major, and temporary or long-term. The analysis of beneficial impacts focuses on the duration (short- or long-term), without attempting to specify the intensity of the benefit. The definition of these characterizations is consistent with that used in the Final Phase III ERP/PEIS, and can be found in Appendix D.

According to the CEQ Regulations for Implementing NEPA (Section 1502.1 and 1502.2) agencies should "focus on significant environmental issues" and for other than significant issues there should be "only enough discussion to show why more study is not warranted." After preliminary investigation, some resource areas were determined to be either unaffected or minimally affected by the proposed action. These resources are not discussed in further detail below. Only those resource areas with potential, adverse impacts are discussed in detail below.

The programmatic analysis looked at a series of resources as part of the biological, physical, and socioeconomic environment. As appropriate in a tiered analysis, the evaluation of each project focuses on the specific resources with a potential to be affected by the proposed project. To avoid redundant or unnecessary information, resources that are not expected to be affected are simply not evaluated further under a given project. Resource areas not analyzed in project-specific detail along with a brief rationale for non-inclusion are listed and discussed below:

Air Quality and Greenhouse Gas Emissions: Jackson, Harrison and Hancock counties are classified as in attainment, meaning criteria air pollutants do not exceed National Ambient Air Quality Standards (NAAQS). For this Phase IV project, construction would occur in four bays and would likely not occur simultaneously. Whether construction occurred simultaneously or incrementally, the project would have no long-term impacts on air quality or to emissions of greenhouse gases. In addition the following best management practices would be implemented for the Restoring Living Shorelines and Reefs in Mississippi Estuaries:

- Shut down idling construction equipment, if feasible.
- Locate staging areas as close to construction sites as practicable to minimize driving distances between staging areas and construction sites.
- Encourage the use of the proper size of equipment for the job to maximize energy efficiency.

- Encourage the use of alternative fuels or power sources for generators at construction sites, such as propane or solar power, or use electrical power where practicable.

Noise: For this Phase IV project, noise impacts would be restricted to a brief construction window and would be short-term minor impacts with little or no long-term impact to ambient noise conditions. In addition, the construction activities are primarily in-water work and would not be directly adjacent to residential and commercial development.

Socioeconomic and Environmental Justice: For the Restoring Living Shorelines and Reefs in Mississippi Estuaries, in-water construction would occur at eight sites within four bays in Jackson, Harrison and Hancock Counties. Socioeconomic impacts would be would be beneficial and short-term. The relatively small and remote construction activities are not expected to create a disproportionately high and adverse effect on minority or low-income populations.

Infrastructure: For the Restoring Living Shorelines and Reefs in Mississippi Estuaries there would be limited storage and movement of land-based material storing and therefore limited, short-term impacts to infrastructure, if any. The project would provide long-term beneficial impacts to infrastructure due to shoreline protection. In addition, any impacts to infrastructure in the project area (pipelines, navigation channels) would be avoided or minimized in the planning, engineering and construction of the project.

Tourism and Recreation: For the Restoring Living Shorelines and Reefs in Mississippi Estuaries, construction would result in short-term adverse impacts to recreational activities, primarily fishing and boating.

6.2.7.1 Physical Environment

Geology and Substrates and Water Quality will be discussed in this section.

6.2.7.1.1 Geology and Substrates

Affected Environment

The project area is located within the Gulf Coastal Plain and the Mississippi Alluvial Plain physiographic regions. Landforms and substrates are generally comprised of Holocene sediments. These sediments are composed of sand, silt, and clay with comparatively high organic matter content. The coastal estuaries of Mississippi are composed of mostly sandy fine-grained sediment, silt and clays (Schmid 2015). The project components of the proposed action would be constructed in estuarine shallow water and shallow open water. The habitats can be divided into two classes - intertidal and subtidal. Intertidal zones (typical tidal range of 0.5 ft.) near the project components are generally composed of mud flats and small areas of natural sand beach. In general, the nearshore subtidal habitat is composed mostly of unconsolidated bottom types including sand, muddy sand, and mud bottom. Seismic activity in the project area is low. Since the late 1800s, about ten earthquakes large enough to be detected have occurred in the Gulf of Mexico. These earthquakes were mostly small-magnitude events (magnitudes of 3 to 4 on the Richter scale).

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.1 of the Final Phase III ERP/PEIS describe the impacts to geology and substrates from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). These project types are expected to result in minor to moderate short-term construction-related adverse impacts, primarily related to equipment staging and use, and rutting. The placement of new structures such as breakwaters could result in minor to moderate long-term adverse effects by changing the natural processes of sediment accretion and erosion, preventing washover events, and causing erosion in offsite locations. However, long-term benefits to geology and substrates are also expected, by reduction in erosion/loss of wetlands and stabilization of substrates. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to geology and substrates. There would be no long-term benefits resulting from slowing shoreline and marsh erosion or from the conversion of cultch to living reefs.

Proposed Action

The maximum construction footprint including breakwater structures, reefs, and flotation channels, if needed, is 375.3 acres. Placement of structures such as breakwaters, intertidal and subtidal reefs would permanently cover existing geology and substrates. The adverse effects would be minor to moderate and long-term, because they would affect substrate/geologic characteristics of the project footprint, and could extend beyond the construction period. There would be long term, minor to moderate impacts to 289.9 acres of soft bottom and hard bottom habitat due to the construction of breakwaters (17.9 acres), subtidal reefs (267 acres) and intertidal reefs (5 acres); Table 6-6. Appropriate navigation signage (if required) would be placed on approximately 12-inch diameter posts adjacent to the breakwaters. This would impact a small area of soft bottom. There would be short term, minor impacts to 85.4 acres of soft bottom habitat for the construction of temporary flotation channels, if needed for construction of breakwaters, subtidal and intertidal reef habitat (Table 6-6). The impacts resulting from the temporary flotation channels would be short-term because the channels would be backfilled as part of the construction process. The project would result in long-term benefit resulting from the development of 289.9 acres of substrate (breakwater materials and cultch) into living reefs that support benthic secondary productivity. There would be long-term benefits to shorelines and marsh resulting from the placement of 21,912 linear feet of breakwater along eroding shorelines (Table 6-2). Breakwaters would reduce the wave energy, thereby slowing shoreline and marsh erosion and resulting in the long-term protection of the shoreline. Therefore, the project would have a long-term beneficial impact on geology and substrate.

Table 6-6. Restoring Living Shorelines and Reefs in Mississippi Estuaries- Project Component Impacts

Project Components	Breakwater Structure Area Max. (acres)	Subtidal Reef Habitat (acres)	Intertidal Reef Habitat (acres)	Temporary Flotation Channels (acres)[11]
Grand Bay and Graveline Bayou (Jackson County)				
Grand Bay Intertidal and Subtidal Reefs		77	3	-
Graveline Bay Intertidal and Subtidal Reefs		70	2	-
Back Bay of Biloxi and Vicinity (Jackson and Harrison County)				
Channel Island Living Shoreline and Subtidal Reefs	1.6	70	-	7.9
Big Island Living Shoreline	3.5	-	-	9.3
Little Island Living Shoreline	1.6	-	-	4.5
Deer Island Subtidal Reef	-	20	-	-
St. Louis Bay (Harrison and Hancock County)				
Wolf River Living Shoreline and Subtidal Reef	1.3	30	-	5.4
St. Louis Bay Living Shoreline	9.9	-	-	58.3
TOTAL	17.9 acres	267 acres	5 acres	85.4 acres

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures are proposed to avoid and minimize impacts to geology and substrates:

- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and, to the extent practicable, avoided depending on project design and/or construction timing.
- In areas where temporary flotation channels are required, work barges would be moored for overnight and weekends/holidays only in areas where previous impacts have occurred (temporary flotation channels, deployment areas).
- Spoil from temporary flotation channels would be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels would be filled in mechanically.
- Pilings would be driven instead of jetting to reduce the disturbance of bottom sediments and bottom dwelling organisms.

[11] Reflects the maximum footprint of temporary flotation channel, if required. Temporary flotation channel dimensions (e.g., length, depth and width) will be minimized and to the extent practicable, avoided depending on project design and/or construction timing.

6.2.7.1.2 Hydrology and Water Quality

Affected Environment

Hydrology and Water Quality

The affected resources consist of shallow water within bays along the Mississippi Gulf Coast in Hancock, Harrison, and Jackson counties. Mississippi's water quality standards specify the appropriate levels for which various water quality parameters or indicators support a water body's designated use(s). Each use assessed for a water body is determined to be either "Attaining" or "Not Attaining" in accordance with the applicable water quality standards and U.S. Environmental Protection Agency (EPA) guidelines for assessments pursuant to §305(b). A water body's use is said to be impaired when—based on current and reliable site-specific data of sufficient quantity, quality, and frequency of collection—it is not attaining its designated use(s). Where data and information of appropriate quality and quantity indicate non-attainment of a designated use or uses for an assessed water body, the water body will be placed on the Mississippi 2014 Section 303(d) List of Impaired Water Bodies (MDEQ 2014). All of the project components are located in the Mississippi Coastal Streams watershed. It has a drainage area of approximately 1,550 square miles (MDEQ 2014) and includes portions of Lamar, Hancock, Pearl River, Stone, Harrison, and Jackson counties. Major tributaries within the Mississippi Coastal Streams watershed include Bayou Casotte, Wolf River, Rotten Bayou, DeLisle Bayou, Bayou La Croix, Bayou Bacon/Jourdan River, Turkey Creek/Bernard Bayou, Biloxi River, and Tuxachanie Creek.

Major rivers carry high sediment loads into the Mississippi Sound. Inland fresh water drainage from these and other smaller rivers, as well as St. Louis Bay and Back Bay of Biloxi, create an estuarine environment in the Mississippi Sound. Variable salinity levels can affect the productivity and survival of organisms living in the Mississippi Sound, as well as economic and recreational activities. Pollution from agriculture, improperly treated sewage, roadways, accidental spills, industry discharges, and other sources also affect the health of the Mississippi Sound.

Grand Bay (Jackson County): Grand Bay is influenced by freshwater flow from Southwest Bayou, Middle Bayou, Clay Bayou, Bayou Cumbest and Bayou Heron. The Grand Bay Intertidal and Subtidal Reefs component features are located in waters classified by the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MDEQ 2012) as "shellfish harvesting[12]", "recreation[13]", and "fish and wildlife[14]" (Bang's Lake), and "recreation" and "fish and wildlife[15]" for all other areas in the project location. Bayou Cumbest, which drains directly into Grand Bay, is listed as impaired on the State of Mississippi 303(d) list (MDEQ 2014) for Organic Enrichment / Low Dissolved Oxygen.

[12] Waters in the shellfish harvesting classification are for propagation and harvesting shellfish for sale or use as a food product.

[13] Waters in the recreation classification are to be suitable for recreational purposes, including such water contact activities as swimming and water skiing.

[14] Waters in the fish and wildlife classification are intended for fishing and for propagation of fish, aquatic life, and wildlife.

[15] Waters that meet the Fish and Wildlife criteria are also be suitable for secondary contact recreation.

Graveline Bay (Jackson County): Graveline Bay is influenced by freshwater flow from several small tributaries. The Graveline Bay Intertidal and Subtidal Reefs component features would be located in waters classified by the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MDEQ 2012) as "shellfish harvesting", "recreation", and "fish and wildlife" (within Graveline Bay proper), and "recreation" and "fish and wildlife" for all other areas in the project location. None of the waterbodies that drain directly into Graveline Bay are listed as impaired on the State of Mississippi 303(d) list (MDEQ 2014).

Back Bay of Biloxi and Vicinity (Jackson and Harrison County): The Back Bay of Biloxi and Vicinity is influenced by freshwater flow from Tchoutacabouffa River and Biloxi River. Three of the project components (Channel Island, Big Island and Little Island) would be located in waters classified by the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MDEQ 2012) as "recreation", and "fish and wildlife". The Deer Island component would be located within waters classified as "shellfish harvesting", "recreation", and "fish and wildlife." None of the waterbodies that drain directly into the Back Bay of Biloxi are listed as impaired on the State of Mississippi 303(d) list (MDEQ 2014).

St. Louis Bay (Harrison and Hancock County): St. Louis Bay is influenced by freshwater flow from the Jourdan River, Bayou Portage and Wolf River. The Wolf River Living Shoreline and Subtidal Reef and St. Louis Bay Living Shoreline project components are located within waters classified by the State of Mississippi Water Quality Criteria for Intrastate, Interstate, and Coastal Waters (MDEQ 2012) as "shellfish harvesting", "recreation", and "fish and wildlife." None of the waterbodies that drain directly into St. Louis Bay are listed as impaired on the State of Mississippi 303(d) list (MDEQ 2014).

Tides and Currents

A tidal datum is referenced to a fixed point known as a benchmark and is typically expressed in terms of mean higher high water (MHHW[16]), mean high water (MHW[17]), mean low water (MLW[18]), mean lower low water (MLLW[19]), and mean tidal levels (MTL[20]) over the observed period of time. MHW is the

[16] Mean Higher High Water: The average of the higher high water height of each tidal day observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch. The National Tidal Datum Epoch is The specific 19-year period adopted by the National Ocean Service as the official time segment over which tide observations are taken and reduced to obtain mean values (e.g., mean lower low water, etc.) for tidal datums.

[17] MHW Mean High Water: The average of all the high water heights observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

[18] Mean Low Water: The average of all the low water heights observed over the National Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

[19] Mean Lower Low Water: The average of the lower low water height of each tidal day observed over the National

average of all the high-water heights observed over one tidal epoch. MLW is the average of all the low-water heights observed over one tidal epoch. MTL is the mean of the MHW and MLW for that period of time. Water depths in project areas range from 5 to 9 ft. for maximum depths.

Grand Bay, Back Bay and Graveline Bay (Harrison and Jackson County): The Grand Bay NERR, Mississippi Sound, MS - Station ID: 8740166 was selected to determine historical water levels, as it is the closest water level gauge to the project area with appropriate data. The mean range of tide between MHW and MLW is 1.36 ft.; wind and seasonal tides affects local water depth and surface level fluctuations. Maximum depth in the Grand Bay project area is 9 ft., and for the Back Bay of Biloxi and vicinity and for Graveline Bay project areas the maximum depth is 5 ft. This gauge is located at 30° 24.8' N, 88° 24.2' W. The data from the tide station are as follows:

- MHHW = 0.99 ft. NAVD 88
- MHW = 0.89 ft. NAVD 88
- MTL = 0.21 ft. NAVD 88
- MLW = -0.47 ft. NAVD 88
- MLLW = -0.60 ft. NAVD 88

St. Louis Bay (Harrison, and Hancock County): The Bay Waveland Yacht Club gauge (Station ID: 8747437) was selected to determine historical water levels, as it is the closest NOAA water level gauge to the project area with appropriate data. The mean range of tide between MHW and MLW is 1.52 ft.; wind and seasonal tides affects local water depth and surface level fluctuations. The maximum depth in the St. Louis Bay project area is 5 ft. This gauge is located at 30° 19.5'N, 89° 19.5'W. The data from the tide station are as follows:

- MHHW = 1.42 ft. NAVD 88
- MHW = 1.32 ft. NAVD 88
- MTL = 0.56 ft. NAVD 88
- MLW = -0.20 ft. NAVD 88
- MLLW = -0.31 ft. NAVD 88

Floodplains

The project components would be completed in shallow marine environments.

Wetlands

In general, estuarine areas adjacent to the proposed features are composed of low, mid, and high marsh zones. In the low marsh areas, regularly flooded by tidal activity, the area consists of mesohaline

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Tidal Datum Epoch. For stations with shorter series, comparison of simultaneous observations with a control tide station is made in order to derive the equivalent datum of the National Tidal Datum Epoch.

[20] Mean Tide Level: The arithmetic mean of mean high water and mean low water.

habitat. Mesohaline is a measurement of salinity and refers to a water salinity ranging from 8 to 15 parts per thousand (ppt). The intermediate (mid) marsh zone is irregularly flooded by tidal activity and is typically dominated by black needlerush (*Juncus roemerianus*), which can be intermixed with salt grass (*Distichlis spicata*) in oligohaline (salinity of 0.5 to 5.0 ppt) areas. In higher elevation areas, it is not uncommon to observe numerous species intermixed including salt grass, black needlerush, and salt meadow cordgrass (*Spartina patens*).

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.2 of the Final Phase III ERP/PEIS describe the impacts to hydrology and water quality from early restoration project types 2 and 6. These project types are expected to result in minor to moderate short-term construction-related adverse impacts, primarily increases in turbidity. Shoreline protection could also result in minor long-term adverse effects by changing the ocean current patterns in the localized area. However, long-term benefits to hydrology and water quality are also expected, including improving wetland function, reduction in the inland flow of salt water, reduction in nutrient and sediment runoff, and reduction in erosion/loss of wetlands. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to hydrology and water quality. No mitigation measures would be necessary. The potential benefits to hydrology and water quality would not be realized.

Proposed Action

Environmental consequences affecting hydrology, water quality, tides and currents, wetlands and floodplains are discussed below.

Hydrology, Tides and Currents: Impacts from breakwater construction and subtidal and intertidal reefs are provided here.

Breakwater construction: Shoreline protection and erosion reduction could generally help reduce storm surges on shorelines and marshes. Breakwater construction could reduce the loss of the wetlands and channel networks particularly in St. Louis Bay. Gaps would be present between breakwater segments that would allow tidal exchange flows and waterway access. Breakwaters would change natural current patterns, sediment accretion and erosion rates. Wave energy and resulting erosion would be substantially reduced. This could be a long-term beneficial effect to shorelines that would extend beyond the construction period.

Intertidal and Subtidal Reef Habitat: Creating intertidal and subtidal reef habitat could help protect eroding wetlands and shallow water areas. Placement of cultch and other materials to establish living

reefs adjacent to shorelines and breakwaters would reduce wave energy reaching shorelines. This would provide long-term beneficial effects by reducing wave energy of storm surges as well.

Water Quality: Placement of the breakwaters, subtidal and intertidal reef would result in short-term, minor adverse impacts to water quality as a result of resuspension of sediment by vessels (barges, tugs, skiffs, etc.) moving in and out of the project area, excavation of the temporary flotation channels, placement of breakwaters and deployment of intertidal and subtidal reefs. The suspended sediment may be transported into surrounding wetlands and waterways. However, the area is currently exposed to elevated turbidity levels as a result of resuspension of sediment from river transport and during frequent storms, tides, and other typical weather events. Impacts from turbidity would be minor, short-term and limited in spatial extent.

