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CHAPTER 6: ENVIRONMENTAL CONSEQUENCES

This Chapter describes the predicted consequences, or effects, of implementing Early Restoration Programmatic Plan alternatives proposed in Chapter 5 on the physical, biological, and human environment described in Chapter 3. This Chapter is organized as follows:

- Section 6.1 provides a brief description of the Early Restoration project area and description of the scope of the analysis for which environmental consequences have been determined.
- Section 6.2 provides definitions of impact determinations and their significance, using resource-specific criteria for the determinations.
- Sections 6.3 through 6.7 present the analysis of the environmental consequences of alternatives by resource. Impacts on the physical and biological environments are further disaggregated by each of the 12 project types (organized by alternative) identified in Chapter 5. For each project type, potential restoration techniques are noted. Impacts on the human use[1] and socioeconomic environment are presented in consideration of project types in their aggregate for each alternative.
- Section 6.8 summarizes the range of impact findings for each alternative.
- Section 6.9 provides an analysis of cumulative impacts of proposed alternatives by resource.
- Section 6.10 provides a discussion of other required findings under NEPA, including unavoidable adverse impacts, the relationship between short-term uses of the human environment and the maintenance and enhancement of long-term productivity, irreversible and irretrievable commitment of resources. The section also includes a discussion of climate change.
- Appendix 6-A provides examples of potential mitigation measures and Best Management Practices (BMPs) that could be implemented to further reduce potential effects to various resources on a project-specific basis.
- Appendix 6-B presents examples of cumulative actions that are ongoing in the Gulf of Mexico.

6.1 Project Area and Scope of Analysis

Although the NRDA regulations do not constrain the geographic location of restoration projects, an area must be defined as the affected environment in order to complete a PEIS which is part of the NEPA process. The area considered as the affected environment for purposes of this PEIS includes the northern Gulf of Mexico and its coastal environment. The ecosystem is comprised of a complex biological community of interacting organisms, including humans, and their physical environment(s). The scope of the analysis is limited to those activities and potential effects from those activities that are reasonably foreseeable from the Early Restoration program alternatives (as described in Chapter 5) proposed herein. As discussed above, the analysis is organized by programmatic alternative and project types within the alternatives, as summarized in Table 6-1.

[1] The term "human use" in this chapter, and in Chapters 8 through 12, is specific to the evaluation under NEPA of the potential impacts on those aspects of the human environment not addressed in the assessment of the physical and biological environments. The term 'human use' here is not intended to address or substitute for an evaluation of human use in the context of OPA or the OPA implementing regulations.

Table 6-1. Summary of Early Restoration Programmatic Plan Project Types by Action Alternatives 2, 3 and 4

ALTERNATIVE 4	
ALTERNATIVE 2	**ALTERNATIVE 3**
• Create and improve wetlands • Protect shorelines and reduce erosion • Restore barrier islands and beaches • Restore and protect submerged aquatic vegetation • Conserve habitat • Restore oysters • Restore and protect finfish and shellfish • Restore and protect birds • Restore and protect sea turtles	• Enhance public access to natural resources for recreational use • Enhance recreational experiences • Promote environmental and cultural stewardship, education, and outreach

It should be noted that the beneficial environmental effects described in this Chapter's NEPA analyses, as well as in the environmental impacts portions of Chapters 8 through 12, consider potential direct, indirect impacts of the alternatives and their associated project types. In addition, the analyses also include the cumulative impacts of the alternatives when combined with other past, present, and reasonably foreseeable actions, as required under NEPA. The NEPA concept of "reasonably foreseeable" differs from the NRDA evaluation of actions to benefit specific injured resources. Chapter 7 provides information on the NRDA component of the project-specific analysis for Phase III and the development of Offsets.

Determining the Level of Impact

Under NEPA, federal agencies must consider the environmental effects of their actions. These effects may include, among others, impacts to social, cultural, and economic resources, as well as natural resources. To identify those resources that could be significantly impacted by the proposed alternatives and actions, appropriate definitions of *impacts* must first be identified. Table 6-2 provides guidelines for resource-specific definitions for determining effects of programmatic alternatives as well as for individual planned actions.

As defined in NEPA, evaluations should include direct and indirect effects. Effects are defined in the Council for Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [C.F.R.] § 1508.8 and 1508.7) as follows:

- Direct effects, which are caused by the action and occur simultaneous to the activity and at the same place.
- Indirect effects, which are caused by the action and occur later in time or farther removed in distance, but are still reasonably foreseeable. Indirect effects may include growth-inducing effects and other effects related to induced changes in the pattern of land use, population density, or growth rate, and related effects on air and water and other natural systems, including ecosystems.
- Cumulative effects are 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. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time.

In this analysis, effects are described by both the expected duration (short-term, long-term) and the expected intensity (in this analysis, impacts are defined as minor, moderate, or major). The intensity definitions used here are described in terms of adverse impacts (other than for cultural resources, which also include a definition of beneficial impacts). For resource areas where there is no expected effect from project activities, a "no impact" conclusion is made. The analysis of beneficial impacts focuses on the duration (short- or long-term), without attempting to specify the intensity of the benefit. As described further in Section 6.3, a "no impact" conclusion is made for the No Action alternative because the No Action alternative would largely result in a continuation of the conditions as described in Chapters 3 and 4, without the benefits to resources intended as a result of Early Restoration.

This chapter evaluates the potential environmental effects by project type, acknowledging that the selection of a programmatic alternative and associated project types do not in themselves result in environmental effects; effects would occur as a result of projects ultimately identified and selected in Phase III and future phases of early restoration. All projects conducted as part of Early Restoration would secure all necessary state and federal permits, authorizations, consultations or other regulatory processes related to sensitive habitats (e.g. wetlands or Essential Fish Habitat) and protected species (e.g. marine mammals such as dolphins, or federally listed species such as sea turtles, etc.), and other applicable requirements. These compliance measures and consultations are already in progress or completed for proposed Phase III projects. Chapter 7 provides an overview of key applicable Federal laws and regulations. For projects proposed in Phase III, specific analysis and compliance status under Federal laws and regulations is provided in greater detail in Chapters 8 through 12. For example, if projects proposed for Early Restoration have the potential to affect an ESA-listed species or designated critical habitat, consultation with NMFS or USFWS would occur and, if necessary, a biological opinion would be prepared. Avoidance of identified locations for threatened and endangered species would be implemented on a site-specific basis. It is important to note that some restoration techniques are intended to benefit listed species and their habitats and would intentionally be targeted to occur in locations where species are or may be present. The analysis in this chapter also assumes that restoration projects would be implemented in appropriate locations and with proper design criteria.

Appendix 6-A provides a listing of example BMPs and mitigation measures that could be included as appropriate on a project-specific basis to avoid, minimize, or reduce potential adverse effects to the resources. Additional BMPs and mitigation measures are discussed in Chapters 8 through 12. The potential programmatic environmental consequences described in this Chapter are presented largely without factoring in the types of specific project actions and requirements (BMPs) that could avoid or minimize the potential adverse effects at a project-specific level in planning and implementation. An exception is the analysis of impacts to protected biological resources and their habitats. For these resources, project types were specifically analyzed with the incorporation of BMPs that would be typically required by trust resource agencies, as these projects would generally not be able to move forward through agency review without incorporation of BMPs. Standard restoration approaches and practices would be considered as individual projects are proposed. These include but are not limited to steps taken through site selection, engineering and design, use of proven restoration techniques and best management practices, and other conditions or activities required for project-specific regulatory

compliance. As part of the project-specific environmental review, appropriate BMPs and mitigation measures would be selected prior to project implementation. For example, projects that require use of a borrow source for material to use in upland or submerged habitats (i.e. beach re-nourishment, wetland or marsh creation, etc.) would use appropriate sources that were chemically and physically suitable to the placement site. Another example would be avoiding or minimizing activities in sensitive habitats during critical periods, such as sea turtle nesting beaches during the nesting season.

In this Chapter, the Trustees describe the direct, indirect, and cumulative impacts that could occur, recognizing that they could be mitigated to some extent as noted above. This approach assists the Trustees in identifying specific projects that effectively avoid or minimize collateral injuries. For the proposed Phase III Early Restoration projects, project-level actions and requirements anticipated to avoid or minimize adverse effects are considered in the proposed project evaluations in Chapters 8 through 12. Appendix 6-A identifies examples of BMPs and mitigation measures that could be employed, depending on site-specific considerations, for each resource. Additional or alternative measures may be developed and implemented as necessary.

Table 6-2. Guidelines for NEPA Impact Determinations in the Programmatic ERP/PEIS.[2]

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
Geology and Substrates	Short-term: During construction period. Long-term: Over the life of the project or longer.	Disturbance to geologic features or soils could be detectable, but could be small and localized. There could be no changes to local geologic features or soil characteristics. Erosion and/or compaction could occur in localized areas.	Disturbance could occur over local and immediately adjacent areas. Impacts to geology or soils could be readily apparent and result in changes to the soil character or local geologic characteristics. Erosion and compaction impacts could occur over local and immediately adjacent areas.	Disturbance could occur over a wide-spread area. Impacts to geology or soils could be readily apparent and could result in changes to the character of the geology or soils over a wide-spread area. Erosion and compaction could occur over a wide-spread area. Disruptions to substrates or soils may be permanent.
Hydrology and Water Quality	Short-term: During construction period. Long-term: Over the life of the project or longer.	Hydrology: The effect on hydrology could be measurable, but it could be small and localized. The effect could only temporarily alter the area's hydrology, including surface and groundwater flows. Water Quality: Impacts could result in a detectable change to water quality, but the change could be expected to be small and localized. Impacts could quickly become undetectable. State water quality standards as required by the Clean Water Act could not be exceeded. Floodplains: Impacts may result in a detectable change to natural and beneficial floodplain values, but the change could be expected to be small, and localized. There could be no appreciable increased risk of flood loss including impacts on human safety, health, and welfare. Wetlands: The effect on wetlands	Hydrology: The effect on hydrology could be measurable, but small and limited to local and adjacent areas. The effect could permanently alter the areas hydrology including surface and groundwater flows. Water Quality: Effects to water quality could be observable over a relatively large area. Impacts could result in a change to water quality that could be readily detectable and limited to local and adjacent areas. Change in water quality could persist; however, could likely not exceed state water quality standards as required by the Clean Water Act. Floodplains: Impacts could result in a change to natural and beneficial floodplain values and could be readily detectable, but limited to local and adjacent areas. Location of operations in floodplains could increase risk of flood loss including impacts on human safety, health, and welfare.	Hydrology: The effect on hydrology could be measurable and wide-spread. The effect could permanently alter hydrologic patterns including surface and groundwater flows. Water Quality: Impacts could likely result in a change to water quality that could be readily detectable and wide-spread. Impacts could likely result in exceedance of state water quality standards and/or could impair designated uses of a water body. Floodplains: Impacts could result in a change to natural and beneficial floodplain values that could have substantial consequences over a wide-spread area. Location of operations could increase risk of flood loss including impacts on human safety, health, and welfare. Wetlands: The action could cause a permanent loss of wetlands across a wide-spread area. The character of the wetlands could be changed so that the functions typically provided by the wetland could be

[2] Note that while this chapter only evaluates programmatic alternatives, the same determinations are applied in the Phase III project level analyses in Chapters 8 through 12.

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
		could be measurable, but small in terms of area and the nature of the impact. A small impact on the size, integrity, or connectivity could occur; however, wetland function could not be affected and natural restoration could occur if left alone.	Wetlands: The action could cause a measurable effect on wetlands indicators (size, integrity, connectivity) or could result in a permanent loss of wetland acreage across local and adjacent areas. However, wetland functions could only be permanently altered in limited areas.	permanently lost.
Air Quality and Greenhouse Gas Emissions	Short-term: During construction period. Long-term: Over the life of the project or longer.	The impact on air quality may be measurable, but could be localized and temporary, such that the emissions do not exceed the Environmental Protection Agency's (EPA's) de minimis criteria for a general conformity determination under the Clean Air Act (40 C.F.R. 93.153). The contributions to GHGs may be measurable, but below 25,000 metric ton/year of carbon dioxide (CO_2) or its equivalent. [3]	The impact on air quality could be measurable and limited to local and adjacent areas. Emissions of criteria pollutants could be at the EPA's de minimis criteria levels for general conformity determination. The contribution to GHG emissions could exceed 25,000 metric tons of CO_2 or its equivalent annually. [4] Although the level of emissions could be similar to a large source (i.e. natural gas and petroleum users, landfills, agriculture, etc.), the levels could not be a dominant contributor to GHGs in the area.	The impact on air quality could be measurable over a wide-spread area. Emissions are high, such that they could exceed the EPA's de minimis criteria for a general conformity determination. The contribution to GHGs could exceed 25,000 metric tons of CO_2 or its equivalent annually. The source could be a dominant contributor in terms of GHG in the area.
Noise	Short-term: During construction period. Long-term: Over the life of the project.	Increased noise could attract attention, but its contribution to the soundscape would be localized and unlikely to affect current user activities.	Increased noise could attract attention, and contribute to the soundscape including in local areas and those adjacent to the action, but could not dominate. User activities could be affected.	Increased noise could attract attention, and dominate the soundscape over wide-spread areas. Noise levels could eliminate or discourage user activities.

[3] "The reference point of 25,000 metric tons of direct CO2-equivalent GHG emissions may provide agencies with a useful indicator – rather than an absolute standard of insignificant effects -- for agencies' action-specific evaluation of GHG emissions and disclosure of that analysis in their NEPA documents. CEQ does not propose this reference point as an indicator of a level of GHG emissions that may significantly affect the quality of the human environment, as that term is used by NEPA, but notes that it serves as a minimum standard for reporting emissions under the Clean Air Act." CEQ, "Draft NEPA guidance on consideration of the effects of climate change and GHG emissions." 2010.

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
Habitats	Short-term: Lasting less than two growing seasons. Long-term: Lasting longer than two growing seasons.	Impacts on native vegetation may be detectable, but could not alter natural conditions and be limited to localized areas. Infrequent disturbance to individual plants could be expected, but without affecting local or range-wide population stability. Infrequent or insignificant one-time disturbance to locally suitable habitat could occur, but sufficient habitat could remain functional at both the local and regional scales to maintain the viability of the species. Opportunity for increased spread of non-native species could be detectable but temporary and localized and could not displace native species populations and distributions.	Impacts on native vegetation could be measureable but limited to local and adjacent areas. Occasional disturbance to individual plants could be expected. These disturbances could affect local populations negatively, but could not be expected to affect regional population stability. Some impacts might occur in key habitats, but sufficient local habitat could retain functional to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	Impacts on native vegetation could be measurable and wide-spread. Frequent disturbances of individual plants could be expected, with negative impacts to both local and regional population levels. These disturbances could negatively affect range-wide population stability. Some impacts might occur in key habitats, and habitat impacts could negatively affect the viability of the species both locally and throughout its range. Actions could result in the wide-spread increase of non-native species resulting in broad and permanent changes to native species populations and distributions.
***Living Coastal and Marine Resources*:** Wildlife Species (including birds)	Short-term: Lasting up to two breeding seasons, depending on length of breeding season. Long-term: Lasting more than two breeding seasons.	Impacts to native species, their habitats, or the natural processes sustaining them could be detectable, but localized and could not measurably alter natural conditions. Infrequent responses to disturbance by some individuals could be expected, but without interference to feeding, reproduction, resting, migrating, or other factors affecting population levels. Small changes to local population numbers, population structure, and other demographic factors could occur. Sufficient habitat could remain functional at both the local and range-wide scales to maintain the viability of the species.	Impacts on native species, their habitats, or the natural processes sustaining them could be measureable but limited to local and adjacent areas. Occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local population levels. Some impacts might occur in key habitats. However, sufficient population numbers or habitat could retain function to maintain the viability of the species both locally and throughout its range. Opportunity for increased spread of non-native species could be detectable and limited to local and adjacent areas, but could only result in temporary	Impacts on native species, their habitats, or the natural processes sustaining them could be detectable, and wide-spread. Frequent responses to disturbance by some individuals could be expected, with negative impacts to feeding, reproduction, migrating, or other factors resulting in a decrease in both local and range-wide population levels and habitat type. Impacts could occur during critical periods of reproduction or in key habitats and could result in direct mortality or loss of habitat that might affect the viability of a species. Local population numbers, population structure, and other demographic factors might experience large changes or declines. Actions could result in the wide-spread increase of non-native species resulting in broad and permanent changes to native

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
		Opportunity for increased spread of non-native species could be detectable but temporary and localized and could not displace native species populations and distributions.	changes to native species population and distributions.	species populations and distributions.
Living Coastal and Marine Resources: Marine and Estuarine Fauna, (fish, shellfish benthic organisms)	Short-term: Lasting up to two spawning seasons, depending on length of season. Long-term: Lasting more than two spawning seasons.	Impacts could be detectable and localized but small. Disturbance of individual species could occur; however, there could be no change in the diversity or local populations of marine and estuarine species. Any disturbance could not interfere with key behaviors such feeding and spawning. There could be no restriction of movements daily or seasonally. Opportunity for increased spread of non-native species could be detectable but temporary and localized and could not displace native species populations and distributions.	Impacts could be readily apparent and result in a change in marine and estuarine species populations in local and adjacent areas. Areas being disturbed may display a change in species diversity; however, overall populations could not be altered. Some key behaviors could be affected but not to the extent that species viability is affected. Some movements could be restricted seasonally. Opportunity for increased spread of non-native species could be detectable and limited to local and adjacent areas, but could only result in temporary changes to native species population and distributions.	Impacts could be readily apparent and could substantially change marine and estuarine species populations over a wide-scale area, possibly river-basin wide. Disturbances could result in a decrease in fish species diversity and populations. The viability of some species could be affected. Species movements could be seasonally constrained or eliminated. Actions could result in the wide-spread increase of non-native species resulting in broad and permanent changes to native species populations and distributions.
Living Coastal and Marine Resources: Protected Species	Short-term: Lasting up to one breeding/growing season. Long-term: Lasting more than one breeding/growing season.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, but small, localized, and could not measurably alter natural conditions. Impacts could likely result in a "may affect, not likely to adversely affect" determination for at least one listed species.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable and some alteration in the numbers of protected species, or occasional responses to disturbance by some individuals could be expected, with some negative impacts to feeding, reproduction, resting, migrating, or other factors affecting local and adjacent population levels. Impacts could occur in key habitats, but sufficient population numbers or habitat could remain functional to maintain the viability of the species both locally and throughout its range.	Impacts on protected species, their habitats, or the natural processes sustaining them could be detectable, wide-spread, and permanent. Substantial impacts to the population numbers of protected species, or interference with their survival, growth, or reproduction could be expected. There could be impacts to key habitat, resulting in substantial reductions in species numbers. Results in an "Is likely to jeopardize proposed or listed species / adversely modify proposed or designated critical habitat (impairment)" determination for at least one listed species.

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
			Some disturbance to individuals or impacts to potential or designated critical habitat could occur. Impacts could likely result in a "may affect, likely to adversely affect" determination for at least one listed species. No adverse modification of critical habitat could be expected.	
Socioeconomics and Environmental Justice	Short-term: During construction period. Long-term: Over the life of the project or longer.	A few individuals, groups, businesses, properties or institutions could be impacted. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions. Actions could not disproportionately affect minority populations and low-income populations.	Many individuals, groups, businesses, properties or institutions could be impacted. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions Actions could disproportionately affect minority populations and low-income populations. However, the impact could be temporary and localized.	A large number of individuals, groups, businesses, properties or institutions could be impacted. Impacts could be readily detectable and observed, extend over a wide-spread area, and could have a substantial influence on social and/or economic conditions. Actions could disproportionately affect minority populations and low-income populations. However, the impact could be permanent and widespread.
Cultural Resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	Adverse impact: The disturbance of a site(s), building, structure or object could be confined to a small area with little, if any, loss of important cultural information potential.	Adverse impact: Disturbance of a site(s), building, structure or object not expected to result in a substantial loss of important cultural information.	Adverse impact: Disturbance of a site(s), building, structure or object could be substantial and may result in the loss of most or all its potential to yield important cultural information.
Infrastructure	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could affect public services or utilities but the impact could be localized and within operational capacities. There could be negligible increases in local daily traffic volumes resulting in perceived inconvenience to drivers but no actual disruptions to traffic.	The action could affect public services or utilities in local and adjacent areas and the impact could require the acquisition of additional service providers or capacity. Detectable increase in daily traffic volumes (with slightly reduced speed of travel) resulting in slowing down traffic and delays, but no change in level of service (LOS). Short service interruptions (temporary closure for a few hours) to roadway and railroad traffic.	The action could affect public services utilities over a wide-spread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily traffic volumes (with reduced speed of travel) resulting in an adverse change in LOS to worsened conditions. Extensive service disruptions (temporary closure of one day or more) to roadways or railroad traffic.