In addition to turbidity, the water quality could be adversely impacted by leaks or spills of fuel and lubricants used by vessels and other equipment during the construction of the temporary flotation channels, breakwater, and reefs. Impacts, if any, would be short-term, localized and minor. Best management practices are listed at the end of this section.

Breakwaters, once established as living reefs, could benefit local water clarity because bi-valves such as oysters and mussels feed by filtering the water column. The reef could also reduce wave energy reaching the shoreline, minimizing erosion, and decreasing sediment suspended in the water column from erosion. Long-term this method could result in minor improvements to water quality. The benefits would be long-term because they would extend beyond the construction period.

Floodplains: The majority of the project is located below the MHW level and would not impact the floodplain in the project area. Shoreline protection and erosion reduction could generally help reduce storm surges on coastal wetlands, and limit the shoreward extent of saltwater flow.

Wetlands: There would be short-term, minor, and localized indirect impacts from sediment movement that could temporarily impact the shoreline edge near the project components. The project would result in long-term beneficial impacts to salt marsh by reducing shoreline erosion and resulting marsh degradation. These actions could reduce the pace and extent of future saltwater intrusion to freshwater and brackish systems and reduce erosion and loss of the wetlands and channel networks.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to hydrology and water quality:

- The Trustee would apply for a Mississippi Coastal Wetland Protection Act Permit and authorization by the USACE. Under the Coastal Zone Management Act of 1972, selected restoration projects must be consistent with the federally-approved coastal management programs for the states in which the projects are to be conducted. Best management practices along with other avoidance and mitigation measures required by state and federal regulatory agencies, would be employed to minimize potential water quality and sedimentation impacts.

Authorization by the U.S. Army Corps of Engineers (USACE) under Section 10/404 and State Water Quality Certifications would be required and permit conditions would be met.

- Appropriate BMPs such as routine maintenance, inspection, and proper refueling of construction equipment would be used to prevent, control, and mitigate impacts.
- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.
- Spoil from temporary flotation channels would be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels would be filled in mechanically.

6.2.7.1.3 Summary of Impacts to the Physical Environment

Impacts to the physical environment from implementation of the Restoring Living Shorelines and Reefs in Mississippi Estuaries would include:

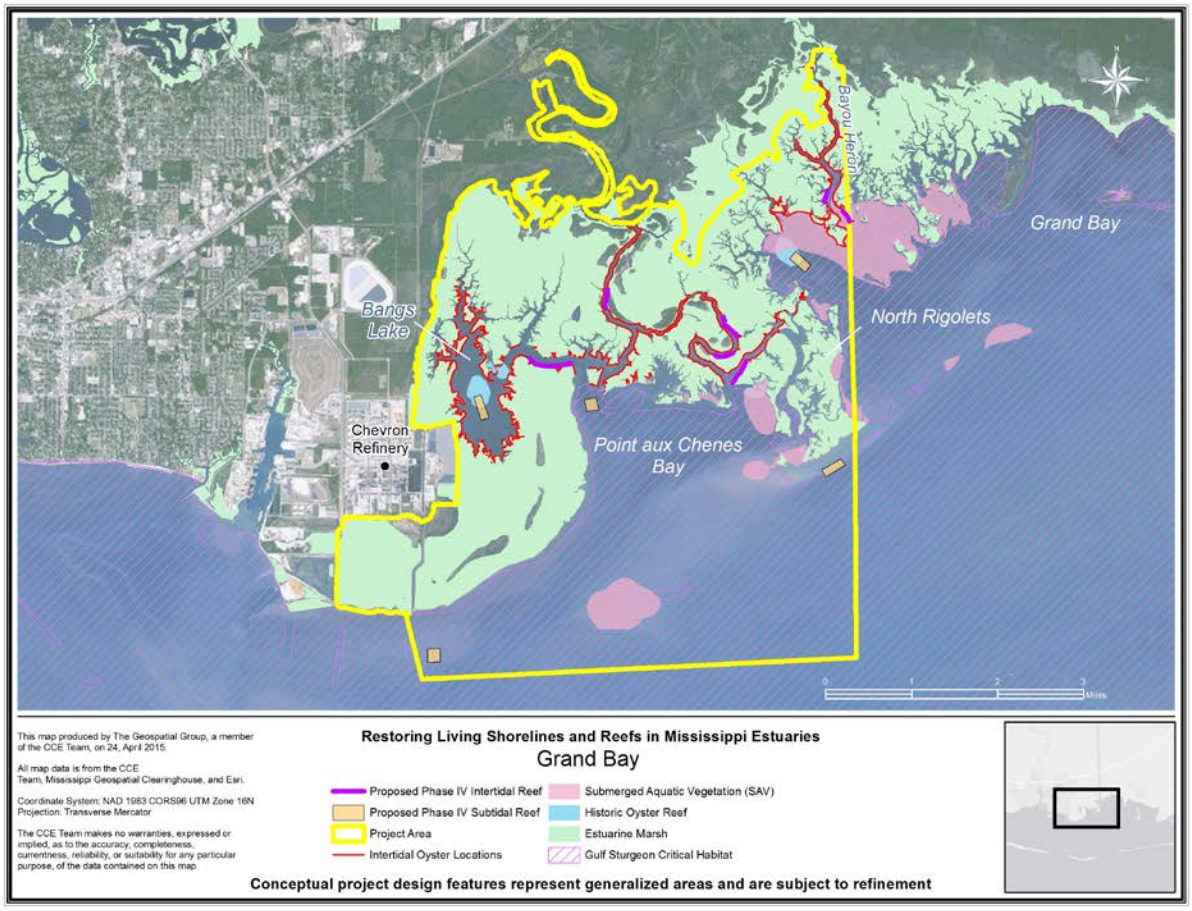
- Geology and substrates: Minor to moderate short to long-term adverse impacts would occur due to the construction of breakwaters, subtidal reefs and intertidal reefs, and the construction of temporary flotation channels (if needed). The project would result in long-term beneficial impact on shorelines and marsh resulting from the placement of breakwater which would reduce the wave energy by slowing shoreline and marsh erosion and resulting in the long-term protection of the shoreline.
- Hydrology, tides and currents: Breakwater construction would provide a long-term beneficial effect to shorelines by reducing erosion. Creation of intertidal and subtidal reef habitat would provide long-term beneficial effects by reducing wave energy of storm surges as well.
- Water quality: Placement of the breakwaters, subtidal and intertidal reef would result in short-term, minor localized adverse impacts to water quality as a result of increased turbidity and potential leaks or spills of fuel and lubricants used by vessels and other equipment during construction. However, long-term benefits would occur due to enhanced water clarity caused by bi-valve filtering of the water column, and decrease of suspended sediment in the water column due to reduction of wave energy reaching the shoreline.
- Floodplains: Beneficial long-term impacts would occur because shoreline protection and erosion reduction could generally help reduce storm surges on coastal wetlands, and limit the shoreward extent of saltwater flow.
- Wetlands: There would be short-term, minor, and localized indirect adverse impacts from sediment movement that could temporarily impact the shoreline edge near the project components. The project would result in long-term beneficial impacts to salt marsh by reducing shoreline erosion and resulting marsh degradation. These actions could reduce the pace and extent of future saltwater intrusion to freshwater and brackish systems and reduce erosion and loss of the wetlands and channel networks.

6.2.7.2 Biological Environment

The Mississippi Sound extends along the southern coasts of Mississippi and Alabama. The Mississippi Sound is separated from the Gulf of Mexico by several narrow barrier islands and sand bars (including Cat Island, Ship Island, Horn Island, and Petit Bois Island), which provide dynamic and diverse habitats especially for over 300 species of migratory or permanent resident bird species (USACE 2009). Along the Mississippi Sound, there are numerous coastal bays including St. Louis Bay, Biloxi Bay, Back Bay of Biloxi, Pascagoula Bay, Graveline Bay and Grand Bay. The Mississippi Sound is shallow with water depths generally not exceeding 20 ft. Water is exchanged with the Gulf of Mexico through the openings between the barrier islands. Its partially protected nature and the influx of riverine freshwater create a salinity gradient within the Sound (Priddy et al. 1955). This delicate mix of fresh and salt water provides a suitable habitat for oysters, shrimp, and other fisheries. Christmas and Waller (1973) reported 138 fish species in 98 genera and 52 families taken from areas across Mississippi Sound. Vittor and Associates (1982) identified over 437 taxa of macrofauna from the sound with densities varying from approximately 1,200 to 38,900 individuals per square yard.

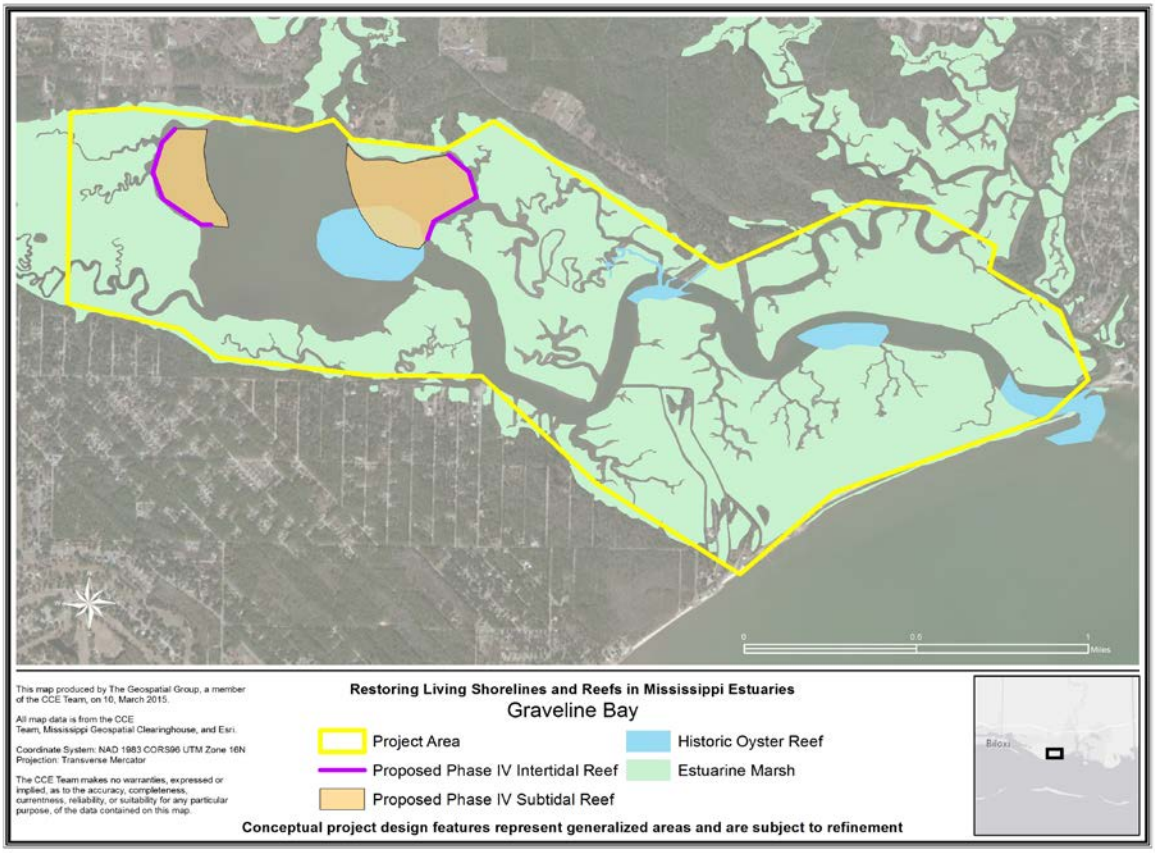
Grand Bay (Jackson County)**:** The Grand Bay National Estuarine Research Reserve/National Wildlife Refuge (NERR/NWR) and Grand Bay Savanna Preserve is a large, pristine, intact estuary which supports a highly diverse floral and faunal community (Figure 6-10). This site, located in southeastern Jackson County, encompasses almost 27,000 acres and is one of the largest estuarine systems in Mississippi. The Grand Bay area lies within the gently sloping, lower Gulf coastal plain and was part of the previous deltas of the Escatawpa and Pascagoula rivers. A mosaic of coastal habitat types extend from near Interstate 10 south for 10 miles to the open waters of the Mississippi Sound, and for 10 miles from near the Chevron Refinery in the west to Isle aux Dames, Alabama, to the east. This broad mosaic of estuarine and non-estuarine wetland habitats forms a largely intact coastal watershed. The open-water estuarine areas support declining oyster reefs and extensive SAV habitats. The intertidal portion of the site includes a wide variety of marsh types (low, mid-level and high elevation zones across a wide range of salinity). The coastal marshes are also among the most extensive and productive in the state. The non-tidal areas include wet pine savanna, coastal bayhead and cypress swamps, freshwater marshes and maritime forests.

Figure 6-10. Habitats in the Grand Bay



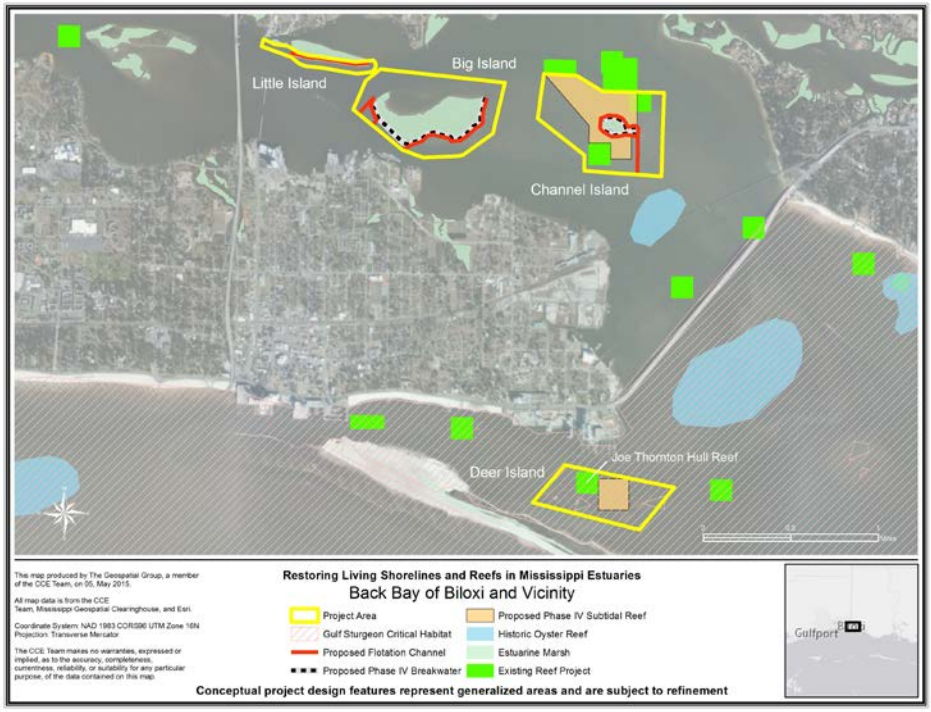
Graveline Bay (Jackson County): Graveline Bay and waterways represent one of only a few relatively undisturbed estuarine bays and small tidal creeks in Mississippi (Figure 6-11). The area supports salt marsh, brackish marsh, and several degraded oyster beds. This shallow, coastal bay/marsh estuarine system receives only local freshwater runoff and consists largely of mid-level needle rush (*Juncus roemerianus*) dominated marsh along its entire length. Smooth cordgrass (*Spartina alterniflora*) occurs largely as narrow (1 to 3 m) bands along the waterways. Subtidal ecological communities/habitats include muddy sand embayment, small tidal creeks and mollusk reefs. Intertidal ecological communities/habitats include sand beach, mesohaline marsh, and oligohaline marsh. Much of the marsh area is already part of the MDMR Coastal Preserve Program.

Figure 6-11. Habitats in Graveline Bay



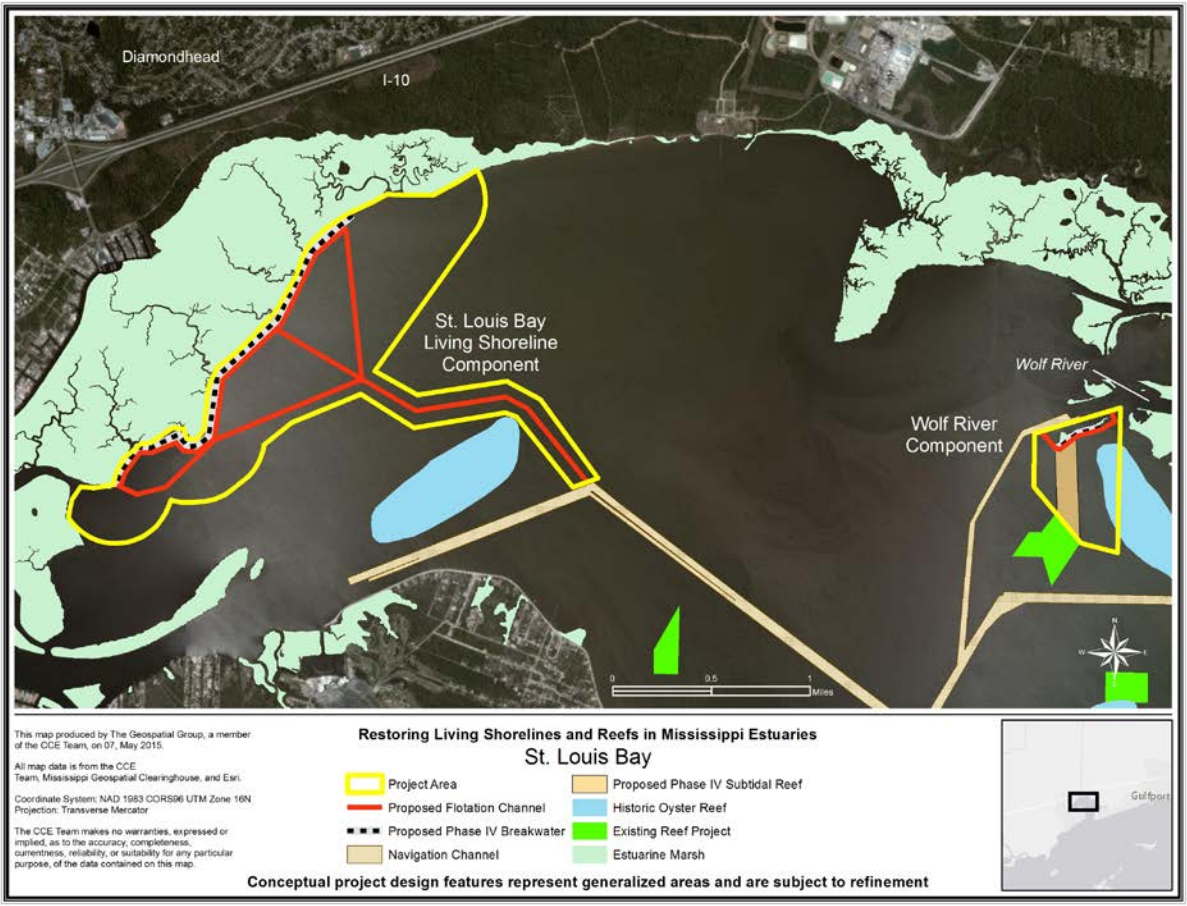
Back Bay of Biloxi (Jackson and Harrison County): The Back Bay of Biloxi is an estuarine bay that receives freshwater from the Biloxi and Tchoutacabouffa rivers as well as numerous tidal streams and bayous that drain local areas (Figure 6-12). It is surrounded by a mix of industrial, commercial and residential properties with large amounts of hardened shorelines. Portions of the shoreline of western Back Bay of Biloxi are within the Biloxi River Coastal Preserve maintained by MDMR. Navigation channels are in use throughout the entire bay, and have high traffic volume. As such, the water in Back Bay of Biloxi is turbid and in general is not conducive to SAV growth. The project area islands are composed primarily of black needle rush (*Juncus roemerianus*) marsh. Smooth cordgrass (*Spartina alterniflora*) occurs as narrow, disjunct bands along low marsh fringes.

Figure 6-12. Habitats in the Back Bay of Biloxi and Vicinity



St. Louis Bay (Harrison and Hancock County): St. Louis Bay is a coastal bay and estuary on the Mississippi Gulf Coast and contains some of few remaining expansive salt marsh ecosystems in Mississippi (Figure 6-13). The Jourdan and Wolf rivers are the two major systems that enter the bay and drain approximately 523,000 acres. Other notable water bodies that drain into St. Louis Bay are Bayou LaCroix from the west and Bayou Portage from the east. Several hundred acres of marsh and upland habitats that flank the mouths of the Wolf and Jourdan rivers are part of the MDMR Coastal Preserves Program. The estuarine marsh south of the city of Diamondhead represents over 1,000 acres of continuous tidal marsh and is the largest habitat of this type in the estuary.

Figure 6-13. Habitats in St. Louis Bay



Living Coastal and Marine Resources includes a discussion of SAVs, invasive species, nearshore benthic invertebrates, marine mammals, protected species, migratory birds, and essential fish habitat.

6.2.7.2.1 Living Coastal and Marine Resources

Submerged Aquatic Vegetation (SAV)

Affected Environment

The project components are entirely in shallow open water environments. In general the areas where structures would be placed are soft bottom areas or remnant oyster reef or artificial reef areas devoid of vegetation.

Grand Bay Project (Jackson County): Large SAV beds exist in the Grand Bay estuary and are monitored by the Grand Bay NERR staff at various locations annually. The last mapping effort took place in 2010 (Figure 6-10) in which a total of 530 acres were documented. The beds are typically patchy with shoal grass (*Halodule wrightii*) and widgeongrass (*Ruppia maritima)* sharing dominance. Macroalgae and epiphytes are documented in the annual transect surveys conducted by Grand Bay NERR staff.

Back Bay of Biloxi and Vicinity (Jackson and Harrison County): Surveys completed in 2010 found evidence of SAVs further upstream into the Biloxi River. No SAVs were found near the project areas (Cho, et. al. 2010). The project areas are located in shallow water with soft bottom substrate.

Graveline Bay and St. Louis Bay Project Components (Jackson, Harrison, and Hancock County): The project components in these bays would be situated near eroded shoreline and on soft bottom substrate. SAV beds are not likely present in these areas. There is no known survey of these areas for SAVs, but the waters are turbid and do not support large, continuous beds.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.5 of the Final Phase III ERP/PEIS describe the impacts to habitats from early restoration project types 2 and 6. These project types are expected to result in short-term minor to moderate adverse impacts to habitat as a result of construction activities. Adverse impacts could include: increased soil erosion, vegetation damage or removal, changes in water quality from turbidity and substrate disturbance from in-water work, and the potential introduction or opportunity for establishment of invasive species. Long-term minor to moderate adverse impacts could occur to habitats adjacent to new breakwaters or other shoreline protection structures as they could change natural current patterns, sediment accretion and erosion rates. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to SAVs. There would be no long-term benefits by creation of protected areas which could be conducive to SAV growth. No mitigation measures would be necessary.

Proposed Action

Due to the eroded environment, turbid waters, and soft bottom substrate, SAV beds are not anticipated within the St. Louis Bay, Back Bay, and Graveline Bay Project components. The Grand Bay Project component area is more likely to have some SAV beds. Prior to construction activities, SAV surveys would be completed in the project component areas. If any SAV beds are found, the project would be modified to avoid the beds if possible. Even with surveys prior to construction, the deployment of the reef material in the Grand Bay Project component area could result in short-term, minor, adverse impacts to SAVs in the vicinity of the project resulting from temporary sedimentation in beds. Any disturbance would temporary in nature; it is anticipated that SAV beds would recover naturally. Construction of the breakwaters in St. Louis Bay and Back Bay could provide or protect areas conducive to SAV growth which could provide long-term benefits as established or ephemeral SAV beds in these waterbodies.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review would result in the avoidance and minimization of impacts to SAVs:

- To the extent practicable, SAVs would be avoided in the siting and construction of breakwaters, intertidal habitat, subtidal habitat and temporary flotation channels.

Invasive Species

Affected Environment

The potential introduction of terrestrial and aquatic non-native invasive species of plants, animals, and microbes is a concern for any proposed project. Non-native invasive species could alter existing terrestrial or aquatic ecosystems, may cause economic damages and losses, and are the second most common reason for protecting species under the Endangered Species Act. The species that are or may become introduced, established, and invasive are difficult to identify. The analysis focuses on pathway control or actions/mechanisms that may be taken or implemented to prevent the spread of invasive species on site or introduction of species to the site. Surveys have not been conducted to determine if invasive species are present.

Environmental Consequences

Programmatic Review

Sections 6.3.2.5 of the Final Phase III ERP/PEIS describe the impacts to habitats from early restoration project types 2 and 6. Construction activities related to placement of breakwaters or other shore protection systems could result in introduction of invasive species during construction activities, e.g., through transport on construction equipment. However, the use of BMPs would help prevent the introduction of invasive species. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts which would result in the introduction of invasive species. No mitigation measures would be necessary.

Proposed Action

This project involves placement of breakwater, reef material, and dredging of temporary flotation channels. A variety of in-water construction equipment would be used. Each of these actions and pieces of equipment serve as a potential pathway to introduce or spread invasive species. BMPs would be implemented to ensure these pathways are “broken” and do not spread or introduce species (see BMPs listed below). The implementation of these BMPs meets the spirit and intent of EO 13112. Due to the implementation of BMPs, the Trustees expect risk from invasive species introduction and spread to be short-term and minor.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review would result in the avoidance and minimization of the introduction and spread of invasive species:

- All equipment to be used during the project, including personal gear, would be inspected and cleaned such that there is no observable presence of mud, seeds, vegetation, insects and other species.
- Reef habitat material would be treated or inspected to remove "non-target" species.

Nearshore Benthic Invertebrates

Affected Environment

Benthic Infauna and Epifauna

Oysters are important as both organisms and habitat with an integral role in the functioning of the ecosystem. The aggregations of oysters that comprise an oyster reef result in a complex and hard substrate that provides habitat for multiple benthic organisms and fish, increasing biodiversity in estuaries. Within an oyster reef community more than 300 other macrofauna species may also be present. Oysters are an ecological keystone species in most estuaries along the Atlantic and Gulf coasts, and oyster populations contribute to the integrity and functionality of estuarine ecosystems.

Nearshore benthic communities in the Gulf are largely composed of macroinvertebrate groups such as mollusks, sponges, polychaetes, corals, and crustaceans. These groups are diverse and are found in Gulf habitats spanning from the intertidal zone to the soft sediments on the continental shelf. Benthic communities perform important ecological functions in the nearshore food web, and several groups (e.g., lobster, shrimp, and crabs) are also commercially important. Sponges, mollusks, arthropods (including crustacea), and polychaetes are all important taxa and contribute substantially to benthic biomass. These taxa include many filter-feeding species, which remove and digest phytoplankton and particulate organic matter and deposit processed materials to the substrate (Felder and Camp 2009). Benthic fauna are often habitat forming and provide habitat and nursery areas for fish and crevices for mobile invertebrates to seek shelter; they also harbor diverse microbial communities (Taylor et al. 2007). Mollusks and crustaceans, including both shrimp and crab, are important ecologically and commercially throughout the Gulf region.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.6 of the Final Phase III ERP/PEIS describe the impacts to living coastal and marine resources from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). These project types would result in short-term and long-term minor to moderate adverse impacts to living coastal and marine resources as a result of restoration construction activities. Project types that include in-water work or dredging could affect oyster populations and other benthic organisms from increased turbidity and siltation, which may increase mortality and inhibit spawning

activities. Increased turbidity could limit available light necessary for photosynthesis, and disruption in the water column and surface water could disturb or kill some pelagic microfaunal organisms. These project types could also result in long-term benefits by providing habitat to living coastal and marine resources. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to nearshore benthic invertebrates. No mitigation measures would be necessary. There would be no creation of intertidal or subtidal reef habitat for nearshore benthic invertebrates.

Proposed Action

A brief summary of impacts from breakwater construction, intertidal and subtidal habitat deployment and construction of temporary flotation channels is provided here.

Breakwater construction: Breakwater deployments would occur near eroded shorelines and would have little effect on oysters, infauna, or epifauna. Short-term minor impacts to local oyster populations or other benthic organisms may occur from increased turbidity, substrate disturbance, or siltation during construction. Mollusks and crustaceans such as shrimp and crab are likely limited in soft-sediment areas where construction would occur. These mobile invertebrates would experience a short-term minor impact and a long-term benefit due to the placement of hardened structure. The project would result in 17.9 acres of soft bottom habitat that would be replaced by a three-dimensional breakwater that would be colonized by oysters, infauna, and other epifauna. The zone between the breakwater and the existing eroded shoreline would also become a more stable soft-bottom habitat for these species. This represents a long-term benefit for these organisms.

Intertidal and subtidal reef habitat deployment: Subtidal reef habitat would be placed on or adjacent to existing or historic intertidal or subtidal reef habitat. Reef material deployment would result in short-term minor adverse impact to remnant hard-surface bottom habitat and/or colonized reefs in the project area. Approximately 267 acres of subtidal reef and five acres of intertidal reef deployment would result in colonization over a two-to-five-year period. Development of the reefs represents a long-term benefit to the infauna and epifauna that typically colonize subtidal reefs. These mobile invertebrates would experience a short-term minor impact and a long-term benefit due to the placement of hardened structure.

Construction of Temporary flotation channels: Construction would temporarily displace sediment-dwelling invertebrates in 85.3 acres. The impact would be short-term and minor. Temporary flotation channels, if needed, would be filled in upon completion of the project and would likely be recolonized by existing organisms in nearby sediments.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to oysters, infauna and epifauna:

- SAV surveys and where needed oyster/hard bottom and artificial/nearshore reef surveys would be conducted as part of project site refinement.
- For breakwaters, intertidal reef habitat, subtidal reef habitat, and temporary flotation channels effort would be made during design and construction to avoid existing environmentally sensitive areas such as viable productive oyster reefs, emergent marsh and SAVs, and other living communities.
- Temporary flotation channel dimensions (e.g., length, depth and width) be minimized and to the extent practicable, avoided depending on project design and/or construction timing.

Marine Mammals

Affected Environment

Marine mammals found within the Gulf of Mexico include 21 species of cetaceans (whales and dolphins) and the West Indian manatee. The Marine Mammal Protection Act (MMPA) prohibits the "taking" of marine mammals incidental to a specified activity, unless such taking is appropriately authorized.

Dolphin Species

The bottlenose dolphin, *Tursiops truncatus*, and the Atlantic spotted dolphin, *Stenella frontalis*, are the two most common marine mammals found in the Gulf of Mexico. Both species feed primarily on fish, squid and crustaceans. While *S. frontalis* spends the majority of its life offshore, *T. truncatus* often travels into coastal bays and inlets for feeding and reproduction.

West Indian Manatee

The West Indian manatee (*Trichechus manatus latirostris*) is listed as endangered under the ESA. The species is endangered due to its small population size (less than 2,500 mature individuals with possible population decline), the possibility of at least a 50 percent future reduction in population size, and near- and long-term threats from human-related activities (USFWS 2013, Mississippi Department of Wildlife Fisheries and Parks [MDWFP] 2001). Between October and April, manatees concentrate in areas of warmer water. During summer months, the species may migrate as far west as the Louisiana and Texas coast on the Gulf of Mexico. Manatees inhabit both salt and fresh water of sufficient depth (about 5 feet to usually less than 18 feet). Manatees will consume any aquatic vegetation available to them including sometimes grazing on the shoreline vegetation.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.6 of the Final Phase III ERP/PEIS describe the impacts to living coastal and marine resources from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). Implementation of these project types could result in short-term, minor to moderate impacts because of possible displacement of marine mammals from the work area due to increase in activity, noise, vibration, and turbidity during construction. These impacts would only affect localized areas. BMPs are expected to avoid or minimize these impacts. If projects have potential for incidental

harassment of marine mammals or adverse effects to ESA-listed marine mammals or sea turtles, authorizations and consultations with appropriate agencies would be required prior to project implementation. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/ PEIS.

No Action

Under the No Action alternative, there would be no impacts to marine mammals. No mitigation measures would be necessary.

Proposed Action

Noise and other activity associated with proposed construction may temporarily disturb certain dolphin species and manatee in the vicinity of the project area through temporary impacts on prey abundance, water quality (turbidity), and underwater noise, and may temporarily increase the potential for boat collisions with certain species in the project area. However, the mobility of these species reduces the risk of injury due to construction activity. Based on the mobility of these species, the short duration of construction activities, and the proposed construction methodology, effects on dolphin species and manatees are not anticipated. The Trustees evaluated the potential for incidental take of marine mammals. The proposed project is located in shallow estuarine waters and will not involve construction methodologies known to impact marine mammals.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to marine mammals:

- Standard Manatee Conditions (A-D) for In-Water work (USFWS 2011)
- Sea Turtle and Smalltooth Sawfish aConstruction Guidelines (NMFS 2006)
- Measures for Reducing Entrapment Risk to Protected Species (NMFS 2012)

Protected Species

Affected Environment

The U.S. Fish and Wildlife Service (USFWS) lists species as threatened or endangered when they meet criteria detailed under the ESA of 1973, as amended (16 U.S.C. §1531 et seq.). Additionally, MDWFP and NOAA National Marine Fisheries Service (NMFS) identify and list protected species. Section 7(a) (2) of the ESA requires that each federal agency ensure that any action authorized, funded, or carried out by the agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of those species. When the action of a federal agency may affect a protected species or its critical habitat, that agency is required to consult with either the NMFS or the USFWS, depending upon the protected species that may be affected. To fulfill requirements and obligations under ESA and Marine Mammal Protection Act (MMPA), NOAA is reviewing and DOI completed a review of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project for compliance with Section 7 of the ESA of 1973 , as amended (16 U.S.C.

1531 et seq.) and Section 101 of the MMPA of 1972, as amended (16 U.S.C. 1371(a)(5) et seq.). Biological Evaluation forms were submitted to the USFWS for consultation and coordination on the ESA, MBTA and BGEPA (DOI 2015) and to NMFS for ESA (NOAA 2015). The USFWS local field office concurred by letter dated August 24, 2015. See Phase IV ERP/EA Chapter 6, sections 6.2.7.2.1. The Trustees are awaiting NMFS SERO's response on ESA. The Trustees coordinated with NMFS SERO's Protected Resources Division to determine that this project does not require authorization under the MMPA. The Migratory Bird Treaty Act (MBTA) compliance and Bald and Golden Eagle Protection Act (BGEPA) are also discussed in this section.

Relevant federally protected species that are known to occur or could occur in Hancock County, Harrison County, or Jackson County are listed in Table 6-7. However, only the piping plover, red knot, five sea turtle species, Gulf sturgeon, West Indian manatee and Alabama red-bellied turtle are likely to occur in or near the project area or could pass through the project area. A brief discussion of the state imperiled diamond back terrapin is also provided in the environmental consequences.

Table 6-7. Restoring Living Shorelines and Reefs in Mississippi Estuaries — Federally threatened, endangered, and proposed species

Common Name	Scientific Name	Federal Status	County	Habitat
Birds				
Piping Plover	*Charadrius melodus*	Threatened	Jackson, Harrison	Beaches and mudflats in southeastern coastal areas. Critical Habitat, MS-15, exists in Jackson County
Red Knot	*Calidris canutus rufa*	Threatened	Jackson, Harrison	Marine intertidal habitats including inlets, estuaries, and bays feeding in mud and sand flats on beaches and barrier islands
Fishes				
Gulf Sturgeon	*Acipenser oxyrinchus desotoi*	Threatened	Jackson, Harrison, Hancock	Migrates from large freshwater coastal rivers to brackish and marine coastal bays and estuaries. The Deer Island Subtidal Reef and the Grand Bay Intertidal and Subtidal Reef project components have structures within Critical Habitat Unit 8
Mammals				
West Indian Manatee	*Trichechus manatus*	Endangered	Jackson, Harrison, Hancock	Fresh and salt water in large coastal rivers, bays, bayous and estuaries
Reptiles				
Hawksbill Sea Turtle	*Eretmochelys imbricata*	Endangered	Jackson, Harrison, Hancock	Coral reefs, open ocean, bays, estuaries
Leatherback Sea Turtle	*Dermochelys coriacea*	Endangered	Jackson, Harrison, Hancock	Open ocean, coastal waters
Kemp's ridley Sea Turtle	*Lepidochelys kempii*	Endangered	Jackson, Harrison, Hancock	Nearshore and inshore coastal waters, often in salt marshes; neritic zones with muddy or sandy substrate (NOAA Fisheries 2014b)
Green Sea Turtle	*Chelonia mydas*	Threatened	Jackson, Harrison, Hancock	Shallow coastal waters with SAVs and algae, nests on open beaches

Common Name	Scientific Name	Federal Status	County	Habitat
Loggerhead Sea Turtle	*Caretta*	Threatened	Jackson, Harrison, Hancock	Open ocean; also inshore areas, bays, salt marshes, ship channels and mouths of large rivers
Alabama Red-belly Turtle	*Pseudemys alabamensis*	Endangered	Jackson, Harrison	Fresh and brackish habitats, river banks, submerged and emergent aquatic vegetation; upland habitat for nesting (MDWFP 2001; USFWS 2013)

Birds

Piping Plover (*Charadrius melodus*): The piping plover does not nest in Mississippi; however, this species uses Gulf Coast beaches and barrier islands for wintering (MDWFP 2001). Plovers use sparsely vegetated sand beaches, mudflats, and salt marshes for roosting and foraging. Piping plover critical habitat MS-15 occurs in the vicinity of the Grand Bay Intertidal and Subtidal Reefs project component but does not occur within the conceptual project footprint.