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
Land and Marine Management	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could require a variance, zoning change or amendment to a land use or area comprehensive or management plan, but could not affect overall use and management beyond the local area.	The action could require a variance, zoning change or amendment to a land use or area comprehensive or management plan, and could affect overall land use and management in local and adjacent areas.	The action could cause permanent changes to and conflict with land uses or management plans over a wide-spread area.
Tourism and Recreational Use	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be partial developed recreational site closures to protect public safety. The same site capacity and visitor experience could remain unchanged after construction. The impact could be detectable and/or could only affect some recreationalists. Users could likely be aware of the action but changes in use could be slight. There could be partial closures to protect public safety. Impacts could be local. There could be a change in local recreational opportunities; however it could affect relatively few visitors, or could not affect any related recreational activities.	There could be complete site closures to protect public safety. However, the sites could be reopened after activities occur. There could be slightly reduced site capacity. The visitor experience could be slightly changed but could still be available. The impact could be readily apparent and/or could affect many recreationalists locally and in adjacent areas. Users could be aware of the action. There could be complete closures to protect public safety. However, the areas could be reopened after activities occur. Some users could choose to pursue activities in other available local or regional areas.	All developed site capacity could be eliminated because developed facilities could be closed and removed. Visitors could be displaced to facilities over a wide-spread area and visitor experiences could no longer be available in many locations. The impact could affect the most recreationalists over a wide-spread area. Users could be highly aware of the action. Users could choose to pursue activities in other available regional areas.
Fisheries and Aquaculture	Short-term: During construction period. Long-term: Over the life of the project or longer.	A few individuals, groups, businesses, properties or institutions could be impacted. Impacts could be small and localized. These impacts are not expected to substantively alter social and/or economic conditions.	Many individuals, groups, businesses, properties or institutions could be impacted. Impacts could be readily apparent and detectable in local and adjacent areas and could have a noticeable effect on social and/or economic conditions.	A large number of individuals, groups, businesses, properties or institutions could be impacted. Impacts could be readily detectable and observed, extend over a wide-spread area, and could have a substantial influence on social and/or economic conditions.
Marine Transportation	Short-term: During construction period. Long-term: Over the life of the project or longer.	The action could affect public services or utilities but the impact could be localized and within operational capacities. There could be negligible increases in local daily marine traffic volumes	The action could affect public services or utilities in local and adjacent areas and the impact could require the acquisition of additional service providers or capacity. Detectable increase in daily marine	The action could affect public services utilities over a wide-spread area resulting in the loss of certain services or necessary utilities. Extensive increase in daily marine traffic volumes (with reduced speed of travel) resulting in an extensive service disruptions

		IMPACT INTENSITY DEFINITIONS		
RESOURCE AREA	**IMPACT DURATION**	**MINOR**	**MODERATE**	**MAJOR**
		resulting in perceived inconvenience to operators but no actual disruptions to transportation.	traffic volumes (with slightly reduced speed of travel) resulting in slowing down traffic and delays. Short service interruptions (temporary delays for a few hours).	(temporary closure of one day or more).
Aesthetics and Visual Resources	Short-term: During construction period. Long-term: Over the life of the project or longer.	There could be a change in the view shed that was readily apparent but could not attract attention, dominate the view, or detract from current user activities or experiences.	There could be a change in the view shed that was readily apparent and attract attention. Changes could not dominate the viewscape, though they could detract from the current user activities or experiences.	Changes to the characteristic views could dominate and detract from current user activities or experiences.
Public Health and Safety , Including Flood and Shoreline Protection	Short-term: During construction period. Long-term: Over the life of the project or longer.	Actions could not result in 1) soil, groundwater, and/or surface water contamination, 2) exposure of contaminated media to construction workers or transmission line operations personnel, and/or 3) mobilization and migration of contaminants currently in the soil, groundwater, or surface water at levels that could harm the workers or general public. Increased risk of potential hazards (e.g., increase likelihood of storm surge) to visitors, residents, and workers from decreased shoreline integrity could be temporary and localized.	Project construction and operation could result in 1) exposure, mobilization and/or migration of existing contaminated soil, groundwater or surface water to an extent that requires mitigation and/or 2) could introduce detectable levels of contaminants to soil, groundwater and/or surface water in localized areas within the project boundaries such that mitigation/remediation is required to restore the affected area to the preconstruction conditions. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be sufficient to cause a permanent change in use patterns and area avoidance in local and adjacent areas.	Actions could result in soil, groundwater and/or surface water contamination, at levels exceeding federal, state, or local hazardous waste criteria including those established by 40 C.F.R. Part 261; 2) mobilization of contaminants currently in the soil, groundwater or surface water resulting in exposure of humans or other sensitive receptors such as plants and wildlife to contaminant levels that could result in health effects; and 3) result in the presence of contaminated soil, groundwater or surface water within the project area exposing workers and/or the public to contaminated or hazardous materials at levels exceeding those permitted by Federal Occupational Safety and Health Administration (OSHA) in 29 C.F.R. Part 1910. Increased risk of potential hazards to visitors, residents, and workers from decreased shoreline integrity could be substantial and could cause permanent changes in use patterns and area avoidance over a wide-spread area.

6.2 Programmatic Alternative 1: No Action

Both OPA and NEPA require the evaluation of the considered actions against a No Action alternative. For Early Restoration, the No Action alternative means that the Trustees would not pursue any additional Early Restoration actions at this time. The No Action alternative does not preclude continued development of the Damage Assessment and Restoration Plan (DARP) and supporting PEIS, but no new Early Restoration would be undertaken at this time.

Current management, restoration and stewardship programs and activities are described in Appendix 6-B. There would be no change in these programs and activities anticipated under the No Action alternative, and therefore no change anticipated in the effects of these activities on resources. Similarly, other stressors affecting Gulf resources (described in Chapters 3 and 4) would also be expected to continue. This section does not re-analyze the existing conditions described in Chapters 3 and 4. The No Action alternative would largely result in a continuation of the conditions as described in Chapters 3 and 4, without the benefits to resources intended as a result of Early Restoration.

Descriptions of effects to specific resources under the No Action Alternative are described below.

6.2.1 Geology and Substrates

Under the No Action alternative, Early Restoration Programmatic Plan actions that would increase stability and function of upland and near-shore coastal substrates would not be initiated at this time. The types of projects that would utilize sediment borrow resources for restoration would not be pursued at this time and those borrow resources could potentially be available for use by others. Correspondingly, potential adverse effects, ranging from minor to moderate and including both short-term (e.g., turbidity) and long-term (use of the materials) impacts would not occur, and benefits to substrates achieved through the use of these materials for restoration would not be realized at this time.

Geomorphic processes are dynamic. Under the No Action alternative, some coastal areas may stabilize over time, while erosion may increase in other areas. As stated in Chapter 3, sediment resources in the Gulf of Mexico are used for many man-made construction and restoration projects. The Gulf of Mexico Alliance (GOMA) has developed a Gulf Regional Sediment Management Master Plan aimed at improving sediment management practices (GOMA 2009). In addition, State master plans for beneficial use of dredged materials have been developed. These plans would be unaffected by the No Action Alternative.

6.2.2 Water Quality and Hydrology

Adverse localized effects to hydrology and water quality may occur associated with the action alternatives; these are expected to be minor and may include both short and long-term effects related to new facility development and operation. These impacts would not occur under the No Action alternative. Similarly, benefits of the action alternatives, particularly Alternatives 2 and 4, to localized water quality and hydrology, range from short to long-term, and these benefits would not be realized under the No Action alternative. Existing hydrologic and water quality conditions and contributing stressors, as described in Chapters 3 and 4, would in large part persist under the No Action alternative.

6.2.3 Air Quality and Greenhouse Gases

Adverse effects to air quality and changes in the emission of greenhouse gases associated with the action alternatives, which range from minor to moderate and include primarily short-term effects associated with construction-related activities, as well as long-term effects related to operation of new facilities such as boat ramps, would not occur under the No Action alternative. Similarly, the short to long-term benefits of the action alternatives, particularly Alternatives 2 and 4, to air quality and greenhouse gas emissions, also would not be realized under the No Action alternative.

6.2.4 Noise

As stated in Chapter 3, there are natural and anthropogenic sources of noise in the coastal environment. Primary sources of terrestrial noise in the coastal environment are transportation and construction-related activities. Adverse noise effects associated with the action alternatives, which range from minor to major and which are primarily short-term in nature, would not occur under the No Action alternative.

6.2.5 Habitats

Adverse effects to habitats associated with the action alternatives would not occur under the No Action alternative. Action alternative impacts include minor to moderate short-term effects and minor and moderate long-term effects. In addition, short to long-term benefits of the action alternatives, particularly Alternatives 2 and 4, to habitats would not be realized under the No Action alternative.

Under the No Action alternative, habitats including wetlands, barrier islands and beaches that are subject to ongoing degradation would continue to be subject to existing stressors. The Trustees are implementing Phase I and Phase II Early Restoration projects that benefit wetlands, sea turtle habitat, dune habitat, and bird habitat. As stated above, these efforts would not be affected by the No Action alternative.

6.2.6 Living Coastal and Marine Resources

Living coastal and marine resources encompass a broad range of species that utilize the Gulf Coast and Gulf waters for some or all life stages (e.g., larval, juvenile, adult) or activities (e.g., breeding, foraging, or migration). While some species utilize this area for only one life stage or activity, such as certain migratory birds that use the area as a stopover, others spend their entire life cycle in the Gulf Coast, such as Gulf sturgeon. Adverse effects to living coastal and marine resources associated with the action alternatives, which could include minor to moderate short-term effects and minor to moderate adverse long-term impacts, would not occur under the No Action alternative. In addition, short to long-term benefits of the action alternatives, particularly Alternatives 2 and 4, to living coastal and marine resources would not be realized under the No Action alternative. The Trustees are implementing Early Restoration projects, identified earlier, that benefit oysters and benthic organisms, and these efforts would not be affected by the No Action alternative.

6.2.7 Socioeconomics and Environmental Justice

Adverse effects to socioeconomics associated with the action alternatives, which could include minor to moderate short-term effects and minor adverse long-term impacts, would not occur under the No Action alternative. Similarly, benefits of the action alternatives, to human use and socioeconomics, including the creation of both temporary and permanent jobs, would not be realized under the No Action alternative. Since no actions would be pursued, there is no potential for disproportionately high

and adverse impacts to minority and low income populations, therefore no environmental justice concerns are raised by pursuit of the No Action alternative.

6.2.8 Cultural Resources

Under the No Action alternative, some cultural resources that may be affected by the Action Alternatives would be preserved in their natural condition. Adverse effects to cultural resources associated with the action alternatives, which could include minor to moderate short-term and long-term adverse effects, would not occur under the No Action alternative.

6.2.9 Infrastructure

Adverse effects to infrastructure associated with the action alternatives, which could include minor to major short-term effects and long-term adverse impacts, would not occur under the No Action alternative. Similarly, benefits of the action alternatives, to infrastructure, such as the creation and improvement of boat ramps and potential benefits associated with shoreline stabilization, would not be realized under the No Action alternative.

6.2.10 Land and Marine Management

Potential effects to land and marine management associated with the action alternatives, including minor to moderate short-term adverse impacts, primarily associated with temporary closures related to construction activities would not be realized under the No Action alternative. Long-term benefits associated with improvements to land and marine areas managed as well as benefits through enhanced environmental education, would not be realized under the No Action Alternative.

6.2.11 Tourism and Recreational Use

Tourism and recreational use in the Gulf Coast region includes a broad range of activities, ranging from beach visitation and boating to hunting and fishing. Effects to tourism associated with the action alternatives, including minor to moderate short-term adverse impacts as well as long-term benefits, would not be realized under the No Action alternative.

6.2.12 Fisheries and Aquaculture

Effects to commercial fisheries and aquaculture associated with the action alternatives, including moderate short-term adverse impacts as well as long-term benefits (e.g., from protection of shorelines and SAV protection and restoration), would not be realized under the No Action alternative.

6.2.13 Marine Transportation

Under the No Action alternative, marine infrastructure would continue to provide important transportation, services, and other important functions. Effects to marine transportation associated with the action alternatives, including short-term and long-term minor adverse impacts and long-term benefits, would not be realized.

6.2.14 Aesthetics and Visual Resources

Aesthetic and visual resource elements include natural features, vistas, or views including shorelines, natural and maintained beaches, mangroves and other wetlands. These can also include urban or community visual elements such as architecture, skylines, or other man made characteristics (see Chapter 3). Effects to aesthetics and visual resources associated with the action alternatives, including short-term moderate and long-term minor adverse effects and long-term benefits, would not be realized under the No Action alternative.

6.2.15 Public Health and Safety, including Flood and Shoreline Protection

As stated in Chapter 3, delivery of public health and safety to Gulf Coast communities has been complicated by large storm events that have historically caused extensive damage to shorelines as well as infrastructure such as roadways, bridges and buildings. Under the No Action alternative, existing programs that provide public health and safety would continue. Effects to public health and safety associated with the action alternatives, including short-term and long-term minor adverse effects and long-term benefits, would not be realized under the No Action alternative.

Flood risk management refers to methods used to reduce or prevent the detrimental effects of flood waters, including the construction of floodways (man-made channels to divert floodwater), levees, lakes, dams, reservoirs, or gates to hold extra water during times of flooding. Shoreline protection consists of engineered structures or other solutions meant to slow erosion due to rising sea levels and storm wave action. Effects to flood risk management and shoreline protection associated with the action alternatives, including short-term and long-term minor adverse effects and long-term benefits, would not be realized under the No Action alternative.

6.3 Alternatives 2 (and 4): Physical and Biological Environments

This section describes the environmental consequences of Alternative 2 for physical and biological environments. Impacts for physical and biological resources are disaggregated by each of the nine project types identified in Chapter 5 under this Alternative. For each project type, potential restoration techniques are noted. Because Alternative 4 is inclusive of Alternative 2, the analysis of environmental consequences for these project types is the same for Alternative 4 as Alternative 2.

6.3.1 Project Type 1: Create and Improve Wetlands

This project type involves creating or improving wetlands to establish or reestablish conditions conducive to wetland vegetative growth and to restore hydrologic function within wetland habitats. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

1. Create or enhance wetlands through placement of dredged material in shallow water bodies
2. Replant vegetation via propagation and/or transplanting
3. Restore hydrologic connections to enhance coastal habitats
4. Backfill canals including drainage canals, access canals established for petrochemical development and canals constructed for other purposes (i.e., recreational and residential uses)

6.3.1.1 Geology and Substrates

Restoration activities undertaken to create and improve wetlands could benefit nearshore geology and substrates by allowing normal geomorphic processes to resume. This, as well as the planting of vegetation and restoring hydrologic connections, would help prevent further erosional loss of natural geological substrates. This would be a long-term beneficial effect to geology and substrates because effects would extend beyond the construction period. Short-term adverse effects to nearshore geology and substrates are expected to be minor to moderate and associated with disturbance during the construction phase.

Use of equipment in submerged substrates to excavate material for wetland creation can disturb sediments. This adverse effect would be minor and short-term because actions would be localized and

generally would not extend beyond the construction period. Substrates at borrow areas could be disturbed or altered during excavation and construction. These adverse effects would be minor to moderate and long-term because they could affect a localized area, or larger area, and extend beyond the construction period.

Staging and equipment used for re-vegetation, canal backfilling, or restoration of hydrologic connections could also result in impacts to geology and substrates, such as rutting or a temporary increase in local erosion. These adverse effects would be minor and short-term because they would be localized and generally would not extend beyond the construction period. However, compaction of soils by these construction activities would be a long-term, minor adverse effect that would extend beyond the construction period, if staging does not occur on an already paved or otherwise disturbed area.

6.3.1.2 Hydrology and Water Quality

Restoration activities could improve the filtering capacity of wetland recharge zones, improving long-term water quality and hydrologic function. Vegetation replanting could also help, through organic production, accumulation of sediment, reduction of storm surges and limitation of the shoreward extent of saltwater flow, thereby reducing the pace and extent of future surface derived saltwater intrusion and assisting in the maintenance of salinity regimes in brackish and freshwater systems. Removing blockages and improving conveyances would distribute flood water both temporally (to have a lower and longer peak) and spatially (over a larger floodplain area). These would be long-term beneficial effects because they would extend beyond the construction period.

Equipment usage and other construction activities in wetland recharge areas could result in short-term minor adverse impacts to surface water related to sediment compaction, disturbance, and erosion.

6.3.1.3 Air Quality and Greenhouse Gases

During restoration activities there could be short-term minor to moderate adverse impacts to air quality from emissions generated by construction equipment and vehicles. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor increase in GHG emissions.

6.3.1.4 Noise

During the construction period, minor to moderate short-term adverse impacts of noise could occur from dredging, backfilling canals, and other noise-generating restoration activities, depending on the location and the equipment being used and the distance to sensitive receptors such as recreational users or wildlife. Over the short-term, these actions could result in a change in the soundscape which would attract attention. Although such changes would not dominate the soundscape, they could detract from the current user activities or experiences. However, upon completion of wetland restoration activities, no long-term noise-related impacts would be anticipated.

6.3.1.5 Habitats

The creation and restoration of wetlands (including the expansion of shoreline and marsh edge along barrier islands) would result in a long-term benefit to the health and stability of many important habitats including wetlands, barrier islands, beaches and dunes, areas of SAV and coastal transition

zones. These activities could help reestablish native plant communities, stabilize substrates and support sediment deposition, strengthen shorelines, and reduce erosion.

Adverse effects could occur to these habitats from different restoration activities such as dredging, placement of sediment transport pipeline, placement of sediment, filling of canals, or in-water construction work. Adverse impacts could include:

- increased soil erosion, vegetation trampling, vegetation removal, or other disturbance from human activity from project staging or construction, or;
- changes in water quality from turbidity and substrate disturbance from in-water work with heavy equipment, re-vegetation activities.
- introduction or opportunity for establishment of invasive species.

These impacts would be, for the most part, minor to moderate and would take place over the short-term, during the construction activity. Depletion of sand or sediment at a borrow site could also result in a localized long-term minor to moderate adverse effect to the borrow site habitat due to the disruption of existing conditions and exploitation of sand and sediments. Borrow sites near the shoreline could contain high nutrient levels which, when disturbed, could affect local water quality by decreasing dissolved oxygen levels. Therefore, the removal of material from these sites for purposes of wetland creation may result in hypoxic conditions in local wetland or coastal habitats. This could be a short- or long-term minor to moderate adverse effect.

BMPs and other mitigation measures that may be employed to further minimize or contain adverse impacts are detailed in Appendix 6-A.

Adverse impacts from wetland restoration actions would not be expected on regional habitat function and viability because these impacts would be short-term, limited to the restoration site, and would only occur during construction. There is a potential for inadvertent introduction of invasive exotic species during construction activities, e.g., through transport on construction equipment. However, the use of BMPs would help prevent the introduction of invasive species. Ultimately, creation of wetlands is expected to be a long-term benefit to wetlands.

6.3.1.6 Living Coastal and Marine Resources

Creating and improving wetlands and shallow water habitats could provide a long-term benefit to coastal and marine resources by reducing or preventing erosion and establishing more stable habitats. Restoring hydrologic connections could support salinity regimes that are conducive to oyster growth. In addition, the creation and restoration of wetlands could provide a long-term benefit by enhancing nesting and/or foraging habitat for birds as well as increasing habitat for terrestrial wildlife. Finfish could also benefit from wetlands restoration, which could provide habitat for foraging, spawning, and shelter. Stabilizing sediment from re-vegetation would indirectly result in a long-term benefit to pelagic microfaunal communities through improved water clarity and enhanced photosynthesis.

Some short-term minor adverse effects could occur if resources, including oysters, fish, sea turtles, marine mammals, benthic communities, and pelagic microfaunal communities are present in the construction area. Possible impacts could include increased turbidity, reduction of water quality, noise

pollution, and disruption to the water column and habitat. In particular, dredging, replanting, or other construction activities could result in the following adverse impacts:

- Dredging sediment from borrow areas could have a short-term, minor effect to oyster populations near the borrow site from increased turbidity and siltation, which may increase mortality and inhibit spawning activities.
- Direct mortality of benthic organisms would likely occur in work areas. Other adverse effects to benthic organisms would include covering and destroying suitable habitat, increasing turbidity during construction, and changing soil and water chemistry (e.g., salinity).These effects would be long-term and minor because affected benthic organisms would be limited to the localized area where wetland restoration work occurred.
- 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 impacts would be short-term and minor because, at the community level, pelagic microfaunal communities could move away to other readily available habitat areas.
- Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by equipment, construction activity, or sediment placement. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. Sound pressure level increases or entrainment could also result in mortality of individual finfish. At the community and population level, these would be minor short-term adverse effects that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Sea turtle and marine mammal individuals 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, all of which could temporarily displace individuals or prey during construction and could result in short-term, minor impacts. Dredging equipment can harm or kill sea turtles; however, with proper implementation of best management practices these impacts are not expected. If projects may incidentally harass marine mammals or adversely affect ESA-listed marine mammals or sea turtles, consultation or authorizations with appropriate agencies would be required prior to project implementation.
- Construction in upland 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, bird and terrestrial wildlife individuals that rest, roost, forage or nest in or near the work area could be temporarily disturbed or displaced. Changes in depths at marsh habitat could also displace some invertebrate species that are attracted to the former habitat. If projects have potential to adversely affect protected bird or terrestrial wildlife species, consultations with the appropriate agencies would be required prior to project implementation.
- Some minor long-term impacts could occur if restoration activities fill in existing wetlands and provide access for native and non-native terrestrial animals that could increase predation of local birds or terrestrial wildlife.

6.3.2 Project Type 2: Protect Shorelines and Reduce Erosion

This project type involves developing shore protection systems to slow or prevent erosion by stabilizing the shoreline through the use of engineered structures which can serve as breakwaters, reefs and platforms for vegetation. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

- Construct breakwaters on/or adjacent to shoreline; and
- Construct living shorelines.

6.3.2.1 Geology and Substrates

Placement of breakwaters and living shorelines could benefit geology and substrates by reducing erosion and increasing the lifespan of shorelines near passes, inlets, or in areas where erosion rates are high and sediment supply is limited. These beneficial effects would be long-term because they would last beyond the construction period.