Red Knot (*Calidris canutus rufa*): In coastal Mississippi, the red knot is mainly a migratory species that uses coastal beaches and marine intertidal areas as stopover feeding locations or staging areas on the way to and from their wintering grounds in South America and breeding areas in the Arctic. Foraging on ocean beaches, mud and sand flats, and salt marshes occurs from March to April during the northward spring migration and September and October during the southward autumn migration (Niles et al. 2007; USFWS 2013). Red knots have been observed wintering on the Gulf Coast and are observed from October to March (USFWS 2013). The nonbreeding diet of this species includes marine invertebrates such as snails, crustaceans, and small mollusks including the coquina clam *(Donax variabilis),* which is common on Gulf coast beaches, and the dwarf surf clam *(Mulinia lateralis)* (Niles et al. 2007; USFWS 2013). Roosting and resting habitat includes areas above the high tide line such as reefs and high sand flats (USFWS 2013).

Fishes

Gulf Sturgeon (*Acipenser oxyrinchus desotoi*): This anadromous species migrates from coastal bays and estuaries to large coastal rivers in the spring for spawning and then returns to brackish and marine environments from October through March for foraging. The riverine spawning habitats for sturgeon in the State of Mississippi include the Mississippi, Pearl, and Pascagoula rivers (Ross et al. 2009; MDWFP 2001) but not the Biloxi and Tchoutacabouffa rivers (USFWS, GSMFC, and NMFS 1995; NMFS and USFWS 2009). The marine wintering areas where individuals have been observed are nearshore and barrier island habitats from the Pearl River east to the barrier islands (Ross et al. 2009). Winter habitat is mainly around Cat, Ship, Horn, and Petit Bois islands with nearshore observations likely due to migratory movements to and from these offshore islands (Rogillio et al. 2007; Ross et al. 2009). The coastal Mississippi Sound waters of the State of Mississippi are designated as critical habitat.

Gulf Sturgeon Designated Critical Habitat

The Deer Island Subtidal Reef project component and portions of the Grand Bay Intertidal and Subtidal Reef project components fall within Gulf sturgeon critical habitat (Unit 8-Lake Ponchartrain-Mississippi

Sound). Critical habitat was designated in 2003 by the National Marine Fisheries Service (NMFS) and was based on seven primary constituent elements (PCEs) essential for its conservation. The proposed project component areas contains four PCEs. The PCEs include abundance of prey items, water quality, sediment quality, and safe and unobstructed migratory pathways. The Trustee is working with NMFS to ensure that the project would not adversely affect any of the PCEs identified.

Mammals

West Indian Manatee (*Trichechus manatus*): This species uses both fresh and saltwater habitats such as coastal rivers, bays, bayous, and estuaries. The manatee is an occasional visitor to Mississippi's coasts, although migration into the area is poorly understood. After wintering in Florida, and perhaps Mexico, manatees migrate northward during spring, including to Mississippi and Alabama waters, although these migrations are not well understood (Fertl et al. 2005). Manatees frequently seek out freshwater sources such as rivers and river mouths and have been known to be found near estuaries (Fertl et al. 2005). SAVs are the typical manatee forage material; however, manatees can also consume other aquatic vegetation, algae, and terrestrial vegetation (Fertl et al. 2005). Given the siting of the project components to avoid SAV beds, any manatee occurrence is expected to be transitory.

Reptiles

Hawksbill Sea Turtle (*Eretmochelys imbricata*): Although this species uses various habitats such as the open ocean, bays, and estuaries throughout different life stages, it is mainly associated with coral reefs. This species nests in Florida from April to November (NOAA Fisheries 2014a). It likely does not nest in Mississippi and observations are rare in the state (MDWFP 2001; NOAA Fisheries 2014a). The main dietary items of this species are sponges and other invertebrates (NOAA Fisheries 2014a).

Leatherback Sea Turtle (*Dermochelys coriacea*): This species mainly inhabits the offshore open ocean; however, it does use nearshore coastal waters during nesting or feeding. Nesting for this species occurs in Florida from April through November. Their main forage item is jellyfish. This species migrates long distances from nesting to feeding areas. While not common, there have been sporadic observations of leatherback sea turtles in Mississippi waters (MDWFP 2001).

Kemp's ridley Sea Turtle (*Lepidochelys kempii*): Typical habitat for this species includes nearshore and inshore coastal waters and often salt marshes and neritic zones with muddy or sandy substrate (NOAA Fisheries 2013b). This species has been observed in nearshore waters of the Mississippi Sound during migration and foraging and has been accidentally caught by shore-based fishermen (MDWFP 2001; Shaver and Rubio 2008). Females typically nest from May through July (NOAA Fisheries 2014b). Males potentially use Gulf of Mexico habitats all year and females presumably use the Mississippi Sound and barrier island habitats for foraging when not nesting (NOAA Fisheries 2014b). Kemp's ridley sea turtles do not nest in Mississippi (MDWFP 2001).

Green Sea Turtle (*Chelonia mydas*): This species typically prefers shallow coastal waters with SAVs and algae for foraging and nests on open beaches (NOAA Fisheries 2015). Nesting typically does not occur on mainland beaches and there is likely no Mississippi nesting at all (MDWFP 2001; NOAA Fisheries 2015).

This species migrates long distances in the open ocean from nesting to feeding areas. Observations of this species in Mississippi are rare (MDWFP 2001).

Loggerhead Sea Turtle (*Caretta caretta*): Loggerhead habitat for foraging and migration includes open ocean, inshore areas, bays, salt marshes, ship channels, and mouths of large rivers. This sea turtle feeds on mollusks, fish, crustaceans, and other marine organisms. This species typically nests at night from late April through September (NOAA Fisheries 2014c). Although loggerheads occasionally use barrier islands for nesting, mainland nesting is rare (MDWFP 2001). Preferences for nesting beaches include high-energy coarse-grained beaches adjacent to the ocean that are narrow and steeply sloped (NOAA Fisheries 2014c). This species has been observed in nearshore waters of the Mississippi Sound during migration and foraging and has been accidentally caught by shore-based fishermen (MDWFP 2001).

Alabama Red-Belly Turtle (*Pseudemys alabamensis*): The habitat of the Alabama red-belly turtle includes fresh and brackish habitats, river banks, submerged and emergent aquatic vegetation, and upland habitat for nesting (MDWFP 2001; USFWS 2013). Within the project component vicinities, individuals of this species are known to be present in the Tchoutacabouffa River, the Biloxi River, and the Back Bay of Biloxi (MDWFP 2001; USFWS 2013); however, this species is mainly a freshwater species associated with river and stream channels and associated wetlands. Nesting occurs from mid-May to mid-July (MDWFP 2001).

Mississippi Diamondback Terrapin (*Malaclemys terrapin pileata*): The Mississippi diamondback terrapin (*Malaclemys terrapin pileata*) utilizes pocket beaches adjacent to marsh for nesting habitat (Frey 2014). Diamondback terrapins have a diet of fish, snails, worms, clams, crabs and marsh plants and live in brackish water habitats such as estuaries and tidal marshes, preferring marshes with nearby channels. Juveniles may spend first few years under mats of flotsam or vegetation (Ernst et al. 1994). Clutches are laid from April to August. The Mississippi diamondback terrapin is ranked by the MDWFP as S2: Imperiled in Mississippi (Mississippi Natural Heritage Program 2015). In constructing project components pocket beaches would be avoided to the extent practicable.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.6 of the Final Phase III ERP/PEIS describe the impacts to living coastal and marine resources from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). These project types would result in short-term minor to moderate adverse impacts to living coastal and marine resources as a result of restoration construction activities. Sensitive species such as sea turtle and marine mammals present in project areas where dredging or underwater use of equipment is occurring could be subject to temporary increased noise, turbidity, and water quality changes as well as alteration or loss of forage or nesting habitat, which could temporarily displace individuals or prey. These project types would create and restore habitat, reduce erosion, improve water quality, protect wildlife and would have long term benefits for a variety of aquatic and terrestrial species. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to endangered species. No mitigation measures would be necessary. There would be no habitat benefits to aquatic and terrestrial species which would benefit protected species.

Proposed Action

Potential impacts to threatened or endangered species and their critical habitat are presented in Table 6-8 including the piping plover, red knot, five sea turtle species, Gulf sturgeon, Alabama red-belly turtle, and West Indian manatee.

Table 6-8. Protected Species Impacts

Species /Critical Habitat	Applicable Project Area/ Project Components	Potential Impacts to Species/Critical Habitat
Green sea turtle *(Chelonia mydas)*	All	While not likely to be impacted, sea turtles are a mobile marine species and project activities would not impede transitory routes. There is no nesting habitat in the project area. There is no designated or proposed critical habitat for sea turtles within the action area. If individuals enter construction areas, construction would be halted and could result in short-term, minor impacts.
Hawksbill sea turtle *(Eretmochelys imbricata)*	All	
Kemp's ridley sea turtle *(Lepidochelys kempii)*	All	
Leatherback sea turtle *(Dermochelys coriacea)*	All	
Loggerhead sea turtle *(Caretta caretta)*	All	
Alabama Red-Belly Turtle (*Pseudemys alabamensis*)	Back Bay; Channel Island Living Shoreline; Big Island Living Shoreline; Little Island Living Shoreline	This species is a concern in the Back Bay of Biloxi. Alabama red-belly turtle habitat includes fresh and brackish waters, river banks and uplands, and submerged and emergent aquatic vegetation Due to the brackish conditions and lack of SAVs for foraging at the project site it is unlikely that the species would be present in the in the project area and that impacts would occur.
Piping plover *(Charadrius melodus)* and red knot (*Calidris canutus rufa*)	Grand Bay Intertidal and Subtidal Reefs	Piping plover are not known to use the action area, however; they could be present between August and May. In coastal Mississippi, the red knot is mainly a migratory species that uses coastal beaches and marine intertidal areas as stopover feeding locations or staging areas from March to April during the northward spring migration and September and October during the southward autumn migration (Niles et al. 2007; USFWS 2013). If an individual enters the project area and is disturbed, it is expected that they would be able to move to another nearby location (within their normal daily movement pattern) to continue foraging, feeding and resting. If individuals of either species are within 150 feet of the construction area, work will stop until the individual(s) leave of their own volition. The project will be implemented to ensure no effects to the PCEs of nearby piping plover are impacted.
West Indian manatee *(Trichechus manatus)*	All	West Indian manatees are not likely to occur in the project area. Short-term minor impacts could occur if manatees come into

Species /Critical Habitat	Applicable Project Area/ Project Components	Potential Impacts to Species/Critical Habitat
		contact with construction activities. Manatees are a mobile marine species and project activities would not impede transitory routes. If individuals are within 50 feet of construction areas, construction would be halted until the individual leaves the area of its own volition.
Gulf sturgeon *(Acipenser oxyrhynchus desotoi)* (Designated Critical Habitat)	Grand Bay Intertidal and Subtidal Reefs; and Deer Island Intertidal Reef	The project is in designated critical habitat. To the extent practicable, project construction at the Deer Island Subtidal Reef and the Grand Bay Intertidal and Subtidal Reef project components would be limited to the window between May and October, after sturgeon have migrated to their riverine habitat. If work continues beyond the May to October window, continued adherence to the Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006) would minimize the potential for impacting Gulf sturgeon. No project components are located within riverine ecosystems. If individuals enter construction areas, short-term, minor impacts could be the result. PCEs for Gulf sturgeon would not be adversely modified by the proposed project.
Mississippi diamondback terrapin (*Malaclemys terrapin pileata*)	All	The proposed project could contain nesting habitat. In order to avoid impacting the diamondback terrapin and habitat, the Trustee would identify and also avoid pocket beaches to the maximum extent practicable in the design of the project. Since work would be conducted in shallow water marine environment, impacts to diamondback terrapin and habitat are not anticipated.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review would result in the avoidance and minimization of impacts to protected species:

<u>Sea turtles mitigation measures (all project components)</u>

- Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006).
- All project work would be in-water and no nesting habitat exists in the project area.
- All construction personnel would be notified of the potential presence of sea turtles in the water and would be reminded of the need to avoid sea turtles.
- If any sea turtles are found to be present in the immediate project area during activities, construction would be halted until species moves away from project area.
- All construction personnel would be notified of the criminal and civil penalties associated with harassing, injuring, or killing sea turtles.
- Train/instruct all construction personnel of what they are to do in the presence of a sea turtle.
- Construction activities would occur during daylight hours and noise would be kept to the minimum feasible.

<u>Shorebirds mitigation measures (all project components)</u>

- All construction personnel would be notified of the potential presence of shorebirds within the project area.

- All construction personnel would be instructed and trained in the protection of shorebirds.
- Construction personnel would be notified of the criminal and civil penalties associated with harassing, injuring or killing shorebirds.
- If piping plovers or red knots are present, work would not occur until the birds have moved from the area by 150 feet.
- Construction noise would be kept to the minimum feasible.

West Indian manatee mitigation measures (all project components)

- Standard Manatee Conditions (A-D) for In-Water Work (USFWS 2011).
- All construction personnel would be notified of the potential presence of West Indian Manatee in the water and reminded of the criminal and civil penalties associated with harassing, injuring, or killing West Indian manatees. All workers would be educated that there could be West Indian manatees in the water and would be advised to look for manatees and, if observed, wait until manatees leave the area to put the equipment in the water.
- Care would be taken when lowering equipment into the water and the sediment in order to ensure that no harm is caused to West Indian Manatee that may potentially be in the water within the construction area.
- Should a West Indian Manatee come within 50 foot of the project area during construction activities, work would immediately cease until the West Indian Manatee has moved away from the project area on its own. Construction noise would be kept to the minimum feasible.

Gulf sturgeon (Deer Island and Grand Bay project components only)

To the extent practicable, construction of the Deer Island Subtidal Reef and the Grand Bay Intertidal and Subtidal Reefs project components that are in Gulf Sturgeon Critical habitat, would be limited to the window between May and October, after sturgeon have migrated to their riverine habitat. If work continues beyond the May to October window, continued adherence to the Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006) would minimize the potential for impacting Gulf sturgeon.

ESA consultations and MMPA coordination (all project components)

To fulfill requirements and obligations under ESA and Marine Mammal Protection Act (MMPA), NOAA is reviewing and DOI completed a review of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project for compliance with Section 7 of the ESA of 1973 , as amended (16 U.S.C. 1531 et seq.) and Section 101 of the MMPA of 1972, as amended (16 U.S.C. 1371(a)(5) et seq.). Biological Evaluation forms were submitted to the USFWS for consultation and coordination on the ESA, MBTA and BGEPA (DOI 2015) and to NMFS for ESA (NOAA 2015). The USFWS local field office concurred by letter dated August 24, 2015. See Phase IV ERP/EA Chapter 6, sections 6.2.7.2.1. The Trustees are awaiting NMFS SERO's response on ESA. The Trustees coordinated with NMFS SERO's Protected Resources Division to determine that this project does not require authorization under the MMPA. The Migratory Bird Treaty

Act (MBTA) compliance and Bald and Golden Eagle Protection Act (BGEPA) are also discussed in this section.

Migratory Birds

Affected Environment

Migratory bird guilds that could have presence in the proposed Restoring Living Shorelines and Reefs in Mississippi Estuaries area include wading birds, shorebirds, seabirds, raptors, goatsuckers, waterfowl, doves and pigeons, and rails and coots (see Table 6-9).

Bald and Golden Eagle Protection Act

The BGEPA of 1940 (16 U.S.C. 668-668c) (BGEPA) prohibits anyone, without a permit issued by the Secretary of the Interior, from "taking" bald eagles, including their parts, nests, or eggs. BGEPA provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald eagle ... [or any golden eagle], alive or dead, or any part, nest, or egg thereof." Golden eagles are not present along the Gulf Coast.

Table 6-9. Migratory Birds Anticipated In The Action Area

Species	Behavior	Species/habitat Impacts
Wading birds (herons, egrets, ibises)	Foraging, feeding, resting, roosting,	Wading birds primarily forage and feed at the water's edge. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting. These birds primarily nest and roost in trees or shrubs (e.g. pines, Bacchurus), which occur outside the action area.
Shorebirds (plovers, oystercatchers, stilts, sandpipers)	Foraging, feeding, resting, roosting	Shorebirds forage, feed, rest, and roost in the action area. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting. These birds primarily nest and roost in the dunes. This project would occur in open water and intertidal zones away from potential shorebird nesting areas; therefore it is not anticipated to impact nesting.
Seabirds (terns, gulls, skimmers, double-crested cormorant, American white pelican, brown pelican)	Foraging, feeding, resting, roosting	Seabirds forage, feed, rest, and roost in the action area. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting. These birds primarily roost in the dunes. This project would occur in open water and intertidal zones away from potential nesting areas; therefore it is not anticipated to impact nesting.
Raptors (osprey, hawks, eagles, owls)	Foraging, feeding, resting, roosting	Raptors forage, feed, and rest in the action area. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting. Most raptors are aerial foragers and soar long distances in search of food. The areas in the estuary where these birds roost and nest are not within the action area.

Species	Behavior	Species/habitat Impacts
Goatsuckers	Foraging, feeding, resting, roosting	Goatsuckers forage, feed, rest, and roost in the action area. However, they are nocturnal/crepuscular and therefore not active during the project work period. They nest in thickets and woodlands, which are not included in the action area.
Waterfowl (ducks, loons, and grebes)	Foraging, feeding, resting, roosting	Waterfowl forage, feed, rest, and roost in the action area. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting. These birds primarily roost and nest in low vegetation. This project would occur in open water and intertidal zones away from potential nesting areas; therefore it is not anticipated to impact nesting.
Doves and pigeons	Foraging, feeding, resting, roosting	Doves and pigeons could forage, feed, rest, and roost in the action area. However, they are unlikely to utilize habitat in the estuarine zone.
Rails and coots	Foraging, feeding, resting, roosting	Rails and coots forage, feed, rest, and roost in the action area. As such, they may be impacted locally and temporarily by the project. It is expected that they would be able to move to another nearby location to continue foraging, feeding and resting if disturbed by the project. These birds primarily roost and nest in marshes, which are within the action area, and adjacent to project activities which are in-water. This project would occur in open water and intertidal zones away from potential areas; therefore it is not anticipated to impact nesting.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.6 of the Final Phase III ERP/PEIS describe the impacts to living coastal and marine resources from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). Short-term minor displacement of local birds and terrestrial species or mortality of intertidal invertebrates could occur during construction, although most wildlife would be expected to move away to forage in other readily available foraging habitat during this activity. If construction occurs during the nesting season, nests could be destroyed, and chicks or fledglings could be harmed, causing a loss of recruitment and a longer term effect. Construction in terrestrial habitats could result in short-term impacts due to operation and staging of heavy equipment which can create noise, reduce or remove available habitat or disrupt normal movement of wildlife. As such, individual birds or terrestrial wildlife that rest, roost, or forage in or near the work area could be temporarily disturbed or displaced. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to migratory birds, bald or golden eagles. No mitigation measures would be necessary.

Proposed Action

This project would occur in open water and intertidal zones away from potential nesting areas; therefore it is not anticipated to impact nesting. Pre-construction nesting surveys for migratory birds and raptors on adjacent land would be conducted and if evidence of nesting is found, coordination with the USFWS would be initiated to develop and implement appropriate conservation measures. Due to the implementation of best management practices, no "take" is anticipated. There are no golden eagles in the project footprint. Raptor nest surveys would be completed on adjacent land where raptor nesting habitat exists. No bald or golden eagles are known to nest within 660 ft. of the project area. Thus, no impacts to golden or bald eagles are anticipated. If evidence of nesting is found, coordination with the USFWS would be initiated to develop and implement appropriate conservation measures. Potential adverse effects to birds include elevated noise levels due to the presence of construction equipment. These species are mobile and would likely exit the area during construction (no impacts to overall population). Therefore, impacts are expected to be short-term, localized, and minor.

Due to the implementation of best management practices, no "take" is anticipated.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to migratory birds including bald and golden eagles:

- If evidence of eagle nesting is found, within 660 ft. of the project area, coordination with the USFWS would be initiated to develop and implement appropriate conservation measures. Due to the implementation of best management practices, no "take" is anticipated.
- If evidence of migratory bird nesting is found, coordination with the USFWS would be initiated to develop and implement appropriate conservation measures.
- Construction noise would be kept to the minimium feasible.

Essential Fish Habitat

Affected Environment

The 1996 Magnuson-Stevens Fishery Conservation and Management Act requires cooperation among NOAA Fisheries, anglers, and federal and state agencies to protect, conserve, and enhance EFH . EFH is defined as those waters and substrates necessary to fish for spawning, breeding, feeding, or growth to maturity. The designation and conservation of EFH seek to minimize adverse effects on habitat caused by fishing and non-fishing activities. NOAA's Estuarine Living Marine Resources Program developed a database on the distribution, relative abundance, and life history characteristics of ecologically and economically important fishes and invertebrates in the nation's estuaries. NOAA has designated EFH for more than 30 estuaries in the northern Gulf of Mexico for a number of species of finfish and shellfish. Table 6-10 lists project species, their EFH and substrates, life stages relative to the proposed action and summary impact analysis (GMFMC 2004 and 2005). A brief discussion of relevant species Fisheries Management Plans is provided here.

Red Drum (*Sciaenops ocellatus*) Fishery Management Plan (FMP): In the Gulf, red drum occur in a variety of habitats, ranging from depths of about 130 feet offshore to very shallow estuarine waters. Red drum utilize SAVs, soft bottom, sand/shell, and emergent marsh habitat during all life cycle stages (Table 6-10). They commonly occur in all of the Gulf's estuaries where they are associated with a variety of substrate types including sand, mud, and hardened bottom. Throughout the Gulf, red drum use SAV meadows as nursery and foraging habitat (GMFMC 2004). Estuaries provide habitat for red drum and species that it preys on. The GMFMC considers all estuaries to be EFH for the red drum. Schools of large red drum are common in the deep Gulf waters with spawning occurring in deeper water near the mouths of bays and inlets, and on the Gulf side of the barrier islands.

In general, for all of the project components the red drum fishery is very common. The estuarine zone is used by this species in all life stages. Habitat use is highest for nearshore hard bottoms, nearshore sand/shell, estuarine SAVs, and estuarine soft bottoms (GMFMC 2005). Larvae, juveniles, and young adults spend the majority of their time in estuarine habitats and prey on a large array of species including blue crab eggs and numerous juvenile fish (Table 6-10).

Reef Fish FMP: The reef fish FMP in the area of the proposed action include snappers and groupers. Reef fish utilize a variety of habitats including SAVs, soft bottom, hard bottom, sand/shell, and emergent marsh during their juvenile and adult life cycle stages (Figure 6-10). They are often found as adults associated with coral reef, limestone, hard bottom, and artificial reef substrates. Occasionally adults occur over sand, away from reefs, but these appear to be foraging individuals. There is some evidence that adults have restricted movement and do not display long migrations. Juveniles of many of the reef fish species are located in shallow, inshore areas associated especially with SAV beds and inshore reefs. There is a general tendency for older and larger fish to occur in deeper water extending to the edge of the continental shelf. Reef fish feed on a variety of invertebrates including shrimp, craps, amphipods, octopus, and squid. Larger reef fish also have a tendency to eat small fish and other larger food items (GMFMC 1981).

Reef fish utilize both pelagic and benthic habitats during their life cycle. A planktonic larval stage lives in the water column and feeds on zooplankton and phytoplankton. Juvenile and adult reef fish are typically demersal and usually associated with bottom topographies on the continental shelf that have high relief: i.e., coral reefs, artificial reefs, rocky hard-bottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. More detail on these habitat types is found in the FMP for Corals and Coral Reefs (GMFMC and SAFMC 1983). However, several species are found over sand and soft-bottom substrates. Some juvenile snapper and grouper such as mutton, gray, lane, and yellowtail snappers and red grouper have been documented in inshore SAV beds, mangrove estuaries, lagoons, and larger bay systems (GMFMC 1981).

The reef fish fishery includes numerous species that utilize the estuarine zone in certain life stages. Most are transitory species and use inshore environments part of the year. Only mutton (*Lutjanus analis*) and gray snapper (*Lutjanus griseus*) use the estuarine zone as adults for feeding. Reef species have the potential to use this zone as early or late juveniles for growth and feeding habitat (Table 6-10).

Coastal Migratory Pelagics FMP: The only species of managed coastal migratory pelagics in the area of the proposed action is Spanish mackerel. Spanish mackerel is jointly managed by the GMFMC and the South Atlantic Fisheries Management Council. Spanish mackerel migrate south during the winter months and return north in the spring to their spawning grounds (GMFMC & SAFMC 1983). Mackerel are opportunistic carnivores and tend to feed on other smaller fishes.

In the area of project components, the Spanish mackerel (*Scomberomorus maculatus*) uses the estuarine zone during the early and late juvenile and adult life stages.

Shrimp FMP: Shrimp use a variety of estuarine and marine habitats in the Gulf of Mexico. Brown shrimp are found within the estuaries to offshore depths of 110 meters (m) throughout the Gulf; white shrimp inhabit estuaries and to depths of about 40 m offshore in the coastal area extending from Florida's Big Bend area through Texas. Brown and white shrimp are generally more abundant in the central and western Gulf.

Brown Shrimp

Brown shrimp range in the Gulf of Mexico from Florida to the northwestern coast of Yucatan. The range is not continuous but is marked by an apparent absence of brown shrimp along Florida's west coast between the Sanibel and the Apalachicola shrimping grounds. In the U.S. Gulf of Mexico, catches are high along the Texas, Louisiana, and Mississippi coasts. Shrimp are typically found as post larvae and juveniles in shallow vegetated habitats (including SAVs, soft bottom, sand/shell, emergent marsh, and oyster reef habitat), and occasionally, in silty sand and non-vegetated bottoms (Table 6-10). Juveniles and sub-adults generally prefer shallow estuaries and marsh edges (plant-water interfaces). Sub-adults migrate from estuaries during outgoing high tides. Adult brown shrimp typically inhabit Gulf waters from the Mean Low Water line to the continental shelf (GMFMC 2005). Post-larvae, early juvenile, and late-juvenile brown shrimp use estuarine habitat for survival. Emergent marsh and marsh edge are particularly important microhabitats for these species, and they use the tidal cycle to enter low emergent marsh adjacent to the shoreline (GMFMC 2004).

White Shrimp

White shrimp are offshore and estuarine dwellers, and are pelagic or demersal depending on their life stage. The eggs are demersal and larval stages are planktonic, and both occur in nearshore marine waters. Post larval white shrimp become benthic upon reaching the nursery areas of estuaries, seeking shallow water with muddy-sand bottoms that are high in organic detritus. Juveniles move from estuarine areas to coastal waters as they mature. Adult white shrimp are demersal and generally inhabit nearshore Gulf waters in depths less than 100 feet on soft mud or silty bottoms (GMFMC 2005). Post-larvae, early juvenile, and late-juvenile white shrimp use estuarine habitat (emergent marsh and soft bottom habitat) for survival (Table 6-10). Emergent marsh and marsh edge are particularly important microhabitats for these species, and they use the tidal cycle to enter low emergent marsh adjacent to the shoreline (GMFMC 2004) (Table 6-10).

Shrimp fishery species that use the estuarine zone near the project components include two penaeid types: brown and white shrimp (*Farfantepenaeus aztecus* and *Litopenaeus setiferus*). Post-larvae, early

juvenile, and late-juvenile shrimp Table 6-10 of both species use estuarine habitat for survival. Emergent marsh and marsh edge are particularly important microhabitats for these species, and they would use the tidal cycle to enter low emergent marsh adjacent to the shoreline (GMFMC 2004). Additionally, brown shrimp are common in oyster reef and SAV habitats.

Highly Migratory Species FMP: EFH for highly migratory species consists of Gulf of Mexico waters and substrates extending from the U.S./Mexico border to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council from estuarine waters out to depths of 100 fathoms.

These areas are connected by currents and water patterns that influence the occurrence of highly migratory species (HMS) at particular times of the year. Due to habitat-specific requirements of each species, EFH for each HMS potentially occurring in the vicinity of the project components is described below (NMFS 2009). The HMS species include scalloped hammerhead shark (*Sphyma lewini*), bonnethead shark (*Sphyma tiburo*), blacktip shark (*Carcharhinus limbatus*), bull shark (*Carcharhinus leucas*), spinner shark (*Carcharhinus brevipinna*), and Atlantic sharpnose shark (*Rhizoprionodon terraenovaee*).

Table 6-10. Restoring Living Shorelines and Reefs in Mississippi Estuaries-EFH Impact By Species

Species	Habitats Utilized	Life stages within the Area of Proposed Action	Grand Bay Project Components (80 acres)	Graveline Bay Project Components (72 acres)	Back Bay of Biloxi Project Components (96.7 acres permanent; 21.7 acres for temporary flotation channels)		St. Louis Bay Project Components (41.2 acres permanent; 63.7 acres for temporary flotation channels)	
					Breakwater	Reef	Breakwater	Reef
Red Drum (*Scianops ocellatus*)	SAVs, soft bottom, hard bottom, sand/shell, emergent marsh	Larvae, post larvae, juvenile, adult, spawning adults	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Mutton Snapper (*Lutjanus analis*)	SAVs	Juvenile, adult						
Cubera Snapper (*Lutjanues cyanopterus*)	SAVs, emergent marsh	juvenile						
Gray Snapper (*Lutjanus griseus*)	SAVs, soft bottom, sand/shell, emergent marsh	Post larvae, juvenile, adult,	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Lane Snapper (*Lutjanus synagris*)	SAVs, soft bottom, sand/shell	Post larvae, juvenile	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short g term, minor
Yellowtail Snapper (*Ocyurus chrysurus*)	SAVs, soft bottom	juvenile	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor
Goliath Grouper (*Epinephelus itajara*)	SAVs, hard bottom	juvenile						
Red Grouper (*Epinephelus morio*)	SAVs, hard bottom	juvenile						

Species	Habitats Utilized	Life stages within the Area of Proposed Action	Grand Bay Project Components (80 acres)	Graveline Bay Project Components (72 acres)	Back Bay of Biloxi Project Components (96.7 acres permanent; 21.7 acres for temporary flotation channels)		St. Louis Bay Project Components (41.2 acres permanent; 63.7 acres for temporary flotation channels)	
Black Grouper (*Mycteroperca bonaci*)	SAVs	juvenile						
Spanish Mackerel (*Scomberomorus maculatus*)	pelagic	Juvenile, adult	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
Brown Shrimp (*Penaeus aztecus*)	SAVs, soft bottom, sand/shell, emergent marsh, oyster reef	Post larvae, juvenile	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor	Short term, minor
White Shrimp (*Penaeus setiferus*	emergent marsh, soft bottom	Post larvae, juvenile	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor	Long term, minor

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.5 of the Final Phase III ERP/PEIS describe the impacts to habitats from early restoration project types 2 and 6. These project types are expected to result in short-term minor to moderate adverse impacts to habitat as a result of construction activities. Adverse impacts could include: increased soil erosion, vegetation damage or removal, changes in water quality from turbidity and substrate disturbance from in-water work, and the potential introduction or opportunity for establishment of invasive species. Long-term minor to moderate adverse impacts could occur to habitats adjacent to new breakwaters or other shoreline protection structures as they could change natural current patterns, sediment accretion and erosion rates; alter availability of invertebrate prey; and cause changes to erosion in off-site locations. Gulf Coast habitats would largely experience long-term beneficial impacts through improved health, stability and resiliency of habitats, including sensitive habitats such as wetlands, barrier islands, areas of SAVs, and reefs. These project types could help reestablish native plant communities, stabilize substrates and support sediment deposition, strengthen shorelines, and reduce erosion. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to EFH. No mitigation measures would be necessary. There would be no long-term benefits from the creation of breakwaters, intertidal and subtidal reef habitats.

Proposed Action

During construction of the breakwaters and reefs, the fine-grained soft bottom habitat would be altered by the placement of materials. The footprint of the project is approximately 375.3 acres (Table 6-11). Approximately 17.9 acres would be filled for breakwater construction, 267 acres for subtidal reef, and

five (5) acres for intertidal oyster reef creation, resulting in a long-term, minimal impact. Approximately 85.4 acres could be excavated for temporary flotation channels resulting in a short-term impact. It is anticipated that finfish would move away to other readily available aquatic habitats during the construction period. Fish present in the area of the project component could be subject to a temporary increase in sound pressure levels, a temporary decrease in water quality, entrainment in dredge sediments, and removal of benthos from areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. Overall, this would be a minor short-term adverse effect that would not be expected to reduce local fish populations or designated EFH.

There would be minor, long-term, adverse impacts to EFH for species that rely on soft bottom habitat as a result of the project. Minor, long-term, adverse impacts to EFH for various life stages of yellowtail snapper and white shrimp are listed in Table 6-10.

There would be short term, minor, impacts to EFH for species that utilize both soft and hard bottom habitat. Short-term, minor, impacts to EFH for various life stages of red drum, gray snapper, lane snapper, Spanish mackerel, and brown shrimp are listed in Table 6-10.

Table 6-11. Restoring Living Shorelines and Reefs in Mississippi Estuaries-Summary of Impacts to EFH

Project Activity	Acreage Impacted	Habitat	Nature of Impact
Breakwater	4.1 miles (17.9 acres)	Intertidal substrate off marsh edge; -3 to 6 ft. contour	Covering sediments with breakwater; establishment of a high relief living reef
Subtidal Reef Habitat	267 acres	0 -10 ft. MLLW; existing or historic hard bottom/reef habitat; unconsolidated bottom types including sand, muddy sand, and mud bottom	Cultch deployment of 267 acres of subtidal reef habitat
Intertidal Reef Habitat	5 acres	0 to 3 ft. MLLW; mud flats and soft bottom; existing or historic intertidal reef habitat	Cultch deployment of 5 acres of intertidal reef habitat
Temporary Flotation Channels	85.4 acres	Soft bottom substrate	Dredge and side cast a 44,635 ft. of channel 80 ft. wide and 6 ft. below MLLW
Total	375.3 acres		

SAV beds would be avoided to the extent practicable. Table 6-11 includes EFH for SAV-dependent species that would be affected by the project. Breakwaters, intertidal reefs and subtidal reefs are expected to develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs and would protect salt marsh habitat.

Table 6-10 includes EFH for various life stages of fishes which benefit from the utilization of hard bottom and marsh including, red drum, cubera snapper, gray snapper, goliath grouper, red grouper, brown shrimp, and white shrimp.

The Final Phase III ERP/PEIS provided mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to essential fish habitat. Essential Fish Habitat consultation with NMFS' Habitat Conservation Division (HCD) was completed (NOAA, 2015). The Trustee will work with NMFS to ensure appropriate conservation measures are used, which could include:

- Use of BMPs to minimize and avoid all potential adverse impacts to EFH during Restoring Living Shorelines and Reefs in Mississippi Estuaries construction and monitoring. This conservation measure recommends the use of BMPs during construction to reduce impacts from project implementation. BMPs shall include but are not limited to:

    a. Work barges would be moored for overnight and weekends/holidays in areas where previous impacts have occurred.
    b. After installation of the structures is completed, the flotation channels would be filled in mechanically.
    c. All construction activities would be completed during daylight hours.