Adverse effects could occur to geology and substrates from installation of shore protection systems. Use of equipment in submerged substrates would disturb sediments; these actions would result in short-term minor adverse effects limited to the area where construction activity occurred. Placement of structures such as living shorelines would permanently cover existing geology and substrates. Adverse effects from soil compaction and rutting of adjacent shoreline substrates during construction may also occur. These structures can change the natural process of sediment accretion and erosion, including preventing washover events[5] and cause erosion in off-site locations. These adverse effects would be minor to moderate and long-term, because they would affect substrate/geologic characteristics of the adjacent shoreline, and could extend beyond the construction period.

6.3.2.2 Hydrology and Water Quality

Shoreline protection and erosion reduction could generally help reduce storm surges on coastal wetlands, and limit the shoreward extent of saltwater flow. 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. This could be a long-term beneficial effect because it would extend beyond the construction period.

Equipment usage and boating traffic in construction areas could pose a minor short-term adverse effect by increasing the risk of water quality contamination during the construction period. In addition, the installation of shore protection systems could increase turbidity. This would be a minor short-term adverse effect because it would be localized and would only occur during the construction period. Shoreline protection could result in minor long-term adverse effects by changing the current patterns in the localized area.

6.3.2.3 Air Quality and Greenhouse Gases

Project construction would require the use of equipment and vehicles, emissions from which could result in short-term minor to moderate adverse impacts to air quality in the project vicinity. There is a

[5] Washover events maintain bare sediments used by shorebirds for nesting and foraging and provide opportunity for sediment colonization by benthic invertebrates which are also used by shorebirds as forage items.

slight potential for fugitive dust creation from construction activities, resulting in minor adverse impacts. Examples of estimated project-specific emissions are described in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project.

6.3.2.4 Noise

During the construction period, adverse impacts to the environment due to an increase in the ambient noise level could occur, particularly along shorelines where construction activities would take place. The severity of impacts would depend to a large degree on the location of the project, the amount of noise that these activities would generate, and the distance to sensitive receptors such as recreational users or wildlife. Installation activities, equipment operation, and vehicle or boat traffic associated with the construction of breakwaters and living shorelines could result in short-term minor to moderate adverse impacts from noise. For example, during the use of motorized heavy equipment such as cranes and barges, noise would be created which could be readily apparent and attract attention. Although such changes would not dominate the soundscape and some sounds could be dampened or masked by ambient wave or ship noise, these actions could detract from the current user activities or experiences and create audible contrast for visitors in the project area.

Over the long-term these features placed along shorelines as a result of restoration activities would become part of the background noise and would not attract attention, dominate the soundscape, or detract from current user activities or experiences.

6.3.2.5 Habitats

Placement of breakwaters and other shore protection systems could protect wetlands, barrier islands, beaches, coastal transition zones, SAV and shallow water habitats by reducing erosion rates, increasing wetland sediment deposition, and prolonging habitat lifespans, which would provide a long-term benefit.

Adverse effects to wetlands could occur if existing wetlands or wetland vegetation were present in the project area where restoration-related construction activities would occur. Construction effects could include filling, disruption, or alteration of wetlands. These effects would be minor because they would be limited to the local area, and may range from short-term to long-term.

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.

Placement of certain types of breakwaters and living shorelines can create long-term adverse impacts due to the permanent nature of the hard structures. In some areas, hard shoreline protection near beaches may lead to accretion near the structure and accelerated erosion around the ends of the structure. Because hard structures may cause net beach erosion, construction of groins and breakwaters may cause long-term minor to moderate long-term adverse impacts in some areas.

Adverse effects to SAV and shallow water habitats could occur where in-water work with heavy equipment is used to place engineered structures. These effects would include covering existing SAV

meadows or increasing turbidity during construction. Turbidity would dissipate quickly and effects from this water quality change would be minor and short-term. However, adverse effects from covering SAV would be minimized due to pre-construction surveys in specific project locations; impacts to SAV could be minor and would be avoided and minimized to the maximum extent practicable.

Short-term minor to moderate adverse effects to coastal transition zones could occur during construction from the use of heavy equipment. In addition, the introduction of breakwaters could have short-term to long-term and minor to moderate adverse effects on coastal transition zones from altered flood control or hydrology.

Breakwaters could change natural current patterns, sediment accretion and erosion rates, availability of invertebrate prey, cause erosion in off-site locations, and alter natural habitats of the dune-beach-nearshore system by the introduction of artificial features. This could result in minor to moderate long-term adverse impacts.

6.3.2.6 Living Coastal and Marine Resources

Placement of breakwaters and living shorelines could protect eroding wetlands and shallow water habitats and, in some cases, would allow for additional wetlands and shallow water habitat creation on the shore side of the constructed breakwaters. These actions would provide long-term benefits to benthic populations, pelagic microfaunal communities, and finfish, by increasing habitat and foraging areas.

Placement of breakwaters and living shorelines would require use of in-water heavy equipment and sediment placement, which would increase human activity, noise, vibration, and turbidity in the short-term. These activities could result in the following adverse impacts:

- Short-term minor impacts to local oyster populations or other benthic organisms may occur from increased turbidity, substrate disturbance, or siltation during construction.
- Short-term, minor disturbance or loss of pelagic microfaunal communities from increased turbidity, which decreases available light necessary for photosynthesis, and from disruption in the water column and surface water. These impacts would be short-term and minor because pelagic microfaunal communities would re-establish once turbidity dissipates;
- Short-term, minor displacement of finfish individuals or mortality of individual finfish, including adults, eggs, or larvae, could occur during construction, depending on timing and location of construction and affected species. However, it is anticipated that finfish would move away to other readily available aquatic habitats during the construction period. Fish present in the dredging or fill-placement area could be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged 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. If projects have a potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Short-term, minor to moderate displacement of individual sea turtles and marine mammals from the work area due to increase in activity, noise, vibration, and turbidity during construction. These impacts would be short-term and minor and would affect localized areas.

Moderate adverse effects could occur to nesting turtles as well. Construction activities could result in destruction of eggs deposited within the boundaries of the proposed project, causing a loss of recruitment and a longer term effect. In addition, construction activities could result in harassment in the form of disturbing or interfering with female turtles attempting to nest within the construction area or on adjacent beaches as a result of construction activities (e.g., false crawls or use of marginal or unsuitable nesting areas).In addition, disorientation of hatchling turtles on beaches adjacent to the construction area as they emerge from the nest and crawl to the water as a result of project lighting may occur. 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.

- 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. BMPs are expected to avoid or minimize these impacts. Structures that extend above the water surface could also potentially improve predator access to nesting birds, resulting in a minor long-term adverse impact limited to the localized area of breakwater placement. If projects have potential to adversely affect protected bird species or other terrestrial wildlife, consultations with the appropriate agencies would be required prior to project implementation.

In particular, the following long-term impacts may occur:

- Long-term, moderate displacement of sea turtles can occur during the construction of breakwaters like groins and jetties. Sea turtles can be adversely affected through the presence of groins or jetties could affect the movement of sand by altering the natural coastal processes and could affect the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest and crawl to the ocean. The physical presence of the groin or jetty creates a physical obstacle to nesting sea turtles. As a result, the groin or jetty is anticipated to result in decreased nesting and loss of nests that do get laid within the nearby area for all subsequent nesting seasons following the completion of the groin or jetty.
- Long-term moderate displacement of shorebirds can occur due to habitat loss from functioning breakwaters. Dredging of inlets as this action can affect spit formation adjacent to inlets, as well as ebb and flood tidal shoal formation. Jetties stabilize inlets and cause island widening and subsequent vegetation growth on the updrift inlet shores; they also cause island narrowing and/or erosion on the downdrift inlet shores. Seawalls and revetments restrict natural island movement and exacerbate erosion. Although dredge and fill projects that place sand on beaches and dunes may restore lost or degraded habitat in some areas, in other areas these projects may degrade habitat quality by altering the natural sediment composition, depressing the invertebrate prey base, hindering habitat migration with sea level rise, and replacing the natural habitats of the dune-beach-nearshore system with artificial geomorphology. These threats are exacerbated by accelerating sea level rise, which increases erosion and habitat loss

where existing development and hardened stabilization structures prevent the natural migration of the beach and/or barrier island.

6.3.3 Project Type 3: Restore Barrier Islands and Beaches

This project type involves restoring barrier islands and beaches which provide important coastal habitat. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

- Re-nourish beaches through sediment addition
- Restore dune and beach systems through the use of passive techniques to trap sand
- Restore barrier islands via placement of dredged sediments
- Plant vegetation on dunes and back-barrier marsh
- Construction of groins, breakwaters, or sediment by-pass structures

6.3.3.1 Geology and Substrates

Placement of appropriate soils on eroding beaches and/or dune systems could benefit geology and substrates by helping stabilize eroding areas. In addition, passive or active efforts to capture sediments and reintroduce them to the system would also help to stabilize these areas. These effects would be long-term because they would last beyond the construction period.

Adverse effects from beach re-nourishment and barrier island restoration may occur to geology and substrates from construction activities. Use of equipment in submerged substrates to excavate material for beach re-nourishment can disturb sediments, which would be a short-term minor effect limited to the area where excavation occurred. Staging and heavy equipment use for beach re-nourishment could result in minor short-term impacts to upland geology and substrates. Borrow sources for beach re-nourishment may occur in upland or submerged areas, which would be disturbed during excavation and removal and the structure of existing soils and geology could be altered. These adverse effects would be minor and long-term because disturbance would be limited to the local area. Placement of structures such as groins or footings may permanently cover existing geology or substrates, effects of which would be minor and long-term because they are limited to the local area. In some areas, hard shoreline protection near beaches may lead to accretion near the structure and accelerated erosion around the ends of the structure. Because hard structures may cause net beach erosion, construction of groins and breakwaters may cause long-term minor to moderate long-term adverse impacts in some areas.

6.3.3.2 Hydrology and Water Quality

Beach re-nourishment and, particularly, barrier island restoration have the potential to reduce the effects of future storm surges on nearshore wetlands and associated brackish-water resources. These effects could include reduced erosion/loss of these wetlands and channel networks as well as reduced inland extent of saltwater encroachment during storms. These would be long-term beneficial effects because they would extend beyond the construction period.

The dredging of borrow sources could locally degrade water quality at the borrow site through the disturbance of sediment and increased turbidity. This would be a minor short-term adverse effect because it would be localized and would only occur during the construction period. Placement of sediment in the nearshore environment to re-nourish beaches could cause sedimentation and turbidity

in the immediate vicinity of the work area. These effects would be minor and short-term as turbidity would dissipate shortly after placement activities are completed.

6.3.3.3 Air Quality and Greenhouse Gases

During dredging, excavation or placement of materials on barrier islands and beaches, there could be minor to moderate adverse impacts to air quality associated with the use of heavy equipment and vehicles. There is a slight potential for fugitive dust creation from construction activities, resulting in minor adverse impacts. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the duration and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to an increase in GHG emissions.

6.3.3.4 Noise

During the construction period, local noise levels would increase and minor to major short-term adverse impacts from noise may occur, particularly at barrier islands and beaches where beach re-nourishment activities would take place. The severity of impacts would depend to a large degree on the location of the project, the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. Typically, impacts are expected to range from minor to moderate. The construction or placement of passive techniques to trap sand could result in temporary changes to the soundscape, which would be only slightly apparent to visitors while this technique is being constructed, and would not attract attention, dominate the soundscape, or detract from current user activities or experiences. In these instances, impacts to ambient noise levels would be minor. Dredging activities associated with barrier island restoration and beach re-nourishment, by contrast, could result in short-term minor to moderate impacts due to noise. These activities could adversely impact the soundscape by introducing mechanical dredging, a readily observable audible contrast if occurring in areas where noise would detract from current user activities or experiences. In these instances, short-term impacts of noise would be minor to moderate.

Over the long-term, the restoration activities would not have a noticeable impact on noise levels. The placement of structures such as groins, breakwaters and sediment by-pass structures in natural areas where these elements did not previously occur would not present an audible contrast to natural surroundings. Any added noise from these elements would not be readily apparent and would not attract attention, dominate the soundscape, or detract from current user activities or experiences.

6.3.3.5 Habitats

The purpose of re-nourishing beaches or restoring barrier islands through sediment addition is to re-build and stabilize the area by providing clean sediment or replenishment of suitable materials from borrow sources compatible with the restoration site. The construction of engineered structures such as breakwaters and groins and sediment by-pass methods could decrease erosion of beaches and may increase the lifespan of beaches near passes, inlets, or in areas where erosion rates are high and sediment supply is limited. However, as described above, breakwaters and groins can cause long-term minor to moderate adverse effects due to changes in current patterns, sediment accretion and erosion, and washover frequency. Benefits would be anticipated from increasing stability and resilience of barrier islands and beaches in the long-term. Re-nourishment of beaches and barrier islands can enhance beach habitat and provide benefits to other habitats, such as wetlands through storm surge

protection. These actions could also provide protection for back-bay SAV habitats and coastal and riparian areas by reducing erosion and scouring.

Back barrier marsh and beach stability could be achieved by planting vegetation to reduce erosion and encourage sediment deposition. Restoration of dune and beach systems by passive techniques to trap sand (i.e. placement of sand fencing, hay bales, and recycled Christmas trees and by replanting and re-vegetating) could also stabilize marsh and beach sediments. These actions could contribute to the stability of the shoreline of the barrier island or beach, resulting in a long-term benefit. Planting vegetation on dunes and in back-barrier marshes could also restore the plant community within wetlands, resulting in long-term beneficial effects. Vegetation planting and dune beach restoration could stabilize marsh and beach sediments contributing to the stability and protection of habitats that are critical to the coastal and riparian ecosystem and yield a long-term benefit to coastal transition zones.

Adverse effects to wetlands from beach re-nourishment through sediment addition would occur if existing wetlands or wetland vegetation were present where restoration associated activities such as dredging, placement of a sediment transport pipeline or in-water construction work take place. The effects could include filling, disruption, or alteration of wetlands. If they occur, these effects would be minor and short-term because they would be limited and localized.

Adverse effects to SAV and shallow water habitats from beach re-nourishment and barrier island restoration may result if sediment deposition occurs in shallow water habitats where SAV is present. Potential adverse impacts on SAV could include covering existing SAV or increasing turbidity during construction. These adverse impacts would be expected to be short-term and minor.

Short-term minor adverse effects to barrier islands or beaches could occur during construction from human activity and/or the use of equipment to place sand traps or plant vegetation on affected dunes, beaches, and marshes. However, hand placement is typically employed for this technique which is a minimally-invasive method. Turbidity effects that could result from construction would be minimized, short-term and minor. SAV population changes would not occur, however the degree of impact would depend on the site's potential for redevelopment of similar habitat functions.

If material was placed over existing hard substrate for beach re-nourishment habitat could be converted long-term from hard substrate to soft bottom habitat. This would be a long-term minor effect as it would be limited to the local area where sandy material was placed over existing hard substrate.

Borrow sites near the shoreline could contain high nutrient levels which, when disturbed, could affect local water quality by decreasing dissolved oxygen levels. Therefore, the removal of material from these sites for purposes of beach or barrier island enhancements may result in hypoxic conditions in local wetland or coastal habitats. This could be a short- or long-term minor to moderate adverse effect.
In some areas, hard shoreline protection near beaches may lead to accretion near the structure and accelerated erosion around the ends of the structure. Because hard structures may cause net beach erosion, construction of groins and breakwaters may cause long-term minor to moderate long-term adverse impacts in some areas.

Adverse effects to wetlands could occur if existing wetlands or wetland vegetation were present in the project area and would be affected by filling, disruption, or alteration of wetlands during construction. These effects could be short or long-term, but would be limited to the local area and therefore considered minor.

Construction activities related restoring barrier islands and beaches could result in inadvertent introduction of invasive species through transport on construction equipment. However, if invasive species became established in or adjacent to restored or enhanced areas, this adverse effect would be short- to long-term, would be limited to the local area and may range from minor to moderate. Use of BMPs would help prevent the introduction of invasive species.

Short-term minor to moderate adverse effects to beaches, dunes and barrier islands could occur during construction from the use of heavy equipment and from construction activities on the beach area, dunes, barrier islands, and to coastal transition zones. In some areas, hard shoreline protection near beaches may lead to accretion near the structure and accelerated erosion around the ends of the structure. Because hard structures may cause net beach erosion, construction of groins and breakwaters may cause long-term minor to moderate long-term adverse impacts in some areas.

Adverse effects to SAV could occur in areas where in-water work with heavy equipment is used to place engineered structures. These effects would include covering existing SAV populations or increasing turbidity during construction. However, turbidity would dissipate quickly and be minor and short-term. However, adverse effects from covering SAV would be minimized due to pre-construction surveys in specific project locations; impacts to SAV could be minor and would be avoided and minimized to the maximum extent practicable.

6.3.3.6 Living Coastal and Marine Resources

There are several long-term beneficial effects to finfish expected from enhancing barrier island systems. Beaches contribute to the quantity and quality of adjacent shallow water soft-bottom habitats that serve as nurseries and foraging areas for some finfish. A larger beach area also enables improved food and nutrient exchange to aquatic habitats.

Re-nourishment of beaches could provide a long-term benefit to terrestrial wildlife by protecting valuable beach and dune habitat. Such benefits include:

- Protecting habitat for endangered beach mice, protected sea turtles, and other protected species.
- Providing a long-term benefit to birds by providing crucial habitat for shorebirds. Some species that nest or winter on barrier islands or sandy beaches could benefit long-term due to the restoration of habitat that has been disappearing from development along the coasts. These beaches are essential stopover areas for migratory birds to rest and feed during migration.
- Protecting and supplementing existing terrestrial species habitat.
- Sediment deposition on beaches could reduce erosion rates and thereby provide protection for back-bay habitats where pelagic microfaunal communities may be present. Overall, this could result in a long-term benefit to pelagic microfaunal communities and an indirect, long-term benefit to the food chain to which pelagic microfaunal communities are a fundamental part.

- Placement of sand fencing, hay bales, and recycled Christmas trees, or planting native dune vegetation can restore the plant community and provide additional habitat and foraging area for shoreline organisms and terrestrial wildlife, and stabilize and restore existing dune systems.
- Planting vegetation on dunes and in back barrier marshes would restore plant communities and could provide additional habitat and foraging area for other shoreline organisms. Native shoreline grasses and other plants tolerant of a dune environment could be used to stabilize dunes. Replanting dune and back-barrier marsh areas could create suitable habitat for birds, benthic communities, finfish, and pelagic microfaunal communities. Shoreline habitats landward of the beach could benefit from beach, dune, and back-barrier marsh restoration because restoring these areas could provide protection from storm surge and erosion. This technique could provide long-term indirect benefits to migratory birds or other terrestrial wildlife by expanding or stabilizing habitat. Additionally, reducing erosion could benefit oyster populations that can be adversely affected by excessive sediment in nearshore waters.
- Restoration of beach, dune, and back-barrier marsh could provide protection from storm surge to nesting and breeding terrestrial species.

To facilitate creation and/or restoration of beaches and barrier islands, sediments would be dredged from borrow sources which could result in the following adverse impacts:

- Sediment removed from nearshore waters could impact local oyster populations or other benthic communities near the borrow site from increased turbidity, substrate disturbances or siltation, which could locally increase mortality and inhibit spawning activities in the short-term until silt dissipated.
- Increased turbidity might limit available light necessary for photosynthesis, and disruption in the water column and surface water could disturb or kill some pelagic microfaunal communities in the immediate vicinity. These impacts would be short-term and minor because pelagic microfaunal communities .would re-establish once turbidity dissipates
- Fish present in the dredging or fill-placement area could be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. This would be a minor adverse effect that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Sea turtle and marine mammal individuals 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 habitats. If projects have potential to incidentally harass marine mammals or may adversely affect sea turtles, consultations with appropriate agencies would be conducted prior to project implementation.
- Birds that forage in or near the dredge site could be temporarily affected. However, these effects would be short-term and minor as birds would be expected to move away to forage in other readily available foraging habitat during the dredging. If projects may adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation.

Short-term minor adverse effects to sea turtle nesting habitat could occur from human activity or equipment operation used during installation of passive means to trap sand such as sand fencing, hay bales, and recycled Christmas trees. These materials can become lodged in shallow water habitats near beach placement sites. However, these materials would degrade or wash out with tidal fluctuations and would not be expected to result in adverse effects to terrestrial or marine species that may be in the area. Beach nourishment can have long-term minor adverse effects on nesting and hatchling sea turtles and sea turtle nests. Placement of sand on a beach in and of itself may not provide suitable nesting habitat for sea turtles. Beach nourishment may result in changes in sand density (compaction), beach shear resistance (hardness), beach moisture content, beach slope, sand color, sand grain size, sand grain shape, and sand grain mineral content if the placed sand is dissimilar from the original beach sand. These changes could result in long-term minor adverse impacts on nest site selection, digging behavior, clutch viability, and hatchling emergence. Although sand placement activities may increase the potential nesting area, significant negative impacts from sand placement and other associated activities (equipment and vehicle use, artificial lighting) to sea turtles may result if protective measures are not incorporated during project construction. These activities during the nesting season, particularly on or near high density nesting beaches, can create barriers for nesting turtles (from equipment left on the beach or tire ruts), increased loss of eggs and hatchlings (through nest destruction, sand compaction, or females not nesting), and, along with other mortality sources, these sources may significantly impact the long-term survival of the species.

Some minor short-term displacement of local birds or wildlife could occur during vegetation planting operations. However, increased vegetation in dune and marsh areas could improve habitats that are important for migratory birds and terrestrial species. Additionally, planting marsh habitats could result in short-term adverse effects to pelagic microfaunal communities due to turbidity and temporary reduction of light availability. Any finfish or other animal species present in the marsh planting areas may also be temporarily disturbed from turbidity or other in-water activities that would cause species to disperse to other areas. These effects would be minor short-term during planting activities only.

Beach nourishment activities can result in short-term and minor to moderate impacts (such as disturbance and reduced foraging efficiency) to shorebirds if the birds are roosting and feeding in the area during a migration stopover or could result in harm or mortality if birds are nesting in the area. For example, the deposition of sand will temporarily deplete the intertidal food base during construction and between 6 months to 2 years later depending on invertebrate faunal recovery rates. If disturbance or reduced foraging efficiency is sustained, the birds may be temporarily displaced resulting in valuable energy reserve expenditures to seek available habitat elsewhere. Expending energy reserves can result in reduced fitness of an individual. These impacts to shorebirds are not only at the site of the nourishment, but may extend along the beach depending on sediment transport at the site. The tilling to loosen compaction of the sand required to minimize sea turtle impacts may affect any wrack that has accumulated on the “new” beach. Impacts to wrack affects feeding and roosting habitat for shorebirds, since they often use wrack for foraging and shelter. Nesting shorebirds, eggs, chicks, or fledglings could be harmed or killed during use of heavy equipment or actual sand placement. Best management practices would be implemented to avoid harm and mortality and minimize other effects.

The geomorphic characteristics of barrier islands, peninsulas, beaches, dunes, overwash fans, and inlets are critical to a variety of natural resources and influence a beach’s ability to respond to wave action,

including storm overwash and sediment transport. However, the protection or persistence of these important natural land forms, processes, and wildlife resources is often in conflict with long-term, large-scale beach stabilization projects and their indirect effects, i.e., increases in residential development, infrastructure, and public recreational uses, and preclusion of overwash, especially into coastal dune lakes and creation of spit formations which are preferred by many shorebirds. The construction of berms, dunes, and nourishment activities can indirectly affect shorebirds by reducing potential for the formation of these optimal habitats, especially along shorelines that are susceptible to overwash, posing concern for their long-term survival and recovery and resulting in long-term minor to moderate adverse impacts.

Construction in upland 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. These effects would be minor and short-term. If engineered structures were constructed in areas where protected species may be present, consultations with appropriate agencies would occur prior to project implementation.

If heavy equipment is used to place, modify or replace engineered structures in the aquatic environment minor short-term impacts could include increased sedimentation, increased turbidity, and potential leaking of construction fluids which could affect finfish, marine mammals, benthic organisms or sea turtles that may be present. However, these would be short-term minor effects because species would be expected to move away to other readily available aquatic areas. Long-term impacts to local oyster populations may occur from sediments or other materials placed directly on top of an existing oyster reef/substrate or from removal of existing hard substrate habitats (such as groins or reefs).

6.3.4 Project Type 4: Restore and Protect Submerged Aquatic Vegetation

This project type involves restoring submerged aquatic vegetation (SAV) beds using one or more techniques including re-vegetation and protection of SAV with buoys, signage, and/or other protective measures. These techniques are often used in combination. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

1. Backfill scars with sediment
2. Re-vegetate SAV beds via propagation and/or transplanting
3. Enhance SAV beds through nutrient addition
4. Protect SAV beds with buoys, signage, and/or other protective measures

6.3.4.1 Geology and Substrates

Implementation of restoration activities would provide a long-term benefit to geology and substrates by backfilling blowholes or propeller scars (which result from boat traffic in shallow water areas) with native fill (i.e., local sediment), which could return the seafloor to its original elevation and grade. Stabilizing the substrate with vegetation could also prevent further disturbance of the substrate from tides, wind, waves, vessel wakes, or currents, which can expand scars and blowholes into adjacent areas.

For all implemented techniques, affected areas would be localized and typically small. Backfilling, re-vegetation, bird stakes or fertilizer spikes, and buoys or signage would have only minor, short or long-term local adverse effects on nearshore sediments due to temporary increase in turbidity during construction or installation.

6.3.4.2 Hydrology and Water Quality

SAV helps stabilize shorelines, diffuse the energy of storms, and trap sediment. As such, restoring SAV could help protect shorelines. SAV restoration activities could also improve wetland filter function, slow water velocities and reduce turbidity, and prevent erosion and sedimentation. These would be long-term beneficial effects because they would extend beyond the construction period.

Equipment usage and other construction activities in wetland recharge areas could result in short-term minor adverse impacts to surface water related to sediment compaction, disturbance, and erosion. There would be negligible local disturbance from placement of signs or buoys. Fertilization and bird stakes would increase the long-term risk of adding more nutrients than could be used by plants on-site, resulting in increased nutrient concentration in adjacent or downstream areas. However, given the small scale of fertilizer use, this effect would be minor.

6.3.4.3 Air Quality and Greenhouse Gases

During restoration activities, there could be short-term minor to moderate adverse impacts to air quality from emissions generated by construction equipment and vehicles. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor increase in GHG emissions.

6.3.4.4 Noise

During the construction period, temporary impacts to ambient noise levels would result from SAV restoration activities. The severity of impacts would depend to a large degree on the location of the project and the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. For example, the placement and use of barges and associated equipment for backfilling scars with sediment would temporarily emit noise, which may detract from current user activities or experiences. These short-term construction-related adverse impacts to ambient noise levels would be minor to moderate in nature.

Over the long-term, the SAV restoration activities would not have a noticeable impact on noise. For example, the placement of signage posted to warn boat traffic of the submerged vegetation would not present an audible contrast to natural surroundings. As a result, noise from these elements would not be apparent and would not attract attention, dominate the soundscape, or detract from current user activities or experiences.

6.3.4.5 Habitats

Backfilling scars and re-vegetating the areas as part of restoration activities would be expected to enhance adjacent wetland, barrier island, beach, or other coastal habitats. Restoring SAV resources could, over the long-term, also improve water quality by providing areas of slower moving water that can reduce shoreline erosion rates. These would be long-term benefits to local habitats, because effects would persist beyond the construction period.

Temporary adverse effects could occur to local habitats affected by SAV restoration activities. There could be minor short-term increases in sediment disturbance and turbidity associated with in-water activities such as SAV planting and fertilization, but this would be expected to settle quickly and be

limited to the localized area where restoration activities occurred. Short-term minor to moderate adverse effects to barrier islands, beaches, coastal transition zones, or other habitats could also occur from the temporary introduction or staging of construction equipment to remediate, replant, and backfill scars to prepare for re-colonization and transplantation of SAV.

Activities related restoring SAV could result in introduction of invasive species. Use of BMPs would help prevent the introduction of invasive species. However, if invasive species became established in or adjacent to restored SAV areas, this adverse effect would be short to long-term, would be limited to the local area and may range from minor to moderate.

6.3.4.6 Living Coastal and Marine Resources

Increasing SAV ecosystem function and area would expand the amount of available habitat creating a long-term beneficial effect to coastal and marine resources that use those areas.

Adverse effects could occur if resources, including oysters, fish, sea turtles, marine mammals, benthic communities, and pelagic microfaunal communities, are present where restoration activities occur. Mortality of benthic organisms could occur in areas identified for borrow source material dredging and in-water construction work, where planting of SAV is taking place, or where staking or placement of signs occurs. These effects would be short-term and minor because they would occur only during in-water activities would be limited to small areas.

SAV restoration actions would result in short-term minor impacts to pelagic microfaunal communities due to substrate disturbance and increased turbidity which, when suspended in the water column, could reduce the ability for some pelagic microfaunal species to photosynthesize. Turbidity from replanting efforts would be temporary and would dissipate quickly, and pelagic microfaunal should be able to re-establish readily available habitats.

Restoration activities that involved the use of in-water equipment and sediment disturbance could affect sea turtles, manatees, and other marine mammals through a temporary increase in activity, noise, vibration, turbidity, and alteration or loss of foraging habitat. This could result in temporary displacement of individuals from the work area. Construction activities will vary depending on the type and size of the project but are generally anticipated to be short-term. If projects may incidentally harass marine mammals or may adversely affect ESA-listed marine mammals or sea turtles, authorizations or consultations with appropriate agencies would be required prior to project implementation.

Fish present in the work area could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. This would be a minor short-term adverse effect that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.

Birds that forage in or near the restoration site could be temporarily disturbed or displaced. However, these effects would be short-term and minor as birds would be expected to move away to forage in other readily available habitat. If projects have potential to adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation.

6.3.5 Project Type 5: Conserve Habitat

This project type involves land acquisition and management actions to conserve Gulf Coast habitats. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include, but are not limited to:

1. Conserve habitat through fee title acquisition
2. Conserve Habitat Though Use Restrictions and/or Management
3. Conserve, manage, and restore habitat that is being acquired or is currently under protection

6.3.5.1 Geology and Substrates

Fee title land acquisition or use of a conservation easement could reduce disturbance of geology and substrates by protecting lands from development pressure. This would be a long-term beneficial effect that will extend the life of the project.

Specific restoration activities identified as part of land management plans could result in short-term minor to moderate adverse effects to affected substrates and/or geology. The intensity of impacts would be highly dependent on the management goals for the acquired land and the location of the project. For example, land acquisition could permit public access for recreational use. This public use, which would depend on management stipulations developed as part of the land acquisition, could result in short-term minor to moderate adverse effects through increased soil compaction, rutting, or erosion from human presence and activity within island marshes, flats, dunes, and beaches. For example, invasive plant species are initially removed from a property, short-term disturbance to geological resources would occur, but the replanting or recolonizing of native vegetation would enhance the acquired land over the long-term.

6.3.5.2 Hydrology and Water Quality

Where easements and protected lands overlap groundwater recharge zones, surface water, or brackish-water resources, water sources and quality could be further protected from future degradation by helping to reduce runoff. Similarly, where protected land overlaps wetlands or shorelines, the protection of natural hydrologic processes could indirectly help limit development and associated effects on water quality, including via saltwater intrusion. These would be long-term beneficial effects that would occur over the life of the project.

Specific restoration activities identified as part of land management plans could result in short-term minor effects to affected water resources. The severity of impacts would be highly dependent on the management goals for the acquired land and the location of the project. For example, land acquisition could permit public access for recreational use. This public use, depending on management stipulations, could result in short-term minor effects through increased sedimentation and turbidity from human presence and activity within wetland/shallow water habitat.

6.3.5.3 Air Quality and Greenhouse Gases

No change from status quo to air quality or GHG impacts would be anticipated over the short or long-term from the identification, nomination and fee title acquisition of specific habitat areas or the addition of conservation easements to such lands.

During implementation of land management plans, there could be short-term minor to moderate adverse impacts to air quality from emissions generated by construction equipment and vehicles.

Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor increase in GHG emissions.

6.3.5.4 Noise

No change in status quo to noise would be anticipated over the short-term from the identification, nomination and fee title acquisition of specific habitat areas or the addition of conservation easements to such lands. Depending on the land use, some changes in noise levels could occur, however, these would need to be evaluated on a project specific basis (e.g., public access might result in minor increases to noise levels from recreational users, or preservation of lands may assist in maintaining natural quiet over a longer-term).

During implementation of the land management plan, minor short- and long-term adverse impacts to ambient noise levels could occur. The severity of impacts would depend to a large degree on the location of the project and the amount of noise that these activities would generate and the proximity of sensitive noise receptors including wildlife to these activities. Noise impacts associated with specific land management and restoration techniques, such as beach re-nourishment, are discussed under the Project Types associated with those techniques

6.3.5.5 Habitats

Conservation of habitat through fee title acquisition or use restrictions could have a long-term benefit to any habitat on the property acquired or protected. Depending on the restoration site and project goals, barrier islands, beaches, coastal transition zones, or other habitats could experience a long-term benefit from being protected and conserved through acquisition and proper management. Conservation would also allow for upland migration of beach, wetland, or other habitats as the sea levels rises and could limit development encroachment.

Specific restoration activities identified as part of land management plans could result in short-term minor to moderate adverse effects to barrier island, coastal transition zone, beach and dune, or other habitats. The severity of impacts would be highly dependent on the management goals for the acquired land and the location of the project.

Construction activities that may occur on conserved lands may result in introduction of invasive species. Use of BMPs would help prevent the introduction of invasive species. However, if invasive species became established in or adjacent to restored or enhanced habitats areas, this adverse effect would be short to long-term, would be limited to the local area and may range from minor to moderate

6.3.5.6 Living Coastal and Marine Resources

Conservation of habitat through fee title acquisition or conservation easements could have a long-term benefit to pelagic microfaunal communities, finfish, sea turtles, marine mammals, birds, and terrestrial wildlife through the protection of barrier island, beach, wetland/shallow water habitat (marshes, estuaries, mangrove swamps, etc.), or other habitat, depending on project specific goals and the location of acquired land. These habitats can be important for food supply and various life stages of some species. Land acquisitions with stipulations that limit human activities that could adversely affect

coastal and marine resources would result in long-term benefits to species that utilize the acquired habitats.

Implementation of land management plans, located within or near restoration activities could result in disturbed, removed, or altered habitats, which could cause minor to moderate, short- and long-term adverse effects to species that use those habitats for forage or nesting purposes. The severity of impacts would be highly dependent on the management goals for the acquired land and the location of the project. For example, land acquisition could permit public access for recreational use. This public use, depending on management stipulations, could result in long-term minor to moderate adverse effects to area species through increased human presence and activity on acquired habitats.

6.3.6 Project Type 6: Restore Oysters

This project type involves the use of cultch or other suitable material for creating reef structures and enhancing oyster populations. Appropriate restoration/protection techniques (described in more detail in Chapter 5) for this project type include, but are not limited to:

- Enhance oyster production through cultch placement, relay, or cultivation
- Use of natural or permissible materials to create oyster reef structure

6.3.6.1 Geology and Substrates

Creating or enhancing nearshore oyster reefs can help protect eroding shorelines on the landward side of the reef structure. In addition, the placement of cultch to establish oyster reefs could reduce wave energy reaching shorelines. This would provide a long-term beneficial effect by reducing shoreline erosion because it would extend beyond the construction period. Depending on where the material was placed, the creation of oyster reefs would reduce the amount of soft bottom habitat resulting in a long-term minor adverse impact to existing soft bottom habitat. If cultch relay or a similar technique is used, there could be a long-term, minor adverse impact on geology and substrate from the removal of oysters from the original site. However, there would be a long-term beneficial impact on substrate in the project area through the increase in hard bottom and elevation as a result of the placement of oyster shell or other suitable substrate for oyster to establish a reef.

6.3.6.2 Hydrology and Water Quality

Creating and enhancing nearshore oyster reefs could help protect eroding wetlands and shallow water areas. Placement of cultch and other materials to establish oyster reefs can reduce wave energy reaching shorelines. This could provide beneficial effects by reducing wave energy of storm surges and thus indirectly reducing saltwater incursion inland. Once established, oyster beds could benefit local water clarity because oysters 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.

Creation of oyster beds involves the placement of materials using offshore equipment and boats. Oyster reef creation can result in a short-term minor adverse impact to water quality due to the disturbance associated with the placement of materials.

6.3.6.3 Air Quality and Greenhouse Gases

During construction of reefs and placement of materials, short-term impacts to air quality and GHGs would occur from the use of gasoline and diesel powered construction vehicles and equipment, including barges, and exhaust produced by the use of this equipment. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. There is a slight potential for fugitive dust creation from construction activities, resulting in minor adverse impacts. No long-term impacts to air quality are anticipated and no long-term emissions of GHG would occur.

6.3.6.4 Noise

During construction or restoration of oyster reefs, the use of heavy motorized equipment would result in short-term minor adverse effects to ambient noise levels. The noise generated from the operation of large barges and other equipment would attract attention and contribute to the soundscape in local areas, resulting in short-term minor impacts. However, the severity of impacts would depend to a large degree on the actual project site, distance to sensitive receptors such as recreational users or wildlife and the level of ambient noise. In areas with low ambient noise, adverse impacts would be greater because the contrast created by barges and other construction equipment. Conversely, in areas where commercial and recreational water vessel traffic is commonplace there are higher ambient noise levels and impacts to ambient noise levels would be less. No adverse impacts to ambient noise levels are expected over the long-term.

6.3.6.5 Habitats

Depending on design and location, creating and enhancing oyster habitat could reduce the intensity of wave action and protect eroding shorelines, which would provide long-term benefits to these habitats. Similarly, restoration or creation of nearshore oyster reefs can help protect shallow water areas that could provide habitat for SAV. Enhancing existing reefs near SAV areas can also encourage more bird activity, which could fertilize SAV beds.

Placement of reefs near shallow water areas would require the use of in-water heavy equipment, which could produce turbidity and adversely affect the immediate area; therefore, these impacts would be short-term and minor.

6.3.6.6 Living Coastal and Marine Resources

Restoration and creation of nearshore oyster reefs can help protect eroding wetlands and shallow water areas that provide habitat for coastal and marine resources. In addition, the reef structure can also provide foraging and shelter areas for these resources such as fish and invertebrates. Creating nearshore oyster reef habitat would result in a long-term beneficial impact on birds because these structures can provide foraging and roosting areas for birds depending on the project design.

Restoration and creation of oyster reefs using natural and permissible materials may cause the short-term and minor loss or displacement of benthic organisms. Placement of these materials on soft bottom habitat would have an adverse impact to benthic organisms. Placement of breakwaters or living shorelines on hard substrate could impact existing oyster populations, resulting in short-term minor effects. Transport of oyster shell may result in the transport of invasive organisms that can have a minor short-term effect on oysters and other reef organisms.

Reef placement and relocation of cultch enhancement activities could require use of in-water heavy equipment that would adversely impact any pelagic microfaunal communities present in the proposed work area. Some smaller projects may not use in-water heavy equipment, but would shoot cultch from cannons off of a boat to the desired location. Adverse impacts would occur from increased turbidity, which decreases available light necessary for photosynthesis, and the degree of impacts would depend on the method used to place the cultch. Disruption in the water column and surface water would disturb or kill some pelagic microfaunal communities. Adverse impacts from in-water work would be short-term and minor because pelagic microfaunal communities would re-establish once turbidity dissipates. Placement of reefs near shallow water areas would involve use of in-water heavy equipment and create turbidity and habitat disturbance, which could have a short-term minor impact on finfish. The noise and disturbance could also have a short-term impact on birds, sea turtles, terrestrial wildlife, and marine mammals that would avoid the area during construction. Minor long-term impacts to birds and terrestrial wildlife could occur from disturbance associated with the potential for increased human activity around the oyster reef. If projects may incidentally harass marine mammals or may adversely affect ESA-listed marine mammals, sea turtles or fish species, authorizations or consultations with appropriate agencies would be required prior to project implementation. Creation of breakwaters, reefs, and living shorelines provides oyster habitat that would have a long-term benefit for oysters.

Oyster cultch placement (including limestone rock, crushed concrete, oyster shell, and other similar material) placed in oyster spawning areas would provide a substrate for oyster larvae to attach and grow, providing a long-term benefit to oysters. Relocating reefs and cultch material from unsuitable or poor habitat conditions to more suitable areas (with strong bottom currents in bay bottoms and intertidal and subtidal areas) could result in a long-term increase in oyster populations. Exposing suitable substrate would also encourage oyster recruitment in those areas. Oyster cultch material placed over existing hard substrate currently occupied by oysters could have a minor short-term impact on local populations as would bagless dredging to “turn over” existing oyster reefs. Long-term beneficial effects to oyster populations would result from cultch placement.

6.3.7 Project Type 7: Restore and Protect Finfish and Shellfish

The purpose of this project type is to reduce direct and bycatch-related mortality of fish and other non-target species. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

- Voluntary, temporary reduction in fishing effort
- Remove debris from freshwater, estuarine, marine, and/or critical habitats
- Provide incentives for voluntary use of technological innovations

6.3.7.1 Geology and Substrates

Equipment that may be employed for the removal of debris from marine environments could include motorized vehicles such as boats to deploy equipment or divers engaged in collection activities. Removal of this debris could temporarily displace substrates within the immediate vicinity as debris is removed and boats/equipment are used. Displaced sediment would be expected to naturally refill in a short-period as a result of the relatively small size of debris. These effects would be short-term and minor because they would likely be small and localized.

6.3.7.2 Hydrology and Water Quality

Temporary reductions in fishing effort and implementation of methods to reduce bycatch mortality could have minor short-term beneficial effects on water quality by temporarily reducing the number of boats on the water. This reduction could reduce the contaminant loadings to surface waters typical of those vessels, assuming that a temporary repose would not lead to an increase in fishing effort in fisheries that were not part of the repose. This is also assuming that vessels were not being used for purposes other than fishing. These effects would be minor and short-term because they would be small, localized, and only occur when boats are not being used for fishing.

The use of equipment to remove debris could pose a minor short-term adverse effect to water quality by increasing the risk of water quality contamination from equipment and vessels used during the removal period. During removal sediment disturbance would increase turbidity within the immediate vicinity of the removal site. This would be a minor short-term adverse effect because it would be localized and would only occur during the debris removal period. Removal of any debris that may leach or otherwise adversely affect water quality would have a long-term beneficial effect because it would remove a potential source of contamination.

6.3.7.3 Air Quality and Greenhouse Gases

Temporary reductions in fishing effort and implementation of methods to reduce bycatch mortality could have minor short-term beneficial effects on air quality by temporarily reducing the number of boats on the water. This reduction could reduce the GHG emission in the local area produced by those vessels, assuming that a temporary repose would not lead to an increase in fishing effort in fisheries that were not affected. This is also assuming that vessels were not being used for purposes other than fishing. These effects would be minor and short-term because they would be small, localized, and only occur when boats are not being used for fishing.

Removal of debris would require the use of equipment and vehicles, emission from which could result in minor adverse impacts to air quality in the project vicinity. The use of gasoline and diesel-powered equipment would contribute to an increase in GHG emissions. Based on the small scale of projects and the short timeframe, impacts would be short-term and minor. No long-term impacts are anticipated.