- Pilings would be driven instead of jetting to reduce the disturbance of bottom sediments and bottom dwelling organisms..

- Monitoring would assess whether unexpected impacts to EFH have occurred. If immediate post-construction monitoring reveals that unavoidable impacts to EFH have occurred, appropriate coordination with regional EFH personnel would take place to determine appropriate response measures, possibly including mitigation. If additional adaptive management of the breakwater structure is necessary after monitoring events, all minimization measures discussed above would be followed.

6.2.7.2.2 Summary of Impacts to the Biological Environment

Impacts to the biological environment from implementation of the Restoring Living Shorelines and Reefs in Mississippi Estuaries would include:

- SAVs: No long-term adverse effects to SAVs are expected. Short-term, minor, adverse impacts to SAVs could occur in the vicinity of the project resulting from temporary sedimentation in beds. Any disturbance would temporary in nature; it is anticipated that SAV beds would recover naturally. Construction of the breakwaters in St. Louis Bay and Back Bay could provide or protect areas conducive to SAV growth which could provide long term benefits as established or ephemeral SAV beds in these waterbodies.

- Invasive Species: No long-term adverse effects from invasive species are expected. Any adverse impacts from invasive species are expected to be short-term and minor. Mitigation measures and BMPs would reduce the likelihood of impacts from invasive species.
- Benthic Infauna and Epifauna: Potential short-term minor impacts to benthic organisms may occur from increased turbidity, substrate disturbance, or siltation during construction. Following construction, there is expected to be increased habitat utilization of the zone between the breakwater and the existing eroded shoreline, and long-term benefit due to the placement of hardened structure. This represents a substantial long-term benefit for these organisms.
- Marine Mammals: Short-term minor adverse effects due to noise and turbidity associated with placement of structures could temporarily disturb marine mammals species if they are in the vicinity of the project area. Based on the mobility of these species, the short duration of construction activities, the proposed construction methodology, and implementation of BMPs, effects on marine mammals are not anticipated.
- Protected Species: The Trustee is coordinating with the USFWS and NOAA-NMFS to determine affects to protected species. A summary of impacts to protected species and critical habitats is provided below:

Protected Species / Critical Habitat	Potential Impacts to Species/Critical Habitat
Five (5) Sea Turtles Species	Applicable to all project components. While not likely to be impacted, sea turtles are a mobile marine species and project activities would not impede transitory routes. There is no nesting habitat in the project area. There is no designated or proposed critical habitat for sea turtles within the action area. If individuals enter construction areas, construction would be halted and could result in short-term, minor impacts.
Alabama Red-Belly Turtle (*Pseudemys alabamensis*)	Applicable to all projects in Back Bay and Vicinity. This species is a concern in the Back Bay of Biloxi. Alabama red-belly turtle habitat includes fresh and brackish waters, river banks and uplands, and submerged and emergent aquatic vegetation Due to the brackish conditions and lack of SAVs for foraging at the project site it is unlikely that the species would be present in the project area and that impacts would occur.
Piping plover *(Charadrius melodus)* and red knot (*Calidris canutus rufa*)	Applicable to Grand Bay Intertidal and Subtidal Reefs. Piping plover are not known to use the action area, however; they could be present between August and May. In coastal Mississippi, the red knot is mainly a migratory species that uses coastal beaches and marine intertidal areas as stopover feeding locations or staging areas from March to April during the northward spring migration and September and October during the southward autumn migration (Niles et al. 2007; USFWS 2013). If an individual enters the project area and is disturbed, it is expected that they would be able to move to another nearby location (within their normal daily movement pattern) to continue foraging, feeding and resting. If individuals of either species are within 150 feet of the construction area, work will stop until the individual(s) leave of their own volition. The project will be implemented to ensure no effects to the PCEs of nearby piping plover are impacted.
West Indian manatee *(Trichechus manatus)*	Applicable to all project components. West Indian manatees are not likely to occur in the project area. Short-term minor impacts could occur if manatees come into contact with construction activities. Manatees are a mobile marine species and project activities would not impede transitory routes. If individuals are within 50 feet of construction areas, construction would be halted until the individual leaves the area of its own volition.

Protected Species / Critical Habitat	Potential Impacts to Species/Critical Habitat
Gulf sturgeon *(Acipenser oxyrhynchus desotoi)* (Designated Critical Habitat)	Applicable to Grand Bay Intertidal and Subtidal Reefs; and Deer Island Intertidal Reef. The project is in designated critical habitat. To the extent practicable, project construction at the Deer Island Subtidal Reef and the Grand Bay Intertidal and Subtidal Reef project components would be limited to the window between May and October, after sturgeon have migrated to their riverine habitat. If work continues beyond the May to October window, continued adherence to the Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006) would minimize the potential for impacting Gulf Sturgeon. No project components are located within riverine ecosystems. If individuals enter construction areas, short-term, minor impacts could be the result. PCEs for Gulf Sturgeon would not be adversely modified by the proposed project.
Mississippi diamondback terrapin (*Malaclemys terrapin pileata*)	Applicable to all project components. The proposed project could contain nesting habitat. In order to avoid impacting the diamondback terrapin and habitat, the Trustee would identify and also avoid pocket beaches to the maximum extent practicable in the design of the project. Since work would be conducted in shallow water marine environment, impacts to diamondback terrapin and habitat are not anticipated.

- Migratory Birds/Bald and Golden Eagles:
    - Due to the implementation of best management practices no "take" is anticipated for bald eagles. Golden eagles are not present in the area.
    - Potential adverse effects to birds include elevated noise levels due to the presence of construction equipment. These species are mobile and would likely exit the area during construction (no impacts to overall population). Therefore, impacts are expected to be short-term, localized, and minor.
- EFH:
    - It is anticipated that finfish would move away to other readily available aquatic habitats during the construction period. Fish present in the area of the project component could be subject to a temporary increase in sound pressure levels, a temporary decrease in water quality, entrainment in dredge sediments, and removal of benthos from areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. Overall, this would be a minor short-term adverse effect that would not be expected to reduce local fish populations or designated EFH.
    - There would be minor, long-term, adverse impacts to EFH for species that rely on soft bottom habitat as a result of the project.
    - There would be short term, minor, impacts to EFH for species that utilize both soft and hard bottom habitat.
    - There would be a long term benefit to EFH by creation of reef habitat.

6.2.7.3 Human Uses and Socioeconomics

6.2.7.3.1 Cultural Resources

Affected Environment

Cultural resources include historic properties listed in, or eligible for listing in the National Register of Historic Places (36 C.F.R. §60[a-d]). The National Historic Preservation Act of 1966 (NHPA), as amended

(16 U.S.C. §470[f]), defines an historic property as "any prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion on the National Register [of Historic Places]." The definition of historic properties also includes significant traditional religious and cultural properties important to Indian tribes. Historic properties include built resources (bridges, buildings, piers, etc.), archaeological sites, and Traditional Cultural Properties, which are significant for their association with practices or beliefs of a living community that are both fundamental to that community's history and a piece of the community's cultural identity. Although often associated with Native American traditions, such properties also may be important for their significance to ethnic groups or communities. Historic properties also include submerged resources.

This project is currently being reviewed under Section 106 of the NHPA to identify any historic properties located within the project area and to evaluate whether the project would affect any historic properties. The Trustee is currently conducting a literature review of the project component areas. Previously recorded archaeological sites, shipwrecks, historical standing structures, National Register of Historic Places (NRHP) properties, National Register Districts and National Historic Landmarks are being reviewed. The preliminary review of the previously recorded archaeological sites using MDAH records revealed archaeological sites located within the vicinity of the project component areas. The types of sites include shell middens and charted shipwrecks.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.8 of the Final Phase III ERP/PEIS describe the impacts to cultural resouces from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and type 6 (Restore Oysters). These project types would be analyzed for potential effects to cultural resources prior to being implemented and most adverse effects to cultural resources would be avoided or minimized. However, inadvertent impacts to unknown sites, buildings, structures, or objects could occur, resulting in minor to moderate short-term and long-term impacts. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to cultural resources. No mitigation measures would be necessary.

Proposed Action

The NHPA charges the federal government with protecting the cultural heritage and resources of the nation. A complete review of this project under Section 106 of the NHPA is ongoing and will be completed prior to any project activities that will restrict consideration of measures to avoid, minimize or mitigate any adverse impacts on historic properties located within the project area. This project will be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

6.2.7.3.2 Land and Marine Management

Affected Resources

Governing the nature of land use development of the project component areas is the 1972 Coastal Zone Management Act (CZMA), which provides for management of the nation's coastal resources and balances economic development with environmental conservation. The overall program objectives of CZMA remain balanced to "preserve, protect, develop, and where possible, to restore or enhance the resources of the nation's coastal zone." The water bottoms are considered state-owned and part of the Public Trust Tidelands.

The National Estuarine Research Reserve and Coastal Preserves in the Project Areas

The Grand Bay National Estuarine Research Reserve, Graveline Bay Preserve, Deer Island Preserve, Wolf River Preserve, and Jourdan River Preserve are managed resources in the vicinity of the proposed project. A summary of planned land and marine management of the preserves is provided here.

Grand Bay (Jackson County): Grand Bay National Estuarine Research Reserve (GBNERR) includes over 18,000 acres of coastal wetlands and estuarine marsh that was designated into the National Estuarine Research Reserve System in 1999 as authorized under the provisions of the Coastal Zone Management Act of 1972. The Mississippi Department of Marine Resources manages GBNERR in conjunction with NOAA. The Grand Bay NERR is located within the larger 26,900 acre Grand Bay Savanna Preserve, which is a part of the Mississippi Coastal Preserve program. Lands within Grand Bay NERR/Grand Bay Savanna Preserve are either privately, locally, state or federally owned.

The Grand Bay National Estuarine Research Reserve Management Plan 2013-2018 (GBNERR 2013) outlines management efforts. Founded on the principle that long-term protection of representative estuaries form stable platforms for research and education, the GBNERR and all reserves in the system employ a place-based approach for the application of management practices and demonstration sites where new ideas are tested. The mission of the GBNERR is to practice and promote informed stewardship of coastal resources through innovative research, education and training. Staff and partners will work collaboratively to address focus areas relating to habitat protection, climate change and water quality. The management plan outlines four goals, including 1) enhancing the GBNERR's goal as a distinguished center for estuarine research, 2) using scientific understanding to inform management of coastal resources, 3) connecting with local communities on value of coastal ecosystems, and 4) improving science-based decision making.

Strategies and actions to enhance protection of Reserve resources are outlined and aligned with Grand Bay objective 2-5:

"Developing partnerships to implement comprehensive management of resources, addressing acquisition, restoration and enhancement, resource protection, public access and resource manipulation".

Restoration activities require planning and review by MDMR and NOAA through the Reserve management plan. Restoration planning may require historical research to determine the "natural" representative state of an estuarine area. Current monitoring efforts at Grand Bay NERR include marsh birds, fish, water quality, and climate change indicators (surface elevation tables).

Graveline Bay Preserve (Jackson County): The Graveline Bay Preserve is designated as a coastal preserve in the Mississippi Coastal Preserves Program. It contains 2,339-acres and is bounded by Graveline Bay and Bayou. MDMR manages the area as a coastal preserve for conservation purposes to protect ecological integrity of tidal marsh (MDMR 2015a). The Graveline Bay project components include intertidal and subtidal reef restoration.

Deer Island Preserve (Harrison County): The Deer Island Preserve is designated as a coastal preserve in the Mississippi Coastal Preserves Program. It consists of 674 acres bounded by the beach along the island. MDMR manages the area as a coastal preserve. Much of the property considered tidal wetlands, already owned by the State (MDMR 2015b). The Deer Island project component, which would occur in the waters of the Mississippi Sound adjacent to the north of Deer Island preserve, includes subtidal reef restoration.

Wolf River Preserve (Harrison County): The Wolf River Preserve is designated as a coastal preserve in the Mississippi Coastal Preserves Program. The 2,426-acre preserve contains non-forested marsh along the Wolf River. MDMR cooperates with intergovernmental and private entities to manage the area as a coastal preserve for conservation purposes to manage the unique ecosystem surrounding the Wolf River Marsh (MDMR 2015c). The Wolf River Living Shoreline and Subtidal Reef component is partially located within the boundaries of the Wolf River Preserve.

Jourdan River Preserve (Hancock and Harrison County): The 6,423-acre Jourdan River Preserve is designated as a coastal preserve in the Mississippi Coastal Preserves Program. Its primary boundary is from the mouth of the Jourdan River (open saline marsh) to where the area becomes forested. MDMR manages the area as a coastal preserve. Much of the property considered tidal wetlands, already owned by the State (MDMR 2015d). The St. Louis Bay Living Shoreline component is almost entirely located within the boundaries of the Jourdan River Preserve.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.10 of the Phase III ERP PEIS describe the impacts to land and marine management from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6 (Restore Oysters). These project types are expected to result in short-term minor to moderate adverse impacts, primarily from the interruption of operations. Long-term benefits to land and marine management are also expected as restoration activities would help align management goals and assist management and staff to best manage properties for the benefit of the environmental and human environment. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP PEIS.

No Action

Under the No Action alternative, there would be no impacts to land and marine management. No mitigation measures would be necessary. There would be no benefits to land and marine management from the creation of intertidal and subtidal reefs habitat.

Proposed Action

The Grand Bay NERR/Grand Bay Savanna Preserve, Graveline Bay Preserve, Wolf River Preserve, Deer Island Preserve, and Jourdan River Preserve are managed resources in the vicinity of the Project.

Grand Bay NERR/Grand Bay Savanna Preserve: There are intertidal and subtidal components in the Grand Bay project area that would occur on the Grand Bay NERR/Grand Bay Savanna Preserve. For the Grand Bay project area, the Trustee will coordinate closely with Grand Bay NERR staff and NOAA to ensure intertidal and subtidal reef restoration is consistent with the Grand Bay NERR Management Plan (GBNERR 2013). Projects would be sited to avoid all ongoing monitoring stations and with consideration of available baseline data. Natural cultch materials (i.e. oyster shells) would be used for intertidal and subtidal cultch placements.

Coastal Preserves: Wolf River Preserve, Deer Island Preserve, and Jourdan River Preserve are in the Mississippi Coastal Preserve Program. For projects within the Coastal Preserve boundary, the Trustee will coordinate with Coastal Preserve staff to ensure that activities do not interfere with and are consistent with current management practices, ecological targets, and site specific management plans .. There could be short-term minor impacts due to deployment of breakwaters, subtidal reefs, intertidal reefs and temporary flotation channels. For breakwaters, intertidal reefs and subtidal reef sited within Coastal Preserve administrative boundaries, materials specially designed to promote oyster accretion will be given preference. Over time, the breakwaters, intertidal and subtidal restoration areas would develop into living reefs that support benthic secondary productivity, including, but not limited to, bivalve mollusks, annelid worms, shrimp, and crabs. Breakwater would reduce shoreline erosion as well as marsh loss. There would be long term ecological benefits that would be consistent with planned land and marine management. The project would not disrupt existing or planned land management or monitoring activities.

The Phase III ERP/PEIS provides mitigation measures in Appendix 6A. The following mitigation measures and environmental review procedures would result in the avoidance and minimization of impacts to land and marine management:

- Because the proposed project has reasonably foreseeable effects on coastal uses or resources that are the subject of a federally approved Coastal Zone Management Plan in Mississippi, the Federal Trustees submitted a consistency determination for the project to the Mississippi Department of Marine Resources (MDMR). MDMR concurred with that determination on behalf of its state. As noted in that response. additional consistency review may be required pursuant to federal regulations (see 15 C.F.R. Part 930) prior to project implementation.

- The Trustee would coordinate with Grand Bay NERR Staff and NOAA to ensure project consistency with the Grand Bay NERR Management Plan (GBNERR 2013).
- Siting of breakwaters, intertidal reefs, subtidal reefs and temporary flotation channels would avoid monitoring sites.
- Construction would be completed so as not to interfere with management or monitoring activities at Grand Bay NERR. There would be no breakwaters or temporary flotation channels constructed in the Grand Bay NERR.
- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.
- In areas where temporary flotation channels are required, work barges would be moored for overnight and weekends/holidays only in areas where previous impacts have occurred (temporary flotation channels, deployment areas).
- Spoil from temporary flotation channels would be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels would be filled in mechanically.
- Natural cultch materials (i.e. oyster shells), or material approved by the Grand Bay NERR staff, would be used for intertidal and subtidal cultch placements in the Grand Bay NERR.
- Restoration planning may require historical research to determine the "natural" representative state of an estuarine area

6.2.7.3.3 Aesthetics and Visual Resources

Affected Environment

The affected environment consists of the footprint of the project components, current open water areas seaward of the breakwater structures, as well as areas visible from the footprint. There are no designated protected viewsheds or historic resources in the vicinity of the project components.

Grand Bay, Graveline Bay, and St. Louis Bay Project Components (Jackson, Harrison, and Hancock Counties): The landscape in the vicinity of the proposed project area is characterized by a mosaic of marsh wetlands with patches of mature coastal forest, which have the effect of providing visual barriers around existing communities. Unobstructed views of open water exist generally only from the shoreline. Visual receptors include boaters in the Mississippi Sound, Grand Bay, Graveline Bay, and St. Louis Bay.

Back Bay of Biloxi and Vicinity Project Components (Jackson and Harrison Counties): Back Bay of Biloxi is surrounded by a mix of industrial, commercial and residential properties. Navigation channels are in use throughout the entire bay, and have high traffic volume.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.14 of the Final Phase III ERP/PEIS describe the impacts to aesthetic and visual resources from early restoration project types 2 (Protect Shorelines and Reduce Erosion) and 6

(Restore Oysters). These project types are expected to result in short-term minor to moderate adverse impacts as a result of the presence of readily apparent construction equipment and personnel as well as barriers and construction-related dust and emissions, which would contrast with and detract from the natural viewshed. In the event that construction related actions involve dredging activities into scenic viewsheds, adverse impacts could be elevated to major, and would remain short-term. In the event that these construction-related projects result in the long-term placement of structures or signage, long-term, minor adverse impacts would occur, with the magnitude of their impact decreasing over time as these objects become more commonplace in the area. Long-term benefits to aesthetics and visual resources are also expected as a result of improved habitat areas that reflect a more natural setting. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to aesthetics and visual resources. No mitigation measures would be necessary. There would be no long-term benefits to aesthetics or visual resources resulting from improved habitat areas.