6.3.7.4 Noise

Temporary reductions in fishing effort could have minor short-term beneficial effects on noise by temporarily reducing the number of boats on the water and reducing the ambient noise level in the area. This reduction in ambient noise levels assumes that those vessels would not increase their fishing effort in areas that were not part of the repose or be used for purposes other than fishing. These effects would be minor and short-term because they would be small, localized, and only occur when boats are not being used for fishing.

The removal of debris could require the use of equipment, which would result in short-term minor to moderate impacts to ambient noise levels. The severity of impacts would depend to a large degree on the location of the project and the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. The effects from noise levels produced by equipment use would be minor and short-term because the noise levels would be localized and only occur when equipment was in use.

6.3.7.5 Habitats

Removal of debris from marine, estuarine, and freshwater environments could result in minor short-term adverse effects to these habitats as a result of the use equipment, displacement of substrate, and increase in turbidity in the removal area. These effects would be minor and short-term because they would be limited to the local area. There would be long-term beneficial impacts to these habitats from the removal of debris. Removal of any debris that may leach or otherwise adversely affect water quality or sediments within these habitats would also result in a long-term beneficial effect because it would remove a potential source of contamination.

6.3.7.6 Living Coastal and Marine Resources

Direct impacts on living coastal and marine resources from a voluntary and temporary reduction in fishing effort or the use of technological innovations would be based on project-specific considerations to determine the magnitude and duration. A voluntary reduction in fishing effort and/or the use of technological innovations could result in the following beneficial impacts:

- Increased finfish population levels of both commercial and recreational fisheries resources by reducing fishing and bycatch mortality;
- Reduced bycatch mortality of sea turtle, marine mammal and bird species as a result of reduced fishing pressure effort and use of technological innovations;

Minor long-term adverse impacts could result from removing a food source for certain gulls, terns, and pelicans that have adapted to following fishing boats in order to forage on the discarded bycatch. A voluntary reduction in fishing effort could also result in adverse effects to biological resources if fishing effort is displaced to another location. Debris such as derelict fishing gear may result in adverse effects to finfish, invertebrates (such as crabs), sea turtles, marine mammals, and birds that are caught, stranded, and killed in this equipment. Removal of this equipment could result in long-term moderate beneficial effects to these species that are susceptible to entanglement and mortality by derelict fishing gear by reducing incidental entanglement and mortality. The beneficial effect to these species would depend on the amount and areas of removal of derelict fishing gear.

Removal efforts may also result in short-term minor adverse effects to living coastal and marine resources present in the removal area due to temporary increases in activity, noise, vibration, and turbidity. Activities are anticipated to be short-term based on the type and size of the project. This could result in temporary displacement of individuals from the work area or mortality of individual species. The equipment that would be used to remove debris would not be anticipated to produce sound levels that would adversely affect fish or marine mammals. Temporary increases in turbidity and alteration of water quality in the work area may result in short-term minor adverse impacts. If eggs and larvae are present in the project area, they are more likely to be negatively impacted and killed by debris removal activities. Minor and short-term disturbances may impact pelagic microfaunal communities in the area from increased turbidity near in-water work, which decreases available light necessary for photosynthesis. Also, disruption in the water column and surface water would disturb or kill some pelagic microfaunal individuals. These impacts could be reduced by avoiding activities during critical spawning and rearing periods for sensitive species. BMPs and other mitigation measures that may be employed to further minimize or contain adverse impacts are detailed in Appendix 6-A. Overall, living

coastal and marine resources would have a long-term beneficial effect from removal of derelict fishing gear and other types of debris from fishery habitats.

6.3.8 Project Type 8: Restore and Protect Birds

This project type involves restoring habitat that would support bird populations and implementing measures that would protect bird habitat or reduce direct impacts to nesting populations. Appropriate restoration/protection techniques for this project type (described in more detail in Chapter 5) include but are not limited to:

- Create or enhance bird nesting and/or foraging habitat;
- Protect bird foraging and nesting habitat, including the use of predator control;
- Control existing encroachment of invasive species and prevent further spread.

6.3.8.1 Geology and Substrates

Creating or enhancing bird habitat by constructing new nesting or foraging habitat such as barrier islands, beaches or wetlands could benefit geology and substrates by adding sediments into the system. Re-planting of shoreline vegetation could result in long-term benefits to soils because native plants could help stabilize shorelines and reduce erosion. These effects would be long-term because they would last beyond the construction period.

Protecting bird habitat from development would benefit geology and substrates by preventing disturbance, loss of soil, and reducing erosion. No adverse effects from protecting bird habitat on geology and substrates would occur.

Efforts to remove and limit the further spread of invasive species could have a long-term benefit to soil substrates since some invasive plant species displace native vegetation that are better suited to prevent erosion. Some invasive plants prevent the colonization of native understory plants with root systems that have evolved to prevent beach sand and soil erosion. No adverse impacts to geology or substrate would occur by limiting invasive species introduction or spread. Controlling invasive plant species entails physical cutting/removal, application of herbicides, and biological control. These techniques would have no impact on geology, but the use of equipment to remove existing vegetation could leave soils vulnerable to erosion until replacement vegetative cover is provided. This would be a short-term minor adverse effect. Herbicides or biological control methods can have a similar effect but the physical presence of dead vegetation may provide short-term erosion control.

6.3.8.2 Hydrology and Water Quality

Creating and enhancing bird nesting and foraging habitat through construction of barrier islands, beaches, and wetlands could result in shoreline stabilization that reduces erosion and reduces adverse impacts to water quality. These would be long-term beneficial effects because they would extend beyond the construction period. Some short-term adverse impacts due to turbidity could occur in the immediate vicinity of the work area. These effects would be minor and short-term as turbidity would dissipate shortly after placement activities are completed. Development of herbaceous wetlands would produce long-term benefits to hydrology and remove nutrients and other impurities from the water which improve water quality. If creation of wetlands requires excavation, short-term adverse impacts could occur, but would be expected to be local and temporary.

Protecting nesting and foraging habitat for birds would have long-term benefits by preventing development and disturbances, which can reduce runoff and benefit water quality.

Preventing the invasion of exotic species could have a long-term benefit to hydrology, since many non-native plant species have higher water requirements and can deplete soil moisture more rapidly than native species. The use of pesticides or herbicides could have an adverse minor short-term impact on water quality if they are applied where they can enter the aquatic ecosystem. Application would be expected to be in compliance with Federal labeling requirements that should limit impacts. Equipment usage and other construction activities in wetland recharge areas could result in short-term adverse impacts to surface water related to sediment compaction, disturbance, and erosion.

The use of heavy equipment to remove existing vegetation could leave soils vulnerable to erosion if replacement vegetative cover is not provided. This could result in a short-term adverse, but local impact on water quality.

6.3.8.3 Air Quality and Greenhouse Gases

During dredging, excavation or placement of materials to restore or enhance beaches, barrier islands and wetlands for bird habitat there could be short-term minor to moderate adverse impacts to air quality from the use of heavy equipment and vehicles. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor increase in GHG emissions.

6.3.8.4 Noise

During the construction period to create or enhance bird habitat, minor to major short-term adverse impacts to ambient noise levels may occur, particularly at barrier islands and beaches where beach re-nourishment activities would take place. The severity of impacts would depend to a large degree on the location of the project, type of equipment, the amount of noise that these activities would generate, and the distance to sensitive receptors such as recreational users or wildlife. Impacts on noise would be short-term during the construction period.

Predator control would have no discernible benefit or adverse impact to noise. To the extent that bird habitat is protected through land acquisition, development or potential activities which could in turn cause noise impacts may be limited.

6.3.8.5 Habitats

Creating and enhancing bird habitat would create long-term benefits from increasing stability and resiliency of barrier islands and beaches. Re-nourishment of beaches and barrier islands can enhance beach habitat and provide benefits to other habitats such as wetlands through storm surge protection. Adverse effects to wetlands could occur if existing wetland vegetation were present in the project area and would be disturbed. Short-term adverse impacts to beaches, dunes and barrier islands could occur during construction from the use of heavy equipment and from construction activities on the beach area, dunes, barrier islands, and to coastal transition zones.

Bird habitat restoration activities such as creation of wetlands, beach enhancements or re-nourishment and dune planting could have short-term to long-term minor adverse impacts on habitats from:

- Filling, disruption, or alteration of wetlands;
- Increased soil erosion, vegetation trampling, vegetation removal, or other human activity from project staging or construction, or implementation of restoration activities on adjacent uplands, coastal transition zones, barrier flats, dunes and beaches;
- Limited cover or loss of SAV populations in areas where in-water construction work, dredging, or placement of an underwater pipeline occurs (noting that pre-construction SAV surveys would be conducted) ; and
- Changes in water quality from turbidity and substrate disturbance from in-water work with construction activities or re-vegetation activities.

Protecting bird habitat from disturbance or development provides long-term benefits for habitat. Restrictions on seasonal or overall human use reduce stress on habitat and reduce habitat degradation. Some predator control could have a long-term benefit to habitat; for example, if fencing eliminates disturbance and protects sensitive habitat. Adverse short-term impacts to local habitat could occur from the disturbance associated with the construction barriers such as fencing.

Long-term benefits to habitat could occur from the prevention and control of invasive plants that contribute to the loss of habitat quality. Use of heavy equipment and herbicides could have a short-term adverse impact on habitat since some species use habitat colonized by non-native vegetation. Replacement of non-native with endemic species would have a long-term benefit to habitat. Use of herbicides and pesticides could have a short-term adverse impact to aquatic habitat if they are applied where they can enter wetlands or water bodies, and impacts to non-target vegetation or species also could occur.

Construction of islands and beaches could have an adverse impact if materials covered existing SAV populations. These impacts would be considered minor and short-term because they would occur in discrete areas. SAV habitat could be avoided through proper survey and selection of project sites. Herbicides used to control invasive plants could also enter the waterway through air dispersion, by leaching into groundwater sources, or by stormwater runoff, which would result in a moderate, short-term impact to local SAV populations.

6.3.8.6 Living Coastal and Marine Resources

Sediment deposition on beaches to create or enhance bird habitat could provide erosion protection for back-bay habitats where pelagic microfaunal communities may be present. Overall, this could result in a long-term benefit to pelagic microfaunal communities and a long-term benefit to the food chain to which pelagic microfaunal communities contribute. Beaches contribute to the quantity and quality of adjacent shallow water soft-bottom habitats that serve as nurseries or forage areas for some finfish. A larger beach area also enables improved food and nutrient exchange to aquatic habitats. Re-nourishment of beaches could be a long-term benefit to terrestrial wildlife by protecting valuable beach and dune habitat. These beaches are essential for a number of endangered beach mice, protected sea turtles and other protected species. This project type targets the improvement for bird habitat, therefore long-term benefits to birds would occur including enhanced habitat for shorebirds. Some species that nest or winter on barrier islands or sandy beaches could benefit long-term due to the restoration of habitat that has been disappearing from development along the coasts. These beaches are essential stopover areas for migratory birds to rest and feed during migration. Re-nourishment of

beaches through sediment addition and restoration of barrier islands could be a long-term benefit to wildlife populations, and could be a long-term benefit by creating new habitat suitable for beach mice and other terrestrial species that utilize beach habitats.

Some short-term adverse impacts could occur from dredging and other borrowing techniques which result in suspended sediments and increased near-site turbidity. Adverse effects from dredging may include:

- Sediment removed from nearshore waters could impact local oyster populations or other benthic communities near the borrow site from increased turbidity, substrate disturbances or siltation, which could locally increase mortality and inhibit spawning activities in the short-term until silt dissipated.
- 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 communities. These impacts would be short-term and minor because pelagic microfaunal communities would re-establish once the turbidity dissipates.
- Fish present in the dredging area could be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. This would be a minor short-term adverse effect that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Sea turtle and marine mammal individuals 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, all of which could temporarily displace individuals or prey during construction and could result in short-term, minor impacts. If projects could incidentally harass marine mammals or adversely affect ESA-listed marine mammals or sea turtles, consultation or authorizations with appropriate agencies would be required prior to project implementation.
- Birds that forage in or near the dredge site could be temporarily affected. However, these effects would be short-term and minor as birds would be expected to move away to forage in other readily available foraging habitat during the dredging. If projects have potential to adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation.

Creating herbaceous wetlands could have long-term benefits to terrestrial and aquatic wildlife by increasing habitat quantity and quality. Planting marsh habitats could result in short-term adverse effects to pelagic microfaunal communities due to turbidity and temporary reduction of light availability. Any finfish or other animal species present in the marsh planting areas may also be temporarily disturbed by turbidity or other in-water activities that would cause species to disperse to other areas. These effects would be short-term during planting activities only and limited to the localized construction area only.

Planting native vegetation on dunes and in back barrier marshes would restore plant communities and could provide additional habitat and foraging area for other shoreline organisms. Shoreline grasses and other plants tolerant of a dune environment could be used to stabilize dunes. Replanting dune and back-barrier marsh areas could create suitable habitat for birds, benthic communities, finfish, pelagic microfaunal communities, manatees and sea turtles and also stabilize the dune or marsh area. Shoreline habitats landward of the beach could benefit from beach, dune, and back-barrier marsh restoration because restoring these areas could provide protection from storm surge and reduce erosion. This technique could provide long-term indirect benefits to migratory and resident birds as well as nesting sea turtles and beach mice or other terrestrial wildlife by expanding or stabilizing habitat. Additionally, reducing erosion could benefit oyster populations that can be adversely affected by excessive sediment in nearshore waters. Some minor short-term displacement of local birds or wildlife could occur during planting operations. However, increased vegetation in dune and marsh areas could improve habitats that are essential for migratory birds and terrestrial species and provide a long-term benefit.

Protecting bird habitat would have long-term benefits to living coastal and marine resources. No adverse impacts to living coastal and marine resources would be expected from protecting bird habitat. Predator control could have an adverse impact to some species, since these efforts such as constructing barriers could also exclude other non-target species that utilize those areas. Exclusion fencing may be buried in wetlands or shallow water habitat, which could result in short-term adverse effects from turbidity and substrate disturbance.

Use of pesticides, herbicides and other chemicals to control invasive species could result in the contamination of habitat through air dispersion, by leaching into adjacent waters, or by stormwater runoff. Use of pesticides and herbicides can have a minor short-term direct effect if wildlife is exposed. For example, removal of rats and other potential predators could have a long-term benefit to many birds and a long-term benefit to rare or sensitive species where predation limits increases in population. Contamination by ingesting treated seeds or insects could cause stress and even mortality for birds and some small mammals. Coastal and marine resources such as finfish, sea turtles, and marine mammals are likely to avoid an area of contamination. If potential for adverse effects to protected finfish, sea turtles or marine mammals from pesticide use existed, consultation with appropriate agencies would occur prior to project implementation.

Use of herbicides to control invasive vegetation could result in a minor long-term benefit to local bird populations if accompanied by efforts to restore native plant communities. Some species may have adapted to using invasive plant communities for nesting, and therefore treatment or removal of this vegetation may have a short-term minor impact.

Non-lethal management methods include fencing, providing artificial nest structures, protecting isolated peninsulas, or constructing islands that exclude predators from a single bird nest or from the entire area surrounding a colony. Predator control could result in long-term benefits to many species, including sensitive or rare bird species whose populations could increase with reduced predation.

6.3.9 Project Type 9: Restore and Protect Sea Turtles

This project type involves restoring and protecting sea turtles through activities that enhance sea turtle habitat, increase the survival of sea turtles, or both. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

- Improve nesting beaches;
- Protect and conserve nesting beaches;
- Expand existing stranding networks and rehabilitation capabilities;
- Enhance compliance monitoring through gear monitoring team coordination and enhanced observer monitoring;
- Enhance training and outreach for enforcement personnel to improve expertise in compliance requirements and increased enforcement activities.

6.3.9.1 Geology and Substrates

Nesting beaches could be conserved and protected by purchasing beach-front properties. This could allow beach and dune migration and sediment migration in response to future climate and weather, which would have long-term beneficial effects on geology and substrates over the life of the project. Nest relocations could have a short-term minor impact to affected substrates but excavated sites would be backfilled immediately after the removal of turtle eggs. No impact on geology and substrate would occur from expanding stranding networks, enhancing compliance monitoring, or enhancing training and outreach. However, if new facilities are constructed, there could be effects on geology and substrate during the construction period which will be evaluated on a site-specific basis.

6.3.9.2 Hydrology and Water Quality

Beach-front properties could be purchased to conserve and protect nesting sea turtle habitat and to allow future upland migration of the beach (i.e. nesting habitat) as sea-levels rise. Land acquisition could also help limit coastal development's effects on water quality, depending on land acquisition goals. Beach re-nourishment activities to improve sea turtle nesting habitat could also benefit hydrology and water quality by stabilizing sediments, and reducing storm surges. These beneficial effects would be long-term because they would occur over the life of the project. No impact on hydrology and water quality would occur from expanding stranding networks, enhancing compliance monitoring, or enhancing training and outreach. However, if new facilities are constructed, there could be minor effects on geology and substrate during the construction period which will be evaluated on a site-specific basis.

6.3.9.3 Air Quality and Greenhouse Gases

During restoration activities, there could be short-term minor to moderate adverse impacts to air quality from emissions generated by construction equipment and vehicles. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor increase in GHG emissions.

6.3.9.4 Noise

Minor to major short-term adverse impacts to ambient noise levels could occur during implementation of restoration activities, particularly at beaches where sea turtle improvement and conservation activities would take place. The severity of impacts would depend to a large degree on the location of the project, the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. The manual implementation of predator controls, lighting, and other nesting site enhancements could result in temporary changes to the soundscape,

which would be only slightly apparent to visitors while this technique is being constructed, and would not attract attention, dominate the soundscape, or detract from current user activities or experiences. In these instances, impacts to noise would be minor. Any use of construction equipment, by contrast, could result in short-term moderate to major impacts to noise.

6.3.9.5 Habitats

Restoration efforts to protect and conserve sea turtle nesting beaches and populations could provide numerous long-term benefits to beach and barrier island habitats, as described below:

- Depending on the restoration site and project goals, barrier islands, beaches, coastal transition zones, or other habitats could experience a long-term benefit from being protected and conserved through acquisition and proper management. Conservation could also allow for upland migration as sea level rises and could limit development encroachment.
- Shoreline habitats landward of the beach (e.g., wetlands) could benefit from adjacent beach and dune area protection because these areas provide protection from storm surge and reduce erosion.

Human activity and/or the use of equipment during installation of predator control and turtle-friendly lighting, mobilization of stranding and response efforts, and monitoring could result in short-term minor to moderate adverse effects to beaches. Long-term minor to moderate adverse effects to beaches could also occur if any permanent structures were erected for equipment storage.

6.3.9.6 Living Coastal and Marine Resources

Protection and conservation of sea turtle nesting beaches would minimize development encroachment on nesting and foraging habitat, which would be a long-term benefit to birds, sea turtles, terrestrial wildlife, and other species that use the beach habitat. For rare wildlife species such as beach mice that depend on beach or dune habitat, protection and conservation of habitat could have a long-term benefit.

Restoration efforts to protect and conserve nesting beaches could also benefit pelagic microfaunal communities and finfish populations. Beach habitats contribute to the quantity and quality of adjacent shallow water habitats that serve as nurseries or forage areas for some finfish species. The beach-shallow water interface also provides nutrient exchange to aquatic habitats. Protecting and restoring these habitats could result in a long-term benefit to these species and indirectly benefit the food chain that relies on the health of adjacent shallow water areas.

Nesting beach improvement via predator control and use of turtle-friendly lighting, as well as nest detection, monitoring, and protection, such as nest marking or relocation, could provide a long-term benefit to sea turtles by increasing nesting success and hatchling survivorship, resulting in a higher number of sea turtles surviving to adulthood and reproductive life stages. For example, turtle-friendly lighting would reduce artificial light sources to minimize the potential for both nesting females and hatchlings to become disoriented or misoriented. Predator control on the beaches could also have a long-term benefit for nesting birds by reducing predation, while increased hatchling survivorship would improve food sources for bird species that prey on hatchlings.

Expansion of existing stranding networks and rehabilitation capabilities would include monitoring and improved response time, particularly in underserved areas, and also benefit stranded marine mammals. Other restoration actions could include additional funding, responder training, or construction of equipment and rehabilitation facilities. Depending on the location of facility construction, the latter action could result in adverse effects to sea turtles from associated noise, human activity, and habitat disturbance or removal. However, improved stranding response would provide a long-term benefit to sea turtle and marine mammal populations. Increased stranding monitoring and expanded rehabilitation capabilities could help sea turtle and marine mammal populations improve as sick and injured individuals are rehabilitated and released to the wild. Faster response times and more rehabilitation facilities could also result in quicker responses that would reduce the number of dead or euthanized animals and also provide important data necessary to identify causes of mortality and inform future management decisions. If potential for adverse effects to protected species may occur as a result of proposed activities, consultations with the appropriate agencies would occur prior to project implementation.

Increased coordination of NOAA's monitoring teams with other state and federal agencies, providing additional trained observers dedicated for bycatch monitoring, and increased at-sea and dockside inspections by NMFS gear specialists and marine law enforcement personnel could result in a long-term benefit to sea turtle and marine mammal populations across the Gulf Coast. Enhanced training, funding, staffing, and outreach for enforcement personnel to reduce bycatch mortality in shrimp trawl or other fisheries and to ensure compliance with existing state and federal regulations could also provide a long-term benefit to sea turtle and marine mammal populations throughout the Gulf Coast.

Adverse effects to sea turtles or other present species could result from restoration activities requiring human activity and vehicle traffic on nesting beaches. Nest relocation, if necessary, could result in a variety of short-term to long-term adverse effects, including survey errors that inadvertently miss or misidentify nests; egg loss due to handling mortality; lower hatching and emerging success; and increased predation of concentrated nests. Any such efforts would be subject to consultation under ESA to assess the level of effect.

However, conservation measures (such as those in the Appendix to Chapter 6 and others developed through the ESA section 7 consultations) and standard practices for nest relocation would avoid or minimize most adverse effects to sea turtles.

Adverse effects from implementation of exclusion fencing or predator control could occur to species that use the affected area. Poison baits could enter the waterway through air dispersion, leaching into adjacent waters, or by stormwater runoff causing a potential short-term minor adverse impact, but these effects would be minimized through proper use following any required permits. Predator control on the beaches could also have a long-term minor impact on terrestrial wildlife by eliminating a potential prey source and directly causing mortality to some species.

6.4 Alternatives 2 (and 4): Human Uses and Socioeconomics

This section describes the environmental consequences of Alternative 2 for human uses and socioeconomics.[6] These impacts consider the nine relevant project types that are identified in Chapter 5 together by resource area. Because Alternative 4 is inclusive of Alternative 2, the analysis of environmental consequences for these project types is the same for Alternative 4 as Alternative 2.

6.4.1 Socioeconomics and Environmental Justice

The environmental setting of a project area can be viewed from both a geographic perspective and a human perspective. The physical environment provides a geographical context for the populations to be evaluated in this Environmental Impact Statement. The human perspective encompasses race, ethnic origin, and economic status of affected groups.

The intent of an environmental justice evaluation under Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority and Low Income Populations" (1994), is to identify communities and groups that meet environmental justice criteria, and suggest strategies to reduce potential adverse impacts of projects on affected groups. The purpose of Executive Order 12898 is to identify and address the disproportionate placement of adverse environmental, economic, social, or health impacts from Federal actions and policies on minority and/or low-income communities. This order requires lead agencies to evaluate impacts on minority or low-income populations during preparation of environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by Federal agencies.

According to CEQ and U.S. Environmental Protection Agency guidelines established to assist Federal and State agencies, a minority population is present in a project area if (1) the minority population of the affected area exceeds 50 percent, or (2) the minority-population percentage of the affected area is meaningfully greater than the minority-population percentage in the general population or other appropriate unit of geographic analysis. By the same rule, a low-income population exists if the project area consists of 50 percent or more people living below the poverty threshold, as defined by the U.S. Census Bureau, or is meaningfully greater than the poverty percentage of the general population or other appropriate unit of geographic analysis.

The CEQ guidance indicates that when agencies determine whether environmental effects are disproportionately high and adverse, they are to consider whether there is or would be an impact on the natural or physical environment (as defined by NEPA) that would adversely affect a minority population or low-income population.

None of the published guidelines define the term "disproportionately high and adverse," but CEQ includes a nonquantitative definition stating that an effect is disproportionate if it appreciably exceeds the risk or rate to the general population (CEQ 1997).

[6] The term "human use" in this chapter, and in chapters 8-12, is specific to the evaluation under NEPA of the potential impacts on those aspects of the human environment not addressed in the assessment of the physical and biological environments. The term 'human use' here is not intended to address or substitute for an evaluation of human use in the context of OPA or the OPA implementing regulations.

The project types proposed under Alternatives 2 and 4 are not, in general, expected to create a disproportionately high and adverse effect on a minority or low-income population; however, population characteristics, including race and ethnicity and per-capita income as it relates to the poverty level as well as effect determinations are considered for the environmental justice analyses in Chapters 8 through 12 and would be considered in future phases of Early Restoration.

Under Alternatives 2 and 4, project spending associated with the implementation and construction of a number of the project types would benefit regional economies. Project construction or implementation spending is likely to occur under project types to create and restore wetlands; protect shorelines and reduce erosion; restore barrier islands and beaches; restore and protect SAV; restore oysters; and restore and protect finfish, birds, and turtles. Project spending would include and contribute to support of the workforce needed to design, engineer, manage, and carry out the projects. Additionally, locally purchased (or rented) equipment and materials would also benefit regional economies.

The duration of project construction and implementation would vary by project. Generally, the higher the project cost and associated project spending, the greater the economic benefits to the region. However, the distribution of economic benefits within the region would also depend on the locations or sourcing of labor, supplies, materials, and equipment. The extent to which labor, equipment, supplies, and materials can be sourced locally or from within the region would increase the economic benefits within the region. These regional economic benefits would include jobs, income, sales, and tax receipts.

Various industries would benefit from the projects, depending on the types of activities occurring. Construction, dredging, vegetation management, and marine and ecosystem planning and science consulting industries are likely to benefit from many of the Alternative 2 project types, including wetland restoration, protecting shorelines, restoring barrier islands and beaches, among others.

Short-term beneficial impacts to the local and regional economies would occur from increases in construction jobs and demand for workforce to support the restoration projects. These jobs would provide income, sales, and downstream economic activity in the region. The level of benefit would be related to the size, duration, and level of effort necessary for each project, as well as the size of the economy in which the project is located. The degree of beneficial impact would also depend on the extent to which the workers and other project materials and equipment are supplied from the region. Non-local workers, brought in for a short period of time, would bring in additional spending as workers stay in local hotels and eat in local eating and drinking establishments, although they typically spend most of their non-per diem income in their home location. In more remote communities, these workers may bring proportionally more benefits in terms of jobs and income to the economy than in large urban areas.

There could be other factors that relate to socioeconomic characteristics that could impact residents and property owners. These could include changes to land use that could affect property taxes or otherwise affect property associated with conserving habitat projects and changes in access to natural resources associated with protecting finfish, birds, and turtles (see 6.6.5, Tourism and Recreational Use). Depending on the type and location of the project, these implications could have a beneficial or at most a minor adverse impact on socioeconomic characteristics. For example, acquisition of lands for conservation or protection purposes could reduce the tax base for property tax collections; however, improvements in habitat associated with this project may draw additional visitors to the area with

associated visitor spending, increasing sales and tax receipts on retail purchases. Adverse impacts to property taxes would vary by the property involved and would depend on the assessed value of the property, which would vary depending on its location. The relative importance of the taxes to the county would also affect the level of impact. It is anticipated that only a few properties would be impacted.

Long-term job creation could also occur under Alternatives 2 and 4. This type of benefit would be associated with project types that have the potential to increase tourism and visitation to an area, such as restoring beaches or islands and protecting shorelines. Additionally, projects that require additional staffing, specialists, and others in the support of new programs, such as turtle monitoring and responders to restore and protect turtles, would have beneficial impacts to the regional economy.

6.4.2 Cultural Resources

All projects conducted as part of Early Restoration would secure all necessary state and federal permits, authorizations, consultations or other regulatory processes related to sensitive habitats (e.g. wetlands or Essential Fish Habitat) and protected species (e.g. marine mammals such as manatee, federal or listed species such as sea turtles, etc.), and other applicable requirements. In particular, a complete review of proposed projects under Section 106 of the NHPA will be completed as environmental review continues. Tribal Consultations would be initiated with all interested federally recognized tribes. Projects will be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Project-specific analyses of potential impacts to cultural resources are presented in Chapters 8 through 12 and would be for future phases of Early Restoration.

While the potential for impacts to cultural resources should be mitigated through BMPs and the Section 106 process, some projects have the potential to adversely impact cultural resources. In particular, under Alternatives 2 and 4, project types involving the removal and placement of dredged materials, and ground or substrate disturbing construction activities have the potential to lead to short and long-term minor to moderate impacts to cultural resources stemming from the potential for inadvertent damage to unknown sites, buildings, structures, or objects. In addition, the use of oyster shells to construct reefs raises the possibility of inadvertent site destruction, because some shell deposits along the coast have accumulated due to prehistoric human activity. Potential source areas of oyster shell would have to be assessed for human or natural accumulations before they are used for construction. Similarly, projects requiring the filling of canals would need to consider whether the canals qualify as historic properties under Section 106.

If not properly conducted, activities conducted under Alternatives 2 and 4 have the potential to compromise a site's integrity and cause a loss of cultural information. BMPs and other mitigation measures that may be employed, depending on site-specific considerations, to further minimize or contain adverse impacts to cultural resources are detailed in Appendix 6-A.

These same project types under Alternatives 2 and 4 could also lead to long-term beneficial impacts through the identification of cultural resources. Cultural or historical sites that may otherwise have been unknown or unprotected may benefit from the NHPA Section 106 review process that could require it be avoided and preserved in its natural state. In this manner, some information may be retrieved and future impacts could be avoided.

6.4.3 Infrastructure

Under Alternatives 2 and 4, project types involving the removal and placement of dredged materials, such as wetland restoration, barrier island restoration, and beach nourishment, and projects involving ground- or substrate-disturbing construction activities, such as the placement of engineered shoreline protection structures, could lead to short and long-term minor to major adverse impacts to infrastructure. These impacts would result if there were inadvertent damage to unknown submerged offshore pipeline infrastructure or buried onshore utility infrastructure. An analysis describing the probability and severity of such potential incidents has not been conducted at the programmatic level for this document. As appropriate on a project-specific basis, surveys would be conducted to locate and aid in avoiding or minimizing potential impacts to buried and submerged infrastructure as a result of specific project activities.

Projects requiring land-based construction activities and associated movement of construction materials and equipment by road could lead to short and long-term minor to major adverse impacts to infrastructure. Project types that enhance public access to natural resources for recreational use, enhance recreational experiences, and/or promote environmental and cultural stewardship, education, and outreach, may include construction activities such as backfilling of canals and shallow water bodies to create wetlands; removal of bulkheads, rip rap and other structures to restore hydrologic connectivity; dune restoration; or the placement of breakwaters or other engineered erosion control structures on the shoreline. Impacts would result from increases in construction traffic; temporary or permanent closure of roads or parking lots; or damage to roadways. These would range in intensity based on the duration of road or parking lot closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of roadway damage.

Similarly, projects requiring the permanent removal or relocation of infrastructure, such as the alteration of land cover for habitat conservation or the removal of piers or other coastal fixtures that are affecting SAV beds targeted for restoration, could lead to short and long-term minor to major adverse impacts on infrastructure.

Projects that stabilize and protect shorelines, reduce erosion, or reduce the effects of wave activity, such as the construction of groins or breakwaters; beach re-nourishment; oyster reef placement; and restoration of SAV beds would have potential long-term beneficial impacts for infrastructure. These would result from the protection of roadways, parking lots, utilities, and other nearshore infrastructure from the effects of storm waves and associated shoreline erosion.

Project types discussed under Alternative 2 that do not involve physical construction activities, including voluntary reductions in fishing effort and voluntary use of improved fishing technology, would have no impact to infrastructure.

6.4.4 Land and Marine Management

Project types implemented under Alternative 2 would have varying impacts on land and marine management depending on the type of management or land ownership applicable to the project site. Most of the project types that would be implemented under Alternative 2 would have no impact to land and marine management, since projects would generally be consistent with the prevailing management plans and direction governing the use of the land and marine areas where the projects would take place.

Projects implemented at national, state and local parks, wildlife refuges, and wildlife management areas could have short-term minor to moderate adverse impacts to land and marine management. These impacts would be temporary, and would occur if activities such as creation or restoration of wetlands; beach re-nourishment; placement of erosion control and shoreline protection; or other projects requiring construction activities result in partial or full closure of these areas during construction. Impacts could include the interruption of park operations; furlough of park staff; assignment of staff to duties not normally associated with their jobs; interruption of interpretive programs; and similar impacts. In the long-term, projects implemented under Alternative 2 would have beneficial impacts on land and marine management at parks, wildlife refuges wildlife management areas because these restoration activities would help park management and staff fulfill their obligations to manage these properties for the benefit of the environment and human enjoyment.

Projects that result in changes in ownership and/or permitted uses, such as the fee acquisition of a parcel or conservation easement held by a land trust, could have long-term impacts to land management. For restoration activities that involve the fee acquisition of land to create wetlands, restore wildlife habitat, protect shorelines, or other types of activities included under Alternative 2, land ownership and potentially zoning would change. Deed restrictions would permanently limit the amount and type of development that would be permitted on these lands and the management and the intensity of use on these properties would likely change. The transfer of fee title to lands and creation of conservation easements, however, are transactions negotiated or arranged between willing parties and as such would not give rise to adverse impacts to land and marine management.

Projects implemented within marine protected areas under Alternative 2 would be designed to restore habitat and conserve living coastal and marine resources and would therefore align with the management goals of these areas. Restoration of SAV, construction of oyster reefs, finfish restoration efforts, and efforts to protect bird and turtle nesting, among other efforts, could have some short-term minor to moderate adverse impacts if these activities require temporary closure of areas that are managed for fishing or recreational use. In the long-term, because projects aimed at habitat restoration and conservation of living resources would align with and further the management goals of marine protected areas, these projects are expected to have beneficial impacts on marine management.

6.4.5 Tourism and Recreational Use

Under Alternatives 2 and 4, project types involving the removal and placement of dredged materials, ground or substrate disturbing construction activities as well as restoration activities could result in some short-term minor to moderate adverse impacts to wildlife viewing, short-term minor to moderate adverse impacts to hunting, beach and waterfront visitors, and tourism and short-term minor to moderate adverse impacts to fishing. Impacts to these different resource areas stem from (1) temporary site closures enacted to protect public safety; and (2) construction activities and associated wildlife disturbances. These activities may result in limits tourism and recreational uses accessibility and opportunities. Degrees of impacts to the various aspects of tourism and recreation are highly dependent on the proximity of projects to the proposed recreation and tourism resources, with impacts likely being highly localized to specific project areas. Impacts as a result of these project types are experienced at greater levels in areas with limited tourist and recreation options, including barrier islands and less populated and/or rural areas leading to short-term minor to moderate adverse impacts in these types of locations. Impacts as a result of these project types could be particularly perceptible to hunting, fishing,

tourism and beach and waterfront visitation as a result of the temporary fish and wildlife (particularly waterfowl) displacement due to disturbances from construction and the loss of tourism and visitors to beach and waterfront areas. If these closures occur in areas with high levels of hunting, fishing, and tourist activity such as beach and waterfront visitation occurs, adverse impacts would be readily apparent to resource users, who may choose to pursue these recreational activities in different locations.

Alternative 2 project types could also result in long-term beneficial impacts to wildlife viewing, hunting, beach and waterfront visitors, tourism and fishing. Long-term beneficial impacts to tourism and wildlife viewing from these restoration projects would occur as a result of the improvement of wildlife and aquatic species habitat and associated increases in wildlife and aquatic species populations, diversity and viewing opportunities. In addition, benefits to beach and waterfront recreation could occur from increased opportunities for swimming, snorkeling, and sightseeing. Similarly, long-term beneficial impacts to hunting and recreational fishing could occur as a result of increases in the wildlife and aquatic species populations. Overall, improvements to habitat quantity and quality could occur over time under such project types and could result in long-term beneficial impacts to the above-mentioned resources through increased opportunities to view more abundant wildlife and enhanced recreational experiences.

6.4.6 Fisheries and Aquaculture

Construction or implementation of project types under Alternative 2 have the potential to adversely impact commercial fisheries through activities that involve the use of in-water equipment, dredging, construction of groins and breakwaters, transplanting and vegetating SAV beds, installation of water signage, and reef placement activities. The potential for turbid waters; displacement of sand and sediment during construction, dredging, and placement; as well as potential for spills and leaks from equipment used in these activities could affect water quality and adversely impact fish and shellfish habitat, resulting in temporary adverse impacts to commercial fisheries in areas where these activities occur. Therefore any impacts would be localized and short-term, and construction activities would only result in disruptions to fishing operations if operations were in close proximity to the restoration projects. Depending on the location of project activities and their proximity to commercially important fisheries, short-term impacts could range from none to moderate.

No long-term impacts to commercial fisheries are anticipated with projects to conserve habitat. Project types intended to further sea turtle conservation may result in additional on-board observers and monitoring of commercial fishery by-catch that could affect commercial fishing operations. The development and implementation of projects to restore and protect finfish would require project-specific considerations of their economic effects on commercial fisheries.

Additionally, the restoration of bird or sea turtle nesting habitat would not result in any foreseeable impacts to commercial fisheries, but could result in short-term minor to moderate effects during any in-water construction (turbidity, disruption of foraging or other uses, etc.).

In the long-term, projects to restore and protect wetlands, protect shorelines and reduce erosion, restore and protect SAV, and restore oysters could provide forage, shelter areas, or improved habitat for commercially important fish and shellfish species. This could potentially benefit certain commercial fisheries that land, harvest, sell, and process these resources.

There are no anticipated short- or long-term impacts on land-based aquaculture operations associated with the project types under Alternative 2; some in-water operations located in proximity to planned projects may experience short-term disruptions related to construction activities resulting in short-term minor adverse impacts.

6.4.7 Marine Transportation

Under Alternative 2, impacts could occur from increases in marine traffic if there were sufficient numbers of barges involved and utilizing a congested shipping route. This could result in minor adverse impacts occurring in highly localized areas. Shipping routes would need to be properly identified prior to the selection of borrow sites for dredge and fill material.

Projects including wetlands, beaches, and barrier islands restoration and shoreline would reduce erosion and provide wave attenuation which would provide a long-term benefit for marine transportation infrastructure such as the Gulf Intracoastal Waterway, ports, and harbors. Long-term beneficial impacts could also result from proper planning and coordination of dredging activities in ways that allow for the dredging of fill material from borrow sites that provide opportunities to improve navigational channels.

6.4.8 Aesthetics and Visual Resources

Under Alternative 2, project types involving the use of construction equipment, including equipment used for the movement and placement of materials (i.e. barges) and barriers enacted to protect public safety would result in some minor to moderate short-term adverse impacts on aesthetics and visual quality. These impacts result from the presence of equipment, barriers and construction-related dust and emissions. During the construction period, visible impedances would detract from the natural landscape and create visual contrast for observers visiting the project areas. Over the short-term, there would be a change in the viewshed that would be readily apparent and that would attract attention. Although such changes would not dominate the viewscape, they would detract from current user activities or experiences. The severity of impacts would depend to a large degree on the location of the proposed projects, the degree to which these activities would be visible, the duration of the construction activities and how commonplace these activities and equipment are in certain areas. Impacts would likely be greatest in areas frequented by large groups of visitors and in areas where more natural viewsheds exist (i.e. barrier islands). In the event that construction and ground disturbing projects result in the long-term placement of structures and signage, long-term minor adverse impacts to aesthetics would occur, though these types of objects are often commonplace and would become less intrusive over time.

Project types involving dredging activities associated with projects centered on beach re-nourishment, by contrast, could result in restricted access to scenic viewsheds within the area where such activity was occurring. These activities would adversely impact the scenic character of natural areas by introducing mechanical dredging, a readily observable visual contrast into the natural setting which would dominate and detract from current user activities or experiences. In these instances, short-term impacts to aesthetics could rise to major. More typically, impacts would be expected to range from minor to moderate.

Restoration, improvement and wetland and habitat creation project types would lead to long-term beneficial impacts from the increased visual character of the landscape occurring from the projects

restoring or enhancing areas to their natural conditions and over-time increasing the scenic quality of the project area.

Project types involving the identification and nomination of specific habitat areas for fee title acquisition or conservation easement would lead to long-term beneficial impacts to aesthetics and visual quality as over time as these restoration techniques would lead to the acquisition and enhancement of natural areas.

6.4.9 Public Health and Safety, Including Flood and Shoreline Protection

Under Alternative 2, project types involving construction and construction activities could result in short-term minor adverse impacts to public health and safety as a result of the operation of heavy equipment and construction materials. In addition, if hazardous chemicals or other materials are unintentionally released into the environment, soils, groundwater, and surface waters would be adversely impacted. Similarly, construction projects involving the use of boats and barges, and associated equipment, for the placement of materials to create habitat could impact the public through construction activities and the potential to contaminate surface waters, resulting in short-term minor adverse impacts. During implementation of land management plans, fire management activities could cause minor health and safety impacts. Measures to avoid risk to public health and safety would include, but not be limited to, approved burn plans/permits; assistance from local fire departments; and monitoring of weather conditions. BMPs and other mitigation measures that may be employed to further minimize or contain adverse impacts are listed in Appendix 6-A.

Long-term beneficial impacts from restoration and rehabilitation projects could reduce the risk of potential hazards, such as storm surges, to visitors, residents, and workers from improved shoreline integrity and additional buffer and flood storage from storms. Project types that include restoring wetlands and submerged aquatic vegetation could reduce water contamination currently present in the localized areas and help to alleviate potential future water contamination, also resulting in long-term beneficial impacts.

6.5 Alternatives 3 (and 4): Physical and Biological Environments

This section describes the environmental consequences of Alternative 3 for physical and biological environments. Impacts for physical and biological environments are disaggregated by each of the three project types identified in Chapter 5 under this Alternative. For each project type, potential restoration techniques are noted. Because Alternative 4 is inclusive of Alternative 3, the analysis of environmental consequences for these project types is the same for Alternative 4 as Alternative 3.

6.5.1 Project Type 10: Enhance Public Access to Natural Resources for Recreational Use

This project type would involve enhancing recreational users' experiences by creating new or improved access to natural resources. Access to recreational areas can be improved by enhancing or constructing infrastructure and by providing or improving access to natural resources in publicly owned areas (parks, marinas, etc.). Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

1. Improving access to natural resources for recreational use through the construction or enhancement of infrastructure

2. Purchase of access rights, easements, and/or property in areas to increase access to resources for recreational purposes

6.5.1.1 Geology and Substrates

Recreational enhancement projects could provide long-term beneficial effects on geology and substrate where existing degraded infrastructure (such as damaged piers or dilapidated public facilities) was improved or enhanced. These types of projects would result in long-term beneficial effects because they would extend beyond the construction period.