Proposed Action

During construction, there would be short-term, minor adverse aesthetic and visual impacts for recreational boaters and fishermen due to construction equipment in and around the project area. Residents, people who use the bays for recreation, and businesses along the shoreline would experience minor adverse aesthetic and visual impacts during construction. After construction is completed, the breakwater and/or the reefs may be exposed at MLW. The outer surface of these reefs consists of natural material such as bagged shells or artificial material such as riprap. Both of these materials are present in the existing environment. The deployed materials would blend well with the surrounding substrate, which would not adversely affect aesthetic and visual resources.

In addition, navigation signs in the project area would alert boaters to the presence of the breakwater (including gaps in the breakwater) and reefs. Because this is an area already used by recreational and commercial boaters, the addition of navigation signs would be consistent with other navigational signage/aids already present in the project vicinity. There would be no long-term impact from sign placement.

6.2.7.3.4 Public Health and Safety and Shoreline Protection

Affected Resources

Shoreline erosion is apparent at all of the project components that include construction of a breakwater. Erosion rates were calculated using 2014 aerials and 1850 or 1950 historical shoreline data (MDEQ 2015) and aerial imagery (Google Earth Pro 2015 and 2015a). Erosion rates range from 0.50 to 4.50 feet per year. No hazardous materials currently exist at the project area and there is no potential for human exposure to natural or man-made hazards.

Environmental Consequences

Programmatic Review

Sections 6.3.2, 6.3.6, and 6.7.15 of the Final Phase III ERP/PEIS describe the impacts to public health and safety, including flood and shoreline protection from early restoration project types 2 (Protect Shorelines and Reduce Erosion)and 6 (Restore Oysters). These project types are expected to result in short-term construction-related adverse impacts, primarily as a result of the operation of heavy equipment and construction materials. In the event that hazardous materials are used and unintentionally released into the environment or the use of barges or boats contaminates surface waters, there could be minor, short-term adverse effects. Long-term beneficial impacts from restoration and rehabilitation projects could reduce the risk of potential future hazards or reduce currently present water contamination. Direct and indirect effects of these project types would largely result in long-term beneficial impacts. The impacts anticipated from the proposed action discussed below are consistent with the range of impacts described in the Final Phase III ERP/PEIS.

No Action

Under the No Action alternative, there would be no impacts to public health and safety and shoreline protection. No mitigation measures would be necessary. There would be no shoreline protection benefits resulting from the construction of breakwaters.

Proposed Action

There could be minor short-term impacts resulting from the operation of heavy equipment or from the incidental releases of surface water contaminates from barge and boats. The proposed breakwater structures would have long-term benefits by helping to protect the shoreline from wave erosion. All hazardous materials handled during construction activities (fuel, lubricants, etc.) would be contained and appropriate barriers would be placed to protect the adjacent coastal resources.

The Final Phase III ERP/PEIS provides mitigation measures in Appendix 6A.The following mitigation measures would be used to avoid and minimize impacts to public health and safety and shoreline protection:

- Best management practices in accordance with Occupational Safety and Health Administration (OSHA) and state and local requirements would be incorporated into construction activities onsite to ensure the proper handling, storage, transport, and disposal of all hazardous materials.
- Personal protective equipment would be required for all construction personnel, and authorized access zones would be established at the perimeter of the project site. As a result, adverse impacts to public health and safety would not be expected.

6.2.7.3.5 Summary of Impacts to the Human Uses and Socioeconomics

Impacts to the human uses and socioeconomics from implementation of the Restoring Living Shorelines and Reefs in Mississippi Estuaries would include:

- Cultural Resources: A complete review of this project under Section 106 of the NHPA would be completed as environmental assessment continues. This project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.
- Land and Marine Management: Implementation of the project would be consistent with planned land and marine management and would not disrupt existing or planned land uses. There could be short-term minor impacts due to deployment of subtidal and intertidal reefs. There would be long term ecological benefits that would be consistent with planned land and marine management.
- Aesthetics and Visual Resources: During construction, there would be short-term, minor adverse aesthetic and visual impacts for recreational boaters and fishermen due to construction equipment in and around the project area. Residents, people who use the bays and estuaries for recreation, and businesses along the shoreline would may experience minor adverse aesthetic and visual impacts during construction. The deployed materials would not adversely affect aesthetic and visual resources.
- Public Health and Safety and Shoreline Protection: There could be minor short-term impacts resulting from the operation of heavy equipment or from the incidental releases of surface water contaminates from barge and boats. The proposed breakwater structures would have long-term benefits by helping to protect the shoreline from wave erosion.

6.2.8 Cumulative Impacts

As discussed in Chapter 4, the CEQ regulations to implement NEPA require the assessment of cumulative impacts in the decision-making process for federal projects, plans, and programs. 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 C.F.R. §1508.7).

This cumulative impacts analysis tiers from the Final Phase III ERP/PEIS analysis of programmatic Alternative 4 (Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities), which evaluated the type of restoration activity proposed for the Restoring Living Shorelines and Reefs in Mississippi Estuaries The Final Phase III ERP/PEIS analysis of cumulative impacts relevant to the proposed Restoring Living Shorelines and Reefs in Mississippi Estuaries project is incorporated by reference into the following cumulative impacts analysis for this Phase IV project. The following analysis focuses on the potential additive effects of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project to the effects of past actions evaluated in the Final Phase III ERP/PEIS cumulative impacts analysis and the effects of some past, present, and reasonably foreseeable future actions not analyzed in the Final Phase III ERP/PEIS.

6.2.8.1 Site Specific Review and Analysis of Cumulative Impacts to Relevant Resources

This section describes past, present, and reasonably foreseeable future actions that were not discussed in the Final Phase III ERP/PEIS, but which are relevant to identifying any cumulative impacts the

proposed Restoring Living Shorelines and Reefs in Mississippi Estuaries Project may have on a local scale. Context and intensity, defined in Section 6.2.4, are used to determine whether a potential cumulative impact from the Restoring Living Shorelines and Reefs in Mississippi Estuaries t exists. The relevant affected resources analyzed in this EA are:

6.2.8.1.1 Geology and Substrates

- Hydrology and Water Quality including Water Resources
- Living Coastal and Marine Resources and Habitats
- Protected Species including MBTA Compliance
- Cultural Resources
- Land and Marine Management
- Aesthetics and Visual Resources
- Public Health and Safety and Shoreline Protection

Those resources described in Section 6.2.7 were considered but not carried forward for further analysis would not have impacts and therefore, would not have cumulative impacts. Air quality and greenhouse gas emissions; noise; socioeconomics and environmental justice; infrastructure and; tourism and recreation are resource areas considered but not carried forward in the Restoring Living Shorelines and Reefs in Mississippi Estuaries EA.

Local and site-specific past, present, and reasonably foreseeable future actions not analyzed in the Final Phase III ERP/PEIS were identified through conversations with state and federal resource agency staff and searching websites for projects relevant to the Restoring Living Shorelines and Reefs in Mississippi Estuaries. The local action area is defined as the four (4) project component locations and immediate surroundings in Grand Bay, Graveline Bay, Back Bay of Biloxi and vicinity, and St. Louis Bay. Actions that would be relevant to the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project cumulative impacts analysis are defined here as those with similar scope, timing, impacts, or location. For restoration related to the Spill (Early Restoration Phases I, II & III, Restore Act, Gulf Environmental Benefit Fund) and for North American Wetlands Conservation Fund projects two websites were searched:

- http://www.nfwf.org/whoweare/mediacenter/pr/Pages/gulf-main-pr-14-1117.aspx
- http://eli-ocean.org/gulf/restoration-projects-database/
- https://restoration.atlas.noaa.gov/src/html/index.html

Past, present, and reasonably foreseeable actions not identified in the Final Phase III ERP/PEIS are summarized in Table 6-12.

Table 6-12. Description of past, present, and reasonably foreseeable future actions not identified in the PEIS

Category/Projects	Project Description	Key Resource Areas with Potential for Cumulative Impacts*
Restoration Related to the Spill (Early Restoration Phases I, II & III, Restore Act, Gulf Environmental Benefit Fund, North American Wetlands Conservation Fund, National Academy of Sciences)		
Bayou Caddy Ecosystem Restoration (Shoreline Stabilization)	The Mississippi Comprehensive Coastal Improvements Program (MsCIP) Bayou Caddy Ecosystem Restoration Site is a constructed restoration/dredged material beneficial use site in Hancock County, Mississippi. The proposed Shoreline Stabilization Project involves the construction of an offshore breakwater and living shoreline located at the Restoration Site, intended to reduce wave energy, protect the site from further storm damage, extend the life of the newly re-constructed geotubes, provide protection to the established wetland, and enhance habitat for oysters, fish and other marine organisms. The project is in the permitting phase.	Short to long-term impacts to: • geology and substrates • hydrology and water quality • living coastal and marine resources • habitat Long-term benefits to: • habitat • land and marine management
Invasive Species Management on Coastal State Land	National Fish and Wildlife Foundation (NFWF) Gulf Environmental Benefit Fund (GEBF) Project to address invasive species management on land within Mississippi's Coastal Preserves Program and on two state parks (Buccaneer and Shepard) and Ward Bayou Wildlife Management Area. Work will include prescribed burning, mechanical and chemical control of invasive vegetation, and feral hog control. Round 2 project funded but not yet started.	Short to long-term impacts to: • living coastal and marine resources • habitat • land and marine management Long-term benefits to: • living coastal and marine resources • habitat • land and marine management
Submerged aquatic vegetation Pilot Project	U.S. Army Corps of Engineers (USACE) MsCIP Phase I (Water Resources Development Act) proposed submerged aquatic vegetation restoration Grand Bay NERR .	Long-term benefits to: • living coastal and marine resources • habitat
Deer Island Restoration Project	1,600 linear feet of Intertidal living shoreline bagged oyster shell and coir logs, north side of Deer Island. 7 acres tidal wetland habitat protected. Completed in 2013, maintenance ongoing until 2017.	Short to long-term impacts to: • geology and substrates • hydrology and water resources • living coastal and marine resources • habitat Long-term benefits to: • living coastal and marine resources • habitat
Deer Island Tidal Marsh Restoration Project (Beneficial Use [BU] Projects)	• Restoration of 40 acres of tidal marsh habitat and 5 acres of beach habitat. Project is ongoing; the site is designed to accept suitable dredge material for several more years before reaching target elevation. • A 98-acre lagoon between the south beach and the island was created during the MsCIP Deer Island Project. Lagoon will be used by the USACE as a BU site for Biloxi Channel maintenance dredging. When completed the site will result in the	Short to long-term impacts to: • geology and substrates • hydrology and water resources • living coastal and marine resources • habitat Long-term benefits to: • living coastal marine resources • habitat

Category/Projects	Project Description	Key Resource Areas with Potential for Cumulative Impacts*
	restoration of 98 acres of tidal marsh habitat. Project is ongoing.	
Deer Island Oyster Reef Restoration Project	MDMR Deer Island Oyster Reef Restoration project revitalized a 17-acre area of oyster reef north of Deer Island was completed 2014.	Short to long-term impacts to: • geology and substrates Long-term benefits to: • living coastal and marine resources • habitat
Bayou Cumbest Restoration	MsCIP Project: Adjacent to Grand Bay Coastal Preserve-restoration of 110 acres of tidal wetlands and management of 38 acres of scrub/shrub wetlands. Includes filling ditches, removal of exotic species, and planting of Native vegetation.	Short to long-term impacts to: • Geology and substrates • hydrology and water resources • living coastal and marine resources • habitat • land and marine management Long-term benefits to: • living coastal and marine resources • habitat • land and marine management
Utilization of Dredge Material for Marsh Restoration in Coastal Mississippi	NNFWF GEBF Project to utilize dredge material in the sustainable restoration and creation of marsh habitat within St. Louis Bay, Back Bay of Biloxi, and Escatawpa is critical to enhancing ecosystem functioning and integrity of priority bays and estuaries of the Mississippi Gulf Coast. Approved Round 2 Project, pending.	Short to long-term impacts to: • geology and substrates • hydrology and water resources • air quality • living coastal and marine resources • habitat Long-term benefits to: • living coastal and marine resources • habitat
LaFrancis Camp Trenaisse	MsCIP project: Feasibility Study is underway to restore 45 acres of open water to marsh by backfilling a pipeline canal; also includes invasive species control in the Hancock County Marsh.	Short to long-term impacts to: • geology and substrates • hydrology and water resources • living coastal and marine resources • habitat Long-term benefits to: • living coastal and marine resources • habitat • land and marine management
Greenwood Island BU Site	28-acre BU site, designed by USACE, built by Port of Pascagoula, now under management by MDMR. Rock containment and sand dike complete. Current project near Pascagoula. Needs another 100-150,000 yards of material. Project is ongoing.	Short to long-term impacts to: • geology and substrates • hydrology and water resources • living coastal and marine resources • habitat Long-term benefits to: • living coastal and marine resources • habitat
Round Island BU Site	Restoration of a relict shoal to the northwest of Round Island, construction of containment structure capable of containing 70 acres was	Short to long-term impacts to: • geology and substrates • hydrology and water resources

Category/Projects	Project Description	Key Resource Areas with Potential for Cumulative Impacts*
	completed in 2014. Site is available to receive BU material and is permitted for 220 acres (ultimate capacity of 2.5 Million cubic yards. Project is ongoing.	• living coastal and marine resources • habitat Long-term benefits to: • living coastal and marine resources • habitat
Tourism and Recreation		
Deer Island Pier Project	Mississippi Secretary of State project to construct a-260-foot access pier on the north side of Deer Island, to provide public access to Deer Island for enhanced recreational and educational use by the general public. Proposed project, currently in the permitting phase.	Short-term impacts to: • geology and substrates • hydrology and water resources • living coastal and marine resources • habitat

6.2.8.1.2 Review and Analysis of Cumulative Impacts to Relevant Natural Resources

This section presents a brief summary of the Final Phase III ERP/PEIS cumulative impact findings for each resource potentially affected by the Restoring Living Shorelines and Reefs in Mississippi. It then considers whether the cumulative actions identified above affect these findings. For the Restoring Living Shorelines and Reefs in Mississippi Project, specifically, the affected resources analyzed in this section include:

- Geology and Substrates
- Hydrology and Water Quality (including wetlands)
- Living Coastal and Marine Resources (including habitats and protected species)
- Land and Marine Management

6.2.8.1.3 Geology and Substrates

This analysis tiers from the Final Phase III ERP/PEIS, Section 6.8.4.1.1 Geology and Substrates, Table 6-4. As described above, the Restoring Mississippi Living Shorelines and Reef in Mississippi Estuaries would have a minor, long-term, adverse impacts on geology and substrates and would also have provide long-term beneficial impacts to shorelines.

The Final Phase III ERP/PEIS found that when Alternative 2 was analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 would not contribute substantially to short-term or long-term cumulative adverse impacts to geology and substrates. However, Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in long-term beneficial cumulative impacts to geology and substrates in the Gulf Coast region because of the potential for synergistic effects of Alternative 2 project types with these other environmental stewardship and restoration activities. In this manner, the Restoring Living Shorelines and Reefs in Mississippi Estuaries is anticipated to fall within the expected range of the Final Phase III ERP/PEIS cumulative impacts.

Ten projects are identified as potential contributors to cumulative impacts (adverse and beneficial) on geology and substrates when their impacts are combined with those of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Phase IV Project; Bayou Caddy Ecosystem Restoration (Shoreline Stabilization), Deer Island Restoration Project, Deer Island Tidal Marsh Restoration Project (Beneficial Use-(BU) Projects), Deer Island Oyster Reef Restoration Project, Bayou Cumbest, Utilization of Dredge Material for Marsh Restoration in Coastal Mississippi, LaFrancis Camp Trenaisse, Greenwood Island BU Site, Round Island BU Site, and Deer Island Pier Project; Table 6-13). Shoreline protection, marsh restoration with BU material and reef restoration project elements would create a short-term adverse impact as well as a long-term beneficial impact. The Deer Island pier project would include the construction of hard structures over soils and sediment.

When the Phase IV Restoring Living Shorelines and Reefs in Mississippi Estuaries is analyzed in combination with other past present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to geology and substrates would likely occur. The Phase IV restoration project would not contribute substantially to cumulative adverse impacts. The Phase IV Early Restoration project, carried out in conjunction with other restoration efforts would also have the potential to result in some long-term beneficial cumulative impacts to geology and substrates.

6.2.8.2 Hydrology and Water Quality

This analysis tiers from the Final Phase III ERP/PEIS, Section 6.8.4.1.2 Hydrology and Water Quality, Table 6-5. As described above, the Restoring Mississippi Living Shorelines and Reef in Mississippi Estuaries would have a minor, short-term, adverse impacts water quality resulting from increased turbidity during construction. Breakwaters, once established as living reefs could benefit local water clarity because bi-valves such as oysters and mussels feed by filtering the water column. The reef could also reduce wave energy reaching the shoreline, minimizing erosion, and decreasing sediment suspended in the water column from erosion. The project types could result in long-term minor improvements to water quality because they would extend beyond the construction period.

The Final Phase III ERP/PEIS found that when Alternative 2 was analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 would not contribute substantially to short-term or long-term cumulative adverse impacts to water quality and hydrology. However, Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to hydrology and water quality in the Gulf Coast region because of the potential for synergistic effects of Alternative 2 project types with these other environmental stewardship and restoration activities. In this manner, the Restoring Living Shorelines and Reefs in Mississippi Estuaries is anticipated to fall within the expected range of the Final Phase III ERP/PEIS cumulative impacts.

Nine projects are identified as potential contributors to cumulative impacts (adverse and beneficial) on hydrology and water quality when their impacts are combined with those of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Phase IV Project; Bayou Caddy Ecosystem Restoration (Shoreline Stabilization), Deer Island Restoration Project, Deer Island Tidal Marsh Restoration Project

(BU Projects), Bayou Cumbest, Utilization of Dredge Material for Marsh Restoration in Coastal Mississippi, LaFrancis Camp Trenaisse, Greenwood Island BU Site, Round Island BU Site, and Deer Island Pier Project). Shoreline protection, marsh restoration with BU material and reef restoration project elements would create a short-term adverse water quality impacts from turbidity associated with construction but would also provide a long-term beneficial impact by reducing wave energies, resulting in shoreline/marsh protection.