Enhancing or constructing infrastructure could require work with heavy equipment in construction or staging areas that would temporarily disturb soils and sediments in upland, shallow water areas or nearshore habitats. These construction activities could result in the local removal, compaction, and erosion of upland, shallow-water, and nearshore substrates in construction/development areas. These would be minor to moderate short- to long-term adverse effects because they would be localized and could have readily apparent effects on local soils, substrates and/or geologic features, with some effects lasting only during the construction period (heavy equipment use) and others extending beyond the construction period (compaction and displacement resulting from infrastructure).

6.5.1.2 Hydrology and Water Quality

Recreational enhancement projects have the potential to have minor to moderate long-term beneficial effects on water quality depending on the proposed activity. If recreational enhancements occurred at an existing site where ongoing degradation is occurring (e.g. unimproved or failing parking areas with poor stormwater management near coastal waters), there could be long-term benefits to water quality. Other projects may have beneficial effects by improving access to marine pump-out stations and reducing marine discharges of waste. Navigational aids would also tend to reduce the risk of boating accidents and associated fluid releases and spills. Projects that reduced degradation of water quality would result in long-term beneficial effects because they would extend beyond the construction period.

Equipment usage and other construction activities in wetland recharge areas could result in short-term minor to moderate adverse impacts to surface water related to sediment compaction, disturbance, and erosion. Conversion of natural areas to impervious surfaces could increase, which could increase stormwater runoff and pollutants to the receiving water body and cause minor long-term adverse effects. Long-term decreases in surface water quality could occur from increased use and presence of boats and equipment within the project area, which would be minor and long-term because the effects would be localized and would extend beyond the construction period. Equipment usage and other construction activities in wetland recharge areas could result in short-term adverse impacts to surface water related to sediment compaction, disturbance, and erosion.

6.5.1.3 Air Quality and Greenhouse Gases

During construction activities, short-term impacts to air quality and GHGs would occur from the use of gasoline and diesel powered construction vehicles and equipment, including barges, and exhaust produced by the use of this equipment. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. There is a slight potential for fugitive dust creation from construction activities, resulting in minor to moderate adverse impacts. Long-term minor adverse

effects from these enhancements due to increased recreational use and associated vehicle traffic may occur.

6.5.1.4 Noise

During the construction period, adverse impacts to ambient noise levels could occur, particularly along shorelines where construction activities would take place. The severity of impacts would depend to a large degree on the location of the project and the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. Installation activities, equipment operation, and vehicle or boat traffic associated with the construction activities could result in short-term minor to major adverse impacts to noise, especially if they occurred in natural areas. For example, during the use of motorized heavy equipment such as cranes and barges, noise would be created which would be readily apparent and attract attention. Although such changes would not dominate the soundscape and some sounds could be dampened or masked by ambient wave or ship noise, these actions could detract from the current user activities or experiences and create audible contrast for visitors in the project area.

Over the long-term, the addition of infrastructure into the existing setting would present some amount of increase in ambient noise levels. For example, a new boat ramp would result in increased noise associated with boat launching. Long-term adverse effects of these enhancements could range from minor to moderate depending on the existing noise level of the surrounding landscape, the location and distance to sensitive receptors, and the anticipated increase in use.

6.5.1.5 Habitats

Not all public access projects necessarily result in benefits to habitats. While some of these projects do result in benefits, benefit from Alternative 3 to these resources is not specifically tied to this project type in Table 6-3 and 6-4. Some recreational enhancement projects may have long-term beneficial effects on wetlands, barrier islands, beaches, coastal transition zones, SAV and shallow water habitats. For example, enhancement projects could reduce degradation and recreation use in habitats in settings where recreation usage that is currently diffuse is redirected to a site that is more appropriate and conducive to recreational activities. Enhancing or constructing infrastructure could require in-water work with heavy equipment and long-term operation and maintenance of these facilities. These activities could result in the following short and long-term minor to moderate adverse impacts:

- Filling, disruption, or alteration of wetlands;
- Soil erosion, vegetation trampling, vegetation removal, or other human activity from project staging or construction, or implementation of recreational enhancements;
- Permanent shading of SAV or other habitats from placement of structures;
- Filling of shallow water areas, and the conversion of upland pervious areas to impervious surfaces (parking areas, buildings, etc.) related to the placement of piers, foundations, or other permanent structures;
- Localized plant species displacement or loss, introduction of invasive species, and degradation of habitats including potential habitat fragmentation as a result of an increased recreational activity and human encroachment in habitats, such as beaches or wetlands;
- Increased human-related disturbances of fish, birds or marine mammals in the long-term that may be present in the waterway related to facilities that include in-water activities;

- Cover or loss of SAV populations in areas where in-water construction work occurs. However, turbidity would dissipate quickly and effects from this water quality change would be minor and short-term. Adverse effects from covering SAV would be minimized due to pre-construction surveys in specific project locations; impacts to SAV could be minor and would be avoided and minimized to the maximum extent practicable.

These effects would depend on the size and scale as well as the location of facilities. Effects would also vary depending on presence of sensitive habitats and availability of other similar sensitive habitats in the project vicinity.

6.5.1.6 Living Coastal and Marine Resources

Some public access projects might have long-term beneficial effects on living coastal and marine resources (e.g., by reducing degradation and recreation use in habitats or on populations in settings where recreation usage that is currently diffuse is redirected to sites that are more appropriate and conducive to recreational activities). In some cases, degradation and recreational use that may have been wide spread, thus affecting a larger geographic region, could be focused on areas that can be managed for the recreational impact and that are not sensitive or important habitats for living coastal and marine resources. These projects could subsequently result in a long-term benefit through the stabilization and protection of sensitive habitats and biological resources. However, not all public access projects necessarily result in these types of benefits to living coastal and marine resources, and the summary tables, Table 6-3 and 6-4, assignment of benefit from Alternative 3 to these resources are not specifically tied to this project type. Enhancing or constructing infrastructure could require in-water work with heavy equipment and long-term operation and maintenance of these facilities. These activities could result in the following adverse impacts:

- Short-term, minor disturbance or loss of pelagic microfaunal and benthic communities from increased turbidity, which decreases available light necessary for photosynthesis, and disruption in the water column and surface water. These impacts would be short-term and minor because pelagic microfaunal communities would re-establish once turbidity dissipates;
- Short-term, minor displacement of finfish individuals or mortality of individual finfish, including adults, eggs, or larvae, could occur during construction, depending on timing and location of construction and affected species. However, it is anticipated that finfish would move away to other readily available aquatic habitats during the construction period. Fish present in the dredging or fill-placement area could be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. Sound pressure level increases or entrainment could result in mortality of individual finfish. This would be a minor short-term adverse effect that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Short-term, minor to moderate displacement of sea turtle and marine mammal individuals from the work area due to increase in activity, noise, vibration, and turbidity during construction. Removal or cover of existing foraging habitat (SAV) by suspended sediments during in-water activities could present another potential adverse effect to sea turtles or manatees. However the extent of covered SAV would be limited to the local area and sediments would be expected

to settle quickly once constriction was completed. Therefore, these impacts would be short-term and minor. If projects may incidentally harass marine mammals or adversely affect ESA-listed marine mammals or sea turtles, consultation or authorizations with appropriate agencies would be required prior to project implementation.

- Long-term, minor to moderate displacement, fragmentation or loss of nesting/rearing and foraging habitat for sea turtles, birds, or terrestrial wildlife as a result of recreational activity and encroachment on beaches and shallow waters used by these species.
- 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. Structures that extend above the water surface could also potentially improve predator access to nesting birds, resulting in a minor long-term adverse impact. If projects have potential to adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation;
- Short-term to long-term, minor displacement or loss of oyster populations or other benthic organisms from increased turbidity, substrate disturbance, or siltation of any hard substrate areas that house oyster populations during construction, loss of habitat from placement of permanent structures on soft sediments or hard substrates, damage to habitats from contact with vessels or from biofouling from leaked or otherwise discharged fluids (oil, gas, and diesel).

6.5.2 Project Type 11: Enhance Recreational Experiences

This project type involves a variety of techniques that could be implemented to enhance recreational experiences. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

- Re-nourish beaches through sediment addition;
- Place stone, concrete, or permissible materials to create artificial reefs;
- Construction to enhance recreational experiences;
- Enhance recreational fishing opportunities through aquaculture techniques; and
- Reduce and remove land-based debris.

6.5.2.1 Geology and Substrates

Sediment deposition on beaches or creation of shallow and/or inshore artificial reefs could result in a benefit to local geology and substrates by reducing erosion, as well as reducing wave action and inducing sediment deposition. These beneficial effects would be long-term because they would extend beyond the construction period. However, these actions also carry the long-term minor to moderate risk of interrupting geomorphic processes. This could include erosion or deposition outside the targeted area to be protected. Beach re-nourishment would require heavy equipment and construction activity that could result in increased sedimentation, compaction, or rutting. These adverse effects would be minor to moderate and short- to long-term because they could occur during the construction period and beyond the construction period. The construction and use of temporary pipelines to deliver sediment could also disturb substrates along the pipeline corridor and increase erosion temporarily. This adverse effect would be minor and short-term because it would be localized and generally would not extend beyond the construction period. Sediment deposition could require periodic maintenance on beaches that have degraded due to ongoing conditions (such as lack of sand deposition due to breakwaters or

jetties and limitation of beach/dune migration due to development) which could result in minor, short-term adverse effects to local substrates through equipment operation and human activity.

Creation of artificial reefs could result in long-term benefits on geology and substrate. Placement of an artificial structure would create more substrate in an area which may or may not be hard-bottom habitat limited. Adverse effects could occur to geology and substrates from installation of artificial reefs. The creation of artificial reefs could cause short-term minor adverse impacts on geology and substrate due to initial placement of the vessel or other man made structure materials. Placement could cause loosening of sediments and may negatively impact any seafloor features; however, these impacts are anticipated to be temporary in nature. Placement of an artificial reef structure could also cause a loss in soft-bottom habitat. Placement of structures would permanently cover existing geology and substrates, which would be a long-term minor effect.

Constructing facilities such as wildlife viewing platforms or dune walkovers adjacent to Gulf waters could result in work with heavy equipment in construction or staging areas; this work could temporarily or permanently affect geology and substrates. These activities would result in removal, displacement, and compaction of geology and substrates, causing minor to moderate short- to long-term adverse effects.

The effects that removal of land-based debris during construction would have on geology and substrates would need to be considered in project-specific analyses. For example, if new recycling facilities are constructed, then minor short-term adverse effects on substrates could occur during construction activities. These effects would be minor and short-term because they would be localized and would occur during the construction period. However, other components of this technique (e.g., developing marine debris reduction programs, encouraging local businesses to recycle) would not likely have any effects on geology and substrates.

6.5.2.2 Hydrology and Water Quality

Beach re-nourishment (depending on design) could help reduce storm surges on coastal wetlands and associated surface water resources, and limit the shoreward extent of saltwater flow. This could provide short-term beneficial effect to hydrology and water quality because it would extend beyond the construction period. Since not all techniques and project types within Alternative 3 would be capable of providing this same benefit to hydrology and water quality, Tables 6-3 and 6-4 do not reflect a benefit to hydrology and water quality for this alternative.

Artificial reef construction could result in short-term minor adverse impacts on water resources, as placement of the material could cause short-term suspension of sediments at the restoration site. These impacts are expected to be temporary in nature, and have no significant impact on water quality. Any structure used for this technique should be properly cleaned of any contaminants. However, minor adverse impacts to water resources could occur if contaminants are released during the ship cleaning process. Indirect impacts would be determined based on site-specific and project-specific considerations.

Turbidity curtains could be utilized to decrease turbidity associated with placement of structures. Turbidity curtains are floating impermeable barriers that are constructed of flexible material with an upper hem containing floatation material and a lower hem that is weighted. They effectively minimize

sediment transport from the area of disturbance by allowing suspended sediment to settle out of the water column in a controlled area (Southeast Florida Coral Reef Initiative 2008).

Equipment usage and other construction activities in wetland recharge areas could result in short-term minor to moderate adverse impacts to surface water related to sediment compaction, disturbance, and erosion. Construction of recreational or aquaculture facilities could result in additional impervious surface, which could increase runoff and reduce infiltration. These would likely be minor long-term effects because they would be small, localized, and extend beyond the construction period. Other adverse facility construction-related effects could include short to long-term minor to moderate decreases in water quality from disruption of sediments, increased turbidity, and increased fluid spill risk from equipment. Additionally, aquaculture facilities or research and development laboratories along the Gulf Coast could adversely affect water quality through the discharge of fish hatchery effluent. This would be a minor long-term adverse effect because effects would be localized and extend beyond the construction period. Increased human activity or vehicle traffic as a result of improved recreation facilities could also result in minor, long-term adverse effects to water quality.

The effects that removal of land-based debris during construction would have on hydrology and water quality would need to be considered in project-specific analyses. For example, if new recycling facilities are constructed, then minor short-term adverse effects on groundwater could occur during construction activities. These effects would be minor and short-term because they would be localized and would occur during the construction period. However, other components of this technique (e.g., developing marine debris reduction programs, encouraging local businesses to recycle) would not likely have any effects on groundwater. In some cases removal of debris could result in a long-term benefit to water quality and hydrology. For example, if debris was disrupting or otherwise affecting surface flow in a small waterway, removal could result in beneficial effects to hydrology.

6.5.2.3 Air Quality and Greenhouse Gases

During construction activities, short-term impacts to air quality and GHGs would occur from the use of gasoline and diesel powered construction vehicles and equipment, including barges, and exhaust produced by the use of this equipment. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. There is a slight potential for fugitive dust creation from construction activities, resulting in minor adverse impacts. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to a short-term and minor to moderate increase in GHG emissions. Long-term minor adverse effects from these enhancements due to increased recreational use and associated vehicle traffic may occur.

6.5.2.4 Noise

During implementation of restoration actions, adverse impacts to the environment due to an increase in the ambient noise level could occur. The severity of impacts would depend to a large degree on the location of the project and the amount of noise that these activities would generate and the distance to sensitive receptors such as recreational users or wildlife. Installation activities, equipment operation, and vehicle or boat traffic associated with the construction of artificial reefs, beach re-nourishment, or facility construction could result in short-term minor to major adverse impacts to noise, especially if they occurred in natural areas. For example, during the use of motorized heavy equipment such as

cranes and barges, noise would be created which could be readily apparent and attract attention. Although such changes would not dominate the soundscape and some sounds could be dampened or masked by ambient wave or ship noise, these actions could detract from the current user activities or experiences and create audible contrast for visitors in the project area.

For projects that would increase motorized use or result in operational noise, long-term adverse changes to the ambient noise levels would be minor to moderate. For projects that would not create an increase in motorized use or operational sound, such as beach re-nourishment, long-term impacts to the ambient noise levels would be unlikely.

6.5.2.5 Habitats

The creation and restoration of beaches could result in a long-term benefit to habitats including wetlands, barrier islands, beaches and dunes, SAV, and coastal transition zones. These activities could help stabilize substrates, support sediment deposition, and reduce erosion. Since not all techniques and project types within Alternative 3 would be capable of providing this same benefit to habitats, the assignment of Alternative 3 benefits to habitats is not specifically associated with this project type.

Adverse effects could occur to these habitats from different restoration activities such as dredging, placement of sediment transport pipeline, placement of sediment, or facility construction. Adverse impacts from these activities could include:

- Filling, disruption, or alteration of adjacent habitats;
- Increased soil erosion, vegetation trampling, vegetation removal, or other human activity from project staging or construction, or implementation of restoration activities on adjacent uplands, coastal transition zones, barrier flats, dunes and beaches;
- Cover or loss of SAV populations in areas where in-water construction work, dredging, or placement of an underwater pipeline occurs; turbidity would dissipate quickly and effects from this water quality change would be minor and short-term. However, adverse effects from covering SAV would be minimized due to pre-construction surveys in specific project locations; impacts to SAV could be minor and would be avoided and minimized to the maximum extent practicable; and
- Change in water quality from turbidity and substrate disturbance from in-water work with heavy equipment or leaching of construction fluids.

These impacts would be, for the most part, minor to moderate and would take place over the short-term, during the construction activity.

The creation of artificial reefs could benefit sessile and benthic encrusting organisms and forage fish by providing substrate and interstitial spaces for use as habitat and forage areas. The benefits from artificial reefs depend on site-specific and project-specific considerations.

Minor to moderate adverse effects such as habitat trade-offs could result from placement of artificial hard substrate on soft bottom habitat as a transition from naturally occurring soft bottom benthic communities and the managed species that utilize these areas could occur. Placement of artificial reef can also modify water circulation patterns and cause accretion or erosion of the adjacent habitats. Proper siting of artificial structures will minimize these potential impacts.

Construction of wildlife viewing platforms, dune walkovers or other features for recreational users could result in adverse short-term and long-term minor to moderate adverse impacts, including:

- Increases in sedimentation and turbidity during construction;
- Fluid spills (e.g. oil, diesel, gasoline, etc.) in or near wetlands or shallow water areas from equipment usage and other construction activities;
- Soil erosion, vegetation trampling, vegetation removal, or other human activity from project staging or construction, or implementation of recreational enhancements on uplands, coastal transition zones, barrier flats, dunes and beaches;
- Permanent conversion of pervious areas to impervious surfaces (parking areas, buildings, etc.) related to the placement of piers, foundations, or other permanent structures, fill of shallow water areas;
- Conversion of upland habitats from placement of structures or facilities;
- Degradation or fragmentation of habitats and/or introduction of invasive or exotic species as a result of increased recreational activity and human encroachment in habitats, such as beaches or wetlands;
- Facilities that included in-water activities could increase long-term human-related disturbances of fish, birds or marine mammals that may be present in the waterway.

These effects would depend on the size, scale, and placement of facilities, presence of sensitive habitats and availability of other similar sensitive habitats in the project vicinity. Placement of structures could also cause permanent shading of SAV or other habitats. There could be short-term adverse disruption of habitats during construction from use of heavy equipment and staging of construction activities.

The effects of removal of land-based debris on Gulf Coast habitats would need to be considered in project-specific analyses. For example, if new recycling facilities are constructed, adverse effects could occur as a result of vegetation clearing, grading, or other actions. These effects would be minor and short-term because they would be localized and would occur during the construction period. However, other components of this technique (e.g., developing marine debris reduction programs, encouraging local businesses to recycle) would not likely have any effects.

6.5.2.6 Living Coastal and Marine Resources

Beach re-nourishment could protect eroding beaches and shallow water habitats. These actions would provide long-term benefits to benthic populations, pelagic microfaunal communities, and finfish, by providing forage areas and habitat. Restored beaches are intended for public use, potential benefits of restored beaches to birds, terrestrial wildlife and other species are not assumed here, but could be an outcome depending on location and level of use.

Some short-term minor adverse effects could occur if resources, including oysters, fish, sea turtles, marine mammals, benthic communities, and pelagic microfaunal communities, were present in the construction area. Possible impacts could include increased turbidity, reduction of water quality, noise pollution, vibration, and disruption to the water column and habitat. In particular, in-water dredging, reef construction, and recreation or aquaculture facility construction activities could result in the following adverse impacts:

- Short-term to long-term, minor displacement or loss of oyster populations or other benthic organisms from increased turbidity, substrate disturbance, leaching of equipment fluids or siltation of any hard substrate areas that house oyster populations during construction;
- 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 communities. These impacts would be short-term and minor because pelagic microfaunal communities would re-establish once the turbidity dissipates;
- Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by equipment, human activity, or sediment. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and alteration or removal of habitat. Sound pressure level increases or entrainment could also result in mortality of individual finfish. These would be minor short-term adverse effects that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation;
- Sea turtle and marine mammal individuals 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, all of which could temporarily displace individuals or prey during construction and result in short-term, minor impacts. Sea turtle and marine mammals may be present in project areas where use of explosives may be used to sink a vessel for creation of an artificial reef. Underwater explosions may affect marine life by causing death, injury, or behavioral reactions; depending on the distance an animal is located from a blast. This could result in short to long-term impacts to individuals and may result in minor to moderate impacts. If projects have potential for adverse effects to marine mammals or sea turtles, consultations or incidental harassment authorizations with appropriate agencies would be required prior to project implementation;
- Construction in upland 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, bird and terrestrial wildlife individuals that forage or nest in or near the work area could be temporarily disturbed or displaced. Effects could vary from minor and short-term to major and long-term depending on the effect of the action. If projects have potential to adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation;
- Stormwater runoff from impervious surfaces could enter waterways and increase turbidity as well as carry pollutants that could affect benthic organisms, fish or foraging bird species; and
- Increase in visitation could result in noise and other disturbances as well as degradation or fragmentation of habitats and upland areas used by wildlife in the vicinity.

The creation of artificial reefs could result in short-term minor adverse impacts on biological resources as the initial placement of the reef could disturb fauna at the site. While the reduction of the available soft bottom habitat would be a long-term impact it is expected to be minimal in relation to the amount of that habitat available in the Gulf. If a vessel is being placed as an artificial reef, a higher disturbance of benthic fauna could be likely, as it would cover a larger area of the seafloor. There could be long-term benefits to benthic encrusting, sessile, and mobile epifauna, and small forage fishes.

The creation of artificial reefs could provide indirect benefits to marine fish, marine mammals, sea turtles, and potentially oysters and shallow water coral. A created artificial reef provides benefit to marine fish, marine mammals, and sea turtles, all of which would utilize a well-colonized reef for food, shelter, or spawning areas. If the reef is placed in shallow enough water, oysters or shallow water coral would also potentially colonize the structure. Long-term minor to moderate benefits could occur if artificial reefs provide habitat for larger resident fishes and temporary foraging sites for larger migratory fishes. When overfishing is a problem, however, artificial reefs may aggravate the overfishing problem by concentrating remaining fishes and making them more vulnerable to fishing pressure, which could be an adverse impact. Whether the availability of new habitat will serve to increase fish and/or invertebrate biomass or will only serve to concentrate organisms at the site, is likely dependent on where the reef is sited and how it is designed.

Sea turtle and marine mammal individuals present in project areas where use of explosives to sink a vessel for creation of an artificial reef could be subject to temporary increased noise, turbidity, and water quality changes, all of which could temporarily displace individuals or prey during construction and could result in short-term, minor impacts. If projects have potential for adverse effects to marine mammals or sea turtles, consultations with appropriate agencies would be required prior to project implementation.

Adverse minor long-term impacts could occur if restoration activities 1) placed materials or sediment directly on top of resources (e.g. existing oyster reef/substrates); 2) removed foraging or nesting habitat, such as replacing vegetation with a permanent structure; 3) provided access for native and non-native terrestrial animals that could increase predation of local nesting birds; or 4) increased recreational use and access of habitats that were previously undisturbed. Some hatcheries/aquaculture operations could result in a long-term minor adverse effect to marine mammals or fish through unintentional exposure of wild organisms to disease through release of contaminated effluent or infected animals. Stocking of hatchery-reared finfish could also, long-term, negatively impact the genetic diversity of the wild stock. Development and implementation of a genetics management plan or release of only sterile individuals may decrease the chance of long-term negative impacts on native populations. Stocked fish could also affect the balance of the fish community, competing for food and habitat resources with finfish species present in the receiving waters. Implementation of stocking management plans with consideration of the location of sensitive finfish species could prevent disruption to the native finfish populations through competition or predation. BMPs and other mitigation measures that may be employed, depending on site-specific considerations, to further minimize or contain adverse impacts to cultural resources are detailed in Appendix 6-A.

The effects of removal of land-based debris on living coastal and marine species would need to be considered in project-specific analyses. For example, if new recycling facilities are constructed, then adverse effects to some species' foraging or nesting habitat could occur as a result of vegetation clearing, grading, or other actions. These effects would be minor and short-term because they would be localized and would occur during the construction period. However, other components of this technique (e.g., developing marine debris reduction programs, encouraging local businesses to recycle) would not likely have any effects.

6.5.3 Project Type 12: Promote Environmental and Cultural Stewardship, Education, and Outreach

This project type would facilitate environmental and cultural stewardship, education, and outreach through a variety of different mediums that concentrate on the coastal resources of the Gulf of Mexico. Appropriate restoration techniques (described in more detail in Chapter 5) for this project type include but are not limited to:

1. Create or enhance natural resource-related education facilities
2. Create or enhance natural resource-related education programs

6.5.3.1 Geology and Substrates

Construction of new or improved educational facilities could result in local removal, displacement, and compaction of geology and substrates. These effects would be minor to moderate and short to long-term because they would be localized and could have readily apparent effects on local substrates/geologic characteristics, with some effects lasting only during the construction period and others extending beyond the construction period (i.e. compaction and displacement resulting from infrastructure).

6.5.3.2 Hydrology and Water Quality

Construction of educational facilities in, or directly upstream of, freshwater or brackish water could result in short-term decreases in water quality from disruption of sediments, and/or increased turbidity. Equipment usage and other construction activities in wetland recharge areas could result in short-term minor to moderate adverse impacts to surface water related to sediment compaction, disturbance, and erosion. Conversion of pervious areas to impervious surfaces could reduce infiltration while increasing stormwater runoff and pollutants to the receiving surface water body. These effects would be minor and long-term because they would be localized and extend beyond the construction period.

6.5.3.3 Air Quality and Greenhouse Gases

During construction activities, short-term impacts to air quality and GHGs would occur from the use of gasoline and diesel powered construction vehicles and equipment, including barges, and exhaust produced by the use of this equipment. Examples of project-specific projected emissions are located in Chapters 8 through 12. The severity of impacts would be highly dependent on the length and type of construction required and the location of the project. There is a slight potential for fugitive dust creation from construction activities, resulting in minor adverse impacts. The use of gasoline and diesel-powered construction vehicles and equipment could contribute to short-term minor to moderate increase in GHG emissions. Long-term minor adverse effects from these enhancements due to increased recreational use and associated vehicle traffic may occur.

6.5.3.4 Noise

Adverse impacts to the ambient environment during the construction of education facilities would be short-term and minor to moderate from noise disturbances such as the operation of bulldozers, front-loaders and other large earth moving equipment required for construction of new or improved recreational facilities. Depending on the surrounding environment, distance to sensitive receptors and ambient noise conditions, these construction sounds could potentially dominate the soundscape and detract from current user activities or experiences.

An increase in education programs could also have long-term minor to moderate adverse noise effects due to increases in motorized use or human activity, if resulting activity occurred in areas of previously undisturbed, quiet settings.

6.5.3.5 Habitats

Providing educational features for both the public and students through coastal exhibits and collections, hands-on activities, educational outreach programs related to coastal resources, and other interactive activities could increase public awareness of wetlands, barrier islands, beaches, and other habitats, as well as highlight their value to the overall ecosystem. The facilitation of educational outreach and interactive activities would be a long-term benefit to the environment by increasing public knowledge of, and support for, preservation and conservation of these habitats, as well as potentially resulting in behavioral changes during future public encounters with sensitive habitats. However, increased visitation to barrier islands, dune areas, or other habitats as a result of educational programs could have long-term minor to moderate adverse effects to previously minimally used or visited habitats.

Enhancing or constructing educational infrastructure could require work with heavy equipment and long-term operation and maintenance of these facilities. Adverse construction and operational habitat effects could include short to long-term minor to moderate adverse effects including:

- Short-term minor to moderate increases in sedimentation and turbidity during construction;
- Filling, disruption, or alteration of wetlands;
- Soil erosion, vegetation trampling, vegetation removal, or other human activity from project staging or construction or implementation of recreational enhancements on uplands, coastal transition zones, barrier flats, dunes and beaches;
- Permanent shading of SAV or other habitats from placement of structures;
- Filling of shallow water areas, and the conversion of upland pervious areas to impervious surfaces (parking areas, buildings, etc.) related to the placement of piers, foundations, or other permanent structures;
- Localized plant species displacement or loss, introduction of invasive species, and degradation or fragmentation of habitats as a result of an increase recreational activity and human encroachment in habitats, such as beaches or wetlands;
- Increased human-related disturbances of fish, birds or marine mammals in the long-term that may be present in the waterway related to facilities that include in-water activities;
- Cover or loss of SAV populations in areas where in-water construction work occurs. However, turbidity would dissipate quickly and effects from this water quality change would be minor and short-term. Adverse effects from covering SAV would be minimized due to pre-construction surveys in specific project locations; impacts to SAV could be minor and would be avoided and minimized to the maximum extent practicable.

6.5.3.6 Living Coastal and Marine Resources

Providing educational features for both the public and students through coastal exhibits and collections, hands-on activities, educational outreach programs related to coastal resources, and other interactive activities could increase public awareness of marine resources and of their value to the ecosystem, potentially leading to greater support for resource management and conservation. This could result in a long-term benefit to nearshore benthic communities, oysters, marine mammals and other species

beyond the lifespan of the project. However, increased visitation to barrier islands, beaches, or other habitats as a result of educational programs could have long-term minor to moderate adverse effects to local marine resources via localized species displacement or loss and degradation of habitats.

Enhancing or constructing infrastructure to promote environmental and cultural features could require work with heavy equipment or operations and maintenance in areas where nearshore benthic communities, finfish, oysters, sea turtles, or other species are present. Adverse construction effects to these species could include short to minor to moderate effects, including:

- Displacement or loss of oyster populations or other benthic organisms from increased turbidity, substrate disturbance, leaching of equipment fluids or siltation of any hard substrate areas that house oyster populations during construction.
- 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 communities. These impacts would be short-term and minor because pelagic microfaunal communities would re-establish once the turbidity dissipates.
- Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by equipment, human activity, or sediment. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and alteration or removal of habitat. Sound pressure level increases or entrainment could also result in mortality of individual finfish. These would be minor short-term adverse effects that would not be expected to reduce local fish populations or designated EFH. If projects have potential to adversely affect protected fish species, consultations with the appropriate agencies would be required prior to project implementation.
- Sea turtle and marine mammal individuals 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, all of which could temporarily displace individuals or prey during construction and result in short-term, minor impacts. If projects have potential for adverse effects to marine mammals or sea turtles, consultations or incidental harassment authorizations with appropriate agencies would be required prior to project implementation.
- Construction in upland 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, bird and terrestrial wildlife individuals that forage or nest in or near the work area could be temporarily disturbed or displaced. Effects could vary from minor and short-term to major and long-term depending on the effect of the action. If projects have potential to adversely affect protected bird species, consultations with the appropriate agencies would be required prior to project implementation.

Additional long-term minor to moderate adverse effects to species could result from the placement of piers, foundations, or other permanent structures; fill of shallow water areas; increased human traffic, and the conversion of pervious areas to impervious surfaces (parking areas, buildings, etc.). These actions could result in disturbance or displacement of local species. Construction of educational or cultural facilities could result in operational effects that could affect living coastal and marine resources, including:

- Stormwater runoff from impervious surfaces could enter waterways and increase situation and turbidity as well as carry pollutants that could affect benthic organisms, fish or foraging bird species;
- Increase in visitation could result in noise and other disturbances as well as degradation or fragmentation of habitats or upland areas used by wildlife in the vicinity;
- Potential for introduction of exotic or invasive species may increase;
- Facilities that included in-water educational activities could increase human-related disturbances of fish, birds or marine mammals that may be present in the waterway.
- If projects have potential to adversely affect protected species, consultations with the appropriate agencies would be required prior to project implementation.

6.6 Alternatives 3 (and 4): Human Uses and Socioeconomics

This section describes the environmental consequences of Alternative 3 for human uses and socioeconomics.[7] These impacts consider the three relevant project types that are identified in Chapter 5 together by resource area. Because Alternative 4 is inclusive of Alternative 3, the analysis of environmental consequences for these project types is the same for Alternative 4 as Alternative 3.

6.6.1 Socioeconomics and Environmental Justice

The environmental setting of a project area can be viewed from both a geographic perspective and a human perspective. The physical environment provides a geographical context for the populations to be evaluated in this Environmental Impact Statement. The human perspective encompasses race, ethnic origin, and economic status of affected groups.

The intent of an environmental justice evaluation under Executive Order 12898,"Federal Actions to Address Environmental Justice in Minority and Low Income Populations" (1994), is to identify communities and groups that meet environmental justice criteria, and suggest strategies to reduce potential adverse impacts of projects on affected groups. The purpose of Executive Order 12898 is to identify and address the disproportionate placement of adverse environmental, economic, social, or health impacts from Federal actions and policies on minority and/or low-income communities. This order requires lead agencies to evaluate impacts on minority or low-income populations during preparation of environmental and socioeconomic analyses of projects or programs that are proposed, funded, or licensed by Federal agencies.

According to CEQ and U.S. Environmental Protection Agency guidelines established to assist Federal and State agencies, a minority population is present in a project area if (1) the minority population of the affected area exceeds 50 percent, or (2) the minority-population percentage of the affected area is meaningfully greater than the minority-population percentage in the general population or other appropriate unit of geographic analysis. By the same rule, a low-income population exists if the project area consists of 50 percent or more people living below the poverty threshold, as defined by the U.S.

[7] The term "human use" in this chapter, and in chapters 8-12, is specific to the evaluation under NEPA of the potential impacts on those aspects of the human environment not addressed in the assessment of the physical and biological environments. The term 'human use' here is not intended to address or substitute for an evaluation of human use in the context of OPA or the OPA implementing regulations.

Census Bureau, or is meaningfully greater than the poverty percentage of the general population or other appropriate unit of geographic analysis.

The CEQ guidance indicates that when agencies determine whether environmental effects are disproportionately high and adverse, they are to consider whether there is or would be an impact on the natural or physical environment (as defined by NEPA) that would adversely affect a minority population or low-income population.

None of the published guidelines define the term "disproportionately high and adverse," but CEQ includes a nonquantitative definition stating that an effect is disproportionate if it appreciably exceeds the risk or rate to the general population (CEQ 1997).

The project types proposed under Alternatives 3 and 4 are not, in general, expected to create a disproportionately high and adverse effect on a minority or low-income population; however, population characteristics, including race and ethnicity and per-capita income as it relates to the poverty level as well as effect determinations are considered for the environmental justice analyses in Chapters 8 through 12 and would be considered in future phases of Early Restoration.

Project spending under Alternative 3 (and 4) would also benefit regional economies. Project construction or implementation spending is likely to occur under projects to enhance public access to natural resources for recreational use and to enhance recreational experiences, including creating new and improved infrastructure for public access, improvements to parks and marinas, renourishing beaches, placing materials to create reef structures, construction of new facilities (bathrooms, lodging, piers, ramps), and removing land-based debris. Project spending would support workforce to design, engineer, manage, and carry out the projects. Additionally, locally purchased (or rented) equipment and materials would also benefit the regional economy.

A number of industries would benefit from the Alternative 3 (and 4) project types, including construction, dredging, recreation service providers, and natural resources educational and outreach consultants.

Short-term beneficial impacts to the local and regional economy would occur from construction jobs and workforce for Alternative 3. These jobs would support income, sales, and downstream economic activity in the regional economy. The level of regional benefit would vary by project and would depend on the magnitude and level of effort necessary for each project, the sourcing of labor and materials, and the size of the economy in which the project is located. In smaller or more remote communities, these project workers may bring proportionally more benefits in terms of jobs and income to the economy than in large urban areas.

Depending on the type and location of the project, these implications could have a beneficial or at most a minor adverse impact on socioeconomic characteristics. For example, acquisition of lands for conservation or protection purposes could reduce the tax base for property tax collections; however, improvements in habitat associated with this project may draw additional visitors to the area with associated visitor spending, increasing sales and tax receipts on retail purchases. Adverse impacts to property taxes would vary by the property involved and would depend on the assessed value of the property, which would vary depending on its location. The relative importance of the taxes to the

county would also affect the level of impact. It is anticipated that only a few properties would be impacted.

Long-term job creation could also occur under Alternative 3. This type of benefit would be associated with project types and techniques that have the potential to increase tourism and visitation to an area, such as creating or improving new recreational facilities and infrastructure and renourishing beaches, and improving the quantity and quality or recreational opportunities such as the installation of artificial reefs. Long-term benefits to socioeconomic characteristics could be anticipated as a result of artificial reef creation from increased recreational opportunities such as fishing, diving, and snorkeling. Additionally, long-term job creation could also occur with project types that increase public access for recreational use and support facilities and programs for environmental and cultural stewardship, education, and outreach. These projects may require additional staffing, specialists, and others in the support of new programs or facilities, which would have beneficial impacts to the regional economy.

6.6.2 Cultural Resources

Project types under Alternative 3 that are centered on the enhancement of public access and recreational experiences could potentially have a minor to moderate long-term adverse impact on cultural resources from ground and substrate disturbing construction activities and dredging activities, as discussed for Alternative 2. In addition, the likely increase in visitor use, over time, could lead to the inadvertent discovery of newly exposed cultural resource sites and an increase in the frequency of unauthorized collection of artifacts and vandalism. Long-term beneficial impacts could occur if discoveries follow proper procedures leading to their protection.

All projects conducted as part of Early Restoration would secure all necessary state and federal permits, authorizations, consultations or other regulatory processes related to sensitive habitats (e.g. wetlands or Essential Fish Habitat)) and protected species (e.g. marine mammals such as manatee, federal or listed species such as sea turtles, etc.), and other applicable requirements. In particular, a complete review of proposed projects under Section 106 of the NHPA will be completed as environmental review continues. Tribal Consultations would be initiated with all interested federally recognized tribes. Projects will be implemented in accordance with all applicable laws and regulations concerning the protection of cultural and historic resources. Project-specific analyses of potential impacts to cultural resources are presented in Chapters 8 through 12 and would be for future phases of Early Restoration.

While the potential for impacts to cultural resources should be mitigated through BMPs and the Section 106 process, some projects have the potential to adversely impact cultural resources. In particular, under Alternatives 3 and 4, project types involving the removal and placement of dredged materials and ground or substrate disturbing construction activities have the potential to lead to short and long-term minor to moderate impacts to cultural resources stemming from the potential for inadvertent damage to unknown sites, buildings, structures, or objects. In addition, the use of oyster shells to construct reefs raises the possibility of inadvertent site destruction, because some shell deposits along the coast have accumulated due to prehistoric human activity. Potential source areas of oyster shell would have to be assessed for human or natural accumulations before they are used for construction. Similarly, projects requiring the filling of canals would need to consider whether the canals qualify as historic properties under Section 106.

If not properly conducted, activities conducted under Alternatives 3 and 4 have the potential to compromise a site's integrity and cause a loss of cultural information. BMPs and other mitigation measures that may be employed, depending on site-specific considerations, to further minimize or contain adverse impacts to cultural resources are detailed in Appendix 6-A.

These same project types under Alternatives 2 and 4 could lead to long-term beneficial impacts through the identification of cultural resources. Cultural or historical sites that may otherwise have been unknown or unprotected may benefit from the NHPA Section 106 review process that could require it be avoided and preserved in its natural state. In this manner, some information may be retrieved and future impacts could be avoided.

6.6.3 Infrastructure

Project types implemented under Alternative 3 (and 4) that involve ground- and substrate- disturbing construction activities could lead to short and long-term minor to major adverse impacts to infrastructure. These impacts would result if there were inadvertent damage to unknown submerged offshore pipeline infrastructure or buried onshore utility infrastructure resulting from dredging associated with navigational channel improvements or damage to buried onshore infrastructure associated with the construction boat ramps, piers, public bathrooms, camp sites, or other recreational and public access facilities. An analysis describing the probability and severity of such potential incidents has not been conducted at the programmatic level for this document. As appropriate on a project-specific basis, surveys would be conducted to locate and aid in avoiding or minimizing potential impacts to buried and submerged infrastructure as a result of specific project activities.

Many of the project types discussed under Alternative 3 would involve the transport of construction vehicles, equipment, and materials. These project types, which include techniques such as placement of artificial reef structures; construction of boardwalks, trails, roads, bridges and other types of public access; and the construction of boat ramps, piers, public bathrooms, lodging facilities and similar amenities, could lead to short and long-term minor to major impacts on infrastructure. The impacts associated with these projects would result from increases in construction traffic; temporary or permanent closure of roads, parking lots, or facilities; or damage to roadways or other infrastructure that provides access to the shoreline. The impacts to existing infrastructure, such as roadways, could also occur from increased vehicle use as a result of increased visitor use over time. These impacts would range in intensity based on the duration of road, parking lot or public access closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of damage to roadways, facilities or access points. Future infrastructure improvements or increased maintenance could be necessary to address impacts to infrastructure.

Projects that upgrade existing infrastructure or add new infrastructure, such as navigational improvements; construction of boat ramps, piers, public bathrooms, and lodging facilities; the construction of trails, boardwalks, and similar types of public access; and many of the other project types discussed above, would have long-term beneficial impacts to infrastructure.

In some cases, increased use of enhanced or created recreational facilities could result in indirect impacts to existing infrastructure such as roads, parking lots, bathrooms, or similar public facilities. These effects are anticipated to be minor and localized and would be long term.

Projects that enhance public access to natural resources for recreational use, enhance recreational experiences, and/or promote environmental and cultural stewardship, education, and outreach, that would not involve construction activities, such as the development of natural resource-related educational programs or research and development to enhance management of recreational fisheries, would have no impacts on infrastructure.

6.6.4 Land and Marine Management

Projects implemented under Alternative 3 would have varying impacts on land and marine management depending on the type of management or land ownership applicable to the project site. Projects would generally be consistent with the prevailing management plans and direction governing the use of the land and marine areas where the projects would take place; therefore, the project types that would be implemented under Alternative 3 are generally expected to have no adverse impacts to land and marine management.

Projects implemented at national, state and local parks, wildlife refuges, and wildlife management areas could have short-term minor to moderate adverse impacts to land and marine management. These impacts would be temporary, and would occur as a result of construction activities related to projects such as the construction of new roads, trails, boardwalks, and other public access improvements; or the construction of boat ramps, piers, lodging facilities, public restroom, campgrounds, and similar facilities. Impacts would be related to temporary, full or partial closures of parks and refuges. In the long-term, projects implemented under Alternative 3 would have beneficial impacts on land and marine management at parks and wildlife refuges, and wildlife management areas because these activities would improve public access and amenities, helping park management and staff fulfill their obligations to manage these properties for the benefit of the environment and human enjoyment.

Most land trusts in the northern Gulf of Mexico region are focused on conservation of critical natural habitat; some land trusts also promote educational and recreational opportunities. Therefore, it is unlikely that projects implemented under Alternative 3 would have impacts to land and marine management on trust lands. Short-term minor to moderate adverse impacts could occur during construction activities to the extent that those activities interfere with the trusts' abilities to fulfill their management obligations as set forth in the trusts' charters or in the deeds to the specific parcels of land. In the long-term, there would be beneficial impacts to land and marine management from projects aimed at providing and enhancing access and recreational opportunities.

Projects that may be implemented within marine protected areas under Alternative 3, such as the placement of artificial reef structures, could have some short-term minor to moderate adverse impacts if these activities require temporary closure of areas that are managed for fishing or other types of recreation. However, because those projects would need to conform to the management plans and direction