When the Phase IV Restoring Living Shorelines and Reefs in Mississippi Estuaries is analyzed in combination with other past present, and reasonably foreseeable future actions, short-term cumulative adverse impacts to hydrology and water quality would likely occur. The Phase IV restoration project would not contribute substantially to cumulative adverse impacts. The Phase IV Early Restoration project, carried out in conjunction with other restoration efforts would also have the potential to result in some long-term beneficial cumulative impacts to hydrology and water quality.

6.2.8.2.1 Living Coastal and Marine Resources (Including Habitats and Protected Species)

This analysis tiers from the Final Phase III ERP/PEIS, Section 6.8.4.2.1 Habitats (Table 6-8) and Section 6.8.4.2.2 Living Coastal and Marine Resources (Table 6-9). As described above, the Restoring Mississippi Living Shorelines and Reef in Mississippi Estuaries would have minor, short-term, adverse impacts on habitats and living and coastal marine resources (e.g. oysters, SAVs) resulting from increased turbidity during construction and unavoidable impacts from subtidal reef and breakwater construction. This Phase IV Project would also provide long-term beneficial impacts as intertidal reef deployments, subtidal reef deployments and breakwaters develop into living reefs. Breakwater placement would also enhance existing marsh habitat and could create SAV habitat. Protected species would be avoided and would potentially benefit from increases in marsh, SAVs and living reefs created by the project.

The Final Phase III ERP/PEIS found that when Alternative 2 was analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 would not contribute substantially to short-term or long-term cumulative adverse impacts to habitats or to living coastal and marine resources. However, Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to habitats and to living coastal and marine resources in the Gulf Coast region because of the potential for synergistic effects of Alternative 2 project types with these other environmental stewardship and restoration activities.

Twelve projects are identified as potential contributors to cumulative impacts (adverse and beneficial) on habitats and living coastal and marine resources when their impacts are combined with those of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Phase IV Project; Bayou Caddy Ecosystem Restoration (Shoreline Stabilization), Invasive Species Management on Coastal State Land, Submerged aquatic vegetation Pilot Project, Deer Island Restoration Project, Deer Island Tidal Marsh Restoration Project (BU Projects), Deer Island Oyster Restoration Project, Bayou Cumbest, Utilization of Dredge Material for Marsh Restoration in Coastal Mississippi, LaFrancis Camp Trenaisse, Greenwood Island BU Site, Round Island BU Site, and Deer Island Pier Project). Shoreline protection, marsh restoration with beneficial use material and reef restoration project elements would create short-term adverse impacts

to habitats and living marine and coastal resources from localized water quality impacts, turbidity, noise, and general intrusion associated with construction activities but could provide a long-term beneficial impact by reducing wave energies, protecting shorelines/marsh, and creating oyster reefs. The Deer Island Peer project could have short-term minor impacts to soft bottom habitat and benthic communities.

When the Phase IV Restoring Living Shorelines and Reefs in Mississippi Estuaries is analyzed in combination with other past present, and reasonably foreseeable future actions, short -term cumulative adverse impacts to habitat and to living marine and coastal resources would likely occur. The Phase IV restoration project would not contribute substantially to cumulative adverse impacts. The Phase IV Early Restoration project, carried out in conjunction with other restoration efforts would also have the potential to result in some long-term beneficial cumulative impacts to habitats and to living marine and coastal resources.

6.2.8.2.2 Land and Marine Management

This analysis tiers from the Final Phase III ERP/PEIS, Section 6.8.4.3.4 Land and Marine Management (Table 6-13). As described above, the Restoring Mississippi Living Shorelines and Reef in Mississippi Estuaries would have be consistent with planned land and marine management and would not disrupt existing or planned land uses. There could be short-term minor impacts due to deployment of breakwaters and subtidal and intertidal reef habitat. There would be long-term ecological benefits that would be consistent with planned land and marine management. This Phase IV Project would also result in long-term ecological benefits that would be consistent with planned land and marine management creation of subtidal and intertidal reef habitat.

The Final Phase III ERP/PEIS found that when analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 would not contribute substantially to short-term or long-term cumulative adverse impacts to land and marine management. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to land and marine management in the Gulf Coast region because of the potential for synergistic effects of Alternative 2 project types with these other environmental stewardship and restoration activities from the alignment of management goals and assistance provided to management and staff to best manage properties from restoration, conservation and recovery efforts.

Four projects are identified as potential contributors to cumulative impacts (adverse and beneficial) on land and marine management when their impacts are combined with those of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Phase IV; Bayou Caddy Ecosystem Restoration (Shoreline Stabilization), Invasive Species Management on Coastal State Land, Bayou Cumbest, and LaFrancis Camp Trenaisse). Shoreline stabilization, marsh restoration and invasive species control measures would be consistent with planned land and marine management on and near state-managed Coastal Preserves and would not disrupt existing or planned land uses. There could be short-term minor impacts during

the implementation of various restoration and management measures. There would be long-term ecological benefits that would be consistent with planned land and marine management.

When the Phase IV Restoring Living Shorelines and Reefs in Mississippi Estuaries is analyzed in combination with other past present, and reasonably foreseeable future actions, short-term cumulative adverse impacts to land and marine management would likely occur. The Phase IV restoration project would not contribute substantially to cumulative adverse impacts. The Phase IV Early Restoration project, carried out in conjunction with other restoration efforts would also have the potential to result in some long-term beneficial cumulative impacts to land and marine management.

6.2.8.2.3 Potential Cumulative Impacts When Evaluated with Other Phase IV Proposed Projects

The Restoring Living Shorelines and Reefs in Mississippi Estuaries would occur across the Mississippi Gulf Coast, in four bays at eight sites. Due to the small scale, minor, local and temporary impacts from the project components, the Phase IV project is not anticipated to contribute to potential adverse cumulative impacts in combination with other Phase IV projects. In terms of location, the closest Phase IV proposed projects to the Restoring Living Shorelines and Reefs in Mississippi Estuaries are the Point Aux Pins Living Shoreline and the Shell Belt-Coden Belt Road Living Shorelines. The projects consist of the construction activities to the southeast of Potersville Bay and between Bayou la Batre and Bayou Coden in the Mississippi Sound, Alabama. Restoration measures would include placement of nearshore intertidal breakwaters that may utilize artificial Wave Attenuation Units (WAUs) and would generally follow a +0.5 to +1.0 ft. Mean Lower Low Water (MLLW) target crest elevation. Cumulatively, these three projects would produce minor, short-term adverse environmental impacts from disturbance to natural and human resources (water quality, geology and substrates, coastal and marine resources, noise, tourism and recreation, and visual and aesthetics). All three of these efforts would contribute to beneficial impacts through the reduction in shoreline erosion, protection of water resources from breakwaters, and habitat enhancement.

The Phase IV St. Louis Bay Living Shoreline and Wolf River Living Shoreline and Subtidal Reef project components are also in proximity to the Phase III Hancock County Marsh Living Shoreline Project. That project would employ living shoreline techniques that utilize natural and/or artificial breakwater material to stabilize shorelines along an area in the eastern and western portions of the marsh. The Phase III Hancock County Marsh Living Shoreline project will also create 46 acres of marsh and 46 acres of subtidal habitat in Hancock County. Cumulatively, these two projects would not produce adverse environmental impacts in the short-term as construction activities would not be expected to occur at the same time. Both projects would contribute to beneficial impacts through the reduction in shoreline erosion, protection of water resources from breakwaters, and habitat enhancement.

The Restoring Living Shorelines and Reefs in Mississippi Estuaries would not contribute adverse cumulative impacts when added to past, present or reasonably forseeable future actions.

6.2.9 Summary and Next Steps

The proposed Restoring Living Shorelines and Reefs in Mississippi Estuaries would include shoreline and marsh protection, and reef creation resulting in increased benthic secondary productivity. It would use breakwater material to prevent shoreline erosion, create 267 acres subtidal reef habitat, and create five acres of intertidal reef habitat. The project is consistent with Alternative 4 (Contribute to Restoring Habitats and Living Coastal and Marine Resources, and Recreational Opportunities) of the Final Phase III ERP/PEIS.

NEPA analysis of the environmental consequences suggests that there would be long-term minor to moderate impacts to geology and substrates, and there would be minor short-term adverse impacts to other project specific resource categories. The project would provide long-term benefits by creating approximately 267 acres subtidal reef habitat, five acres of intertidal reef habitat, and approximately four miles (17.9 acres) of breakwater that will become high profile reef habitat. The Trustees have initiated coordination and consultation under the ESA, the MBTA , the MMPA, and the BGEPA. The Trustees have initiated consultation under the National Historic Preservation Act and other federal statutes. A summary of the results from each coordination and consultation process is provided below:

- Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA): NOAA reviewed the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project for compliance with the MSFCMA. It was determined that some activities have the potential for temporary short and long term minor site-specific adverse impacts to water bottom and water column characterized as Essential Fish Habitat, however, NMFS concurred that the best management practices (BMPs) proposed for implementation would be sufficient to avoid, minimize or offset impacts and no additional conservation recommendations were required (NOAA 2015).
- Endangered Species Act (ESA), MBTA, BGEPA, and Marine Mammal Protection Act (MMPA): To fulfill requirements and obligations under ESA and MMPA, NOAA and DOI are undergoing a review of the Restoring Living Shorelines and Reefs in Mississippi Estuaries Project for compliance with Section 7 of the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.) and Section 101 of the Marine Mammal Protection Act of 1972, as amended (16 U.S.C. 1371(a)(5) et seq.). Biological Evaluation forms have been submitted to the USFWS for consultation and coordination on the ESA, MBTA and BGEPA (DOI 2015) and to NMFS for ESA (NOAA 2015). The Trustees coordinated with NMFS SERO's Protected Resources Division to determine that this project does not require authorization under the MMPA.
- A compliance review for impacts to cultural and historical resources protected under Section 106 of the National Historic Preservation Act and Tribal consultations has been initiated and will be completed prior to project implementation.

The Trustees considered public comment and information relevant to environmental concerns bearing on the proposed actions or their impacts. Public comments and Trustee responses are found in Chapter 15.

Throughout the design process, every practical attempt will be made to avoid and minimize potentially adverse environmental, social, and cultural impacts. The following conservation measures and BMPs (sorted by resource type) will be implemented to minimize impacts to resources:

Green House Gas Emissions

- Shut down idling construction equipment, if feasible.
- Locate staging areas as close to construction sites as practicable to minimize driving distances between staging areas and construction sites.
- Encourage the use of the proper size of equipment for the job to maximize energy efficiency.
- Encourage the use of alternative fuels or power sources for generators at construction sites, such as propane or solar power, or use electrical power where practicable.

Geology and Substrates

- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.

- Spoil from temporary flotation channels will be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels will be filled in mechanically.
- A vibratory hammer from a barge will be used to push piles to a depth ranging from 10 to 30 feet below the substrate. This will put the day board sign at approximately +10.0 Mean Lower Low Water (MLLW).

Hydrology and Water Quality

- The Trustee will apply for a Mississippi Coastal Wetland Protection Act Permit and authorization by the USACE. Under the Coastal Zone Management Act of 1972, selected restoration projects must be consistent with the federally-approved coastal management programs for the states in which the projects are to be conducted. Best management practices along with other avoidance and mitigation measures required by state and federal regulatory agencies, will be employed to minimize potential water quality and sedimentation impacts. Authorization by the U.S. Army Corps of Engineers (USACE) under Section 10/404 and State Water Quality Certifications will be required and permit conditions will be met.
- Appropriate BMPs such as routine maintenance, inspection, and proper refueling of construction equipment will be used to prevent, control, and mitigate impacts.
- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.
- Spoil from temporary flotation channels will be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels will be filled in mechanically.

Submerged Aquatic Vegetation

- To the extent practicable, SAVs will be avoided in the siting and construction of breakwaters, intertidal habitat, subtidal habitat and temporary flotation channels.

Invasive Species

- All equipment to be used during the project, including personal gear, will be inspected and cleaned such that there is no observable presence of mud, seeds, vegetation, insects and other species.
- Reef habitat material will be treated or inspected to remove "non-target" species.

Benthic Infauna and Epifauna

- SAV surveys and where needed oyster/hard bottom and artificial/nearshore reef surveys will be conducted as part of project site refinement.
- For breakwaters, intertidal reef habitat, subtidal reef habitat, and temporary flotation channels effort will be made during design and construction to avoid existing environmentally sensitive areas such as viable productive oyster reefs, emergent marsh and SAVs, and other living communities.
- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.

Marine Mammals

- Standard Manatee Conditions (A-D) for In-Water work (USFWS 2011)
- Smalltooth Sawfish and Sea Turtle construction guidelines (NMFS 2006)
- Measures for Reducing Entrapment Risk to Protected Species (NMFS 2012)

Protected Species

<u>Sea turtles mitigation measures (all project components)</u>

- Sea Turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006).
- All project work will be in-water and no nesting habitat exists in the project area.
- All construction personnel will be notified of the potential presence of sea turtles in the water and will be reminded of the need to avoid sea turtles.
- If any sea turtles are found to be present in the immediate project area during activities, construction will be halted until species moves away from project area.
- All construction personnel will be notified of the criminal and civil penalties associated with harassing, injuring, or killing sea turtles.
- Train/instruct all construction personnel of what they are to do in the presence of a sea turtle.
- Construction activities will occur during daylight hours and noise will be kept to the minimum feasible.

Shorebirds mitigation measures (all project components)

- All construction personnel will be notified of the potential presence of shorebirds within the project area.
- All construction personnel will be instructed and trained in the protection of shorebirds.
- Construction personnel will be notified of the criminal and civil penalties associated with harassing, injuring or killing shorebirds.
- If piping plovers or red knots are present, work will not occur until the birds have moved from the area by 150 feet.
- Construction noise will be kept to the minimum feasible.

West Indian manatee mitigation measures (all project components)

- Standard Manatee Conditions (A-D) for In-Water Work (USFWS 2011).
- All construction personnel will be notified of the potential presence of West Indian Manatee in the water and reminded of the criminal and civil penalties associated with harassing, injuring, or killing West Indian manatees. All workers will be educated that there could be West Indian manatees in the water and will be advised to look for manatees and, if observed, wait until manatees leave the area to put the equipment in the water.
- Care will be taken when lowering equipment into the water and the sediment in order to ensure that no harm is caused to West Indian Manatee that may potentially be in the water within the construction area.
- Should a West Indian Manatee come within 50 foot of the project area during construction activities, work will immediately cease until the West Indian Manatee has moved away from the project area on its own. Construction noise will be kept to the minimum feasible.

Gulf Sturgeon (Deer Island and Grand Bay project components only)

- To the extent practicable, the Deer Island Subtidal Reef and the Grand Bay Intertidal and Subtidal Reefs project components that are in Gulf Sturgeon Critical habitat, will be limited to the window between May and October, after sturgeon have migrated to their riverine habitat. If work continues beyond the May to October window, continued adherence to the Sea turtle and Smalltooth Sawfish Construction Conditions (NMFS 2006) will minimize the potential for impacting Gulf Sturgeon.

ESA consultations and MMPA coordination (all project components)

- ESA Section 7 coordination is underway and the appropriate recommendations will be incorporated into the selected project. Because no adverse effects to manatee are expected, the Trustees determined that no take of manatee under MMPA will occur.

Migratory Bird Treat Act/Bald and Golden Eagle Protection Act

- If evidence of eagle nesting is found, within 660 ft. of the project area, coordination with the USFWS will be initiated to develop and implement appropriate conservation measures. Due to the implementation of best management practices no "take" is anticipated.
- If evidence of migratory bird nesting is found, coordination with the USFWS will be initiated to develop and implement appropriate conservation measures.
- Construction noise will be kept to the minimium feasible.

Essential Fish Habitat

- After installation of the structures is completed, the flotation channels would be filled in mechanically.
- All construction activities would be completed during daylight hours.
- Pilings would be driven instead of jetting to reduce the disturbance of bottom sediments and bottom dwelling organisms.
- Monitoring will assess whether unexpected impacts to EFH have occurred.
- If immediate post-construction monitoring reveals that unavoidable impacts to EFH have occurred, appropriate coordination with regional EFH personnel will take place to determine appropriate response measures, possibly including mitigation. If additional adaptive management of the breakwater structure is necessary after monitoring events, all minimization measures discussed above will be followed.

Cultural Resources

- This project would be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources.

Land and Marine Management/Coastal Zone Management Act

- Pursuant to the Coastal Zone Management Act of 1972, federal actions must be consistent with the federally approved coastal management programs for states where the activities will affect a coastal use or resource of the state. The Federal Trustees submitted their consistency determination for this project to MDMR on May 21, 2015. MDMR replied by letter dated June 29, 2015 with its determination that the selected actions are consistent with the Mississippi Coastal Program. As noted in that response. additional consistency review may be required pursuant to federal regulations (see 15 C.F.R. Part 930) prior to project implementation.
- The Trustee will coordinate with Grand Bay NERR Staff and NOAA to ensure project consistency with the Grand Bay NERR Management Plan (GBNERR 2013).
- Siting of breakwaters, intertidal reefs, subtidal reefs and temporary flotation channels will avoid monitoring sites.

- Construction will be completed so as not to interfere with management or monitoring activities at Grand Bay NERR. There will be no breakwaters or temporary flotation channels constructed in the Grand Bay NERR.
- Temporary flotation channel dimensions (e.g., length, depth and width) would be minimized and to the extent practicable, avoided depending on project design and/or construction timing.Spoil from temporary flotation channels will be placed on the side of the channel. After installation of the structures is completed, the temporary flotation channels will be filled in mechanically.
- Natural cultch materials (i.e. oyster shells) will be used for intertidal and subtidal cultch placements in the Grand Bay NERR or material approved by the Grand Bay NERR staff.
- Restoration planning may require historical research to determine the "natural" representative state of an estuarine area

Public Health and Safety and Shoreline Protection

- Best management practices in accordance with Occupational Safety and Health Administration (OSHA) and state and local requirements will be incorporated into construction activities onsite to ensure the proper handling, storage, transport, and disposal of all hazardous materials.
- Personal protective equipment will be required for all construction personnel, and authorized access zones will be established at the perimeter of the project site. As a result, adverse impacts to public health and safety will not be expected.

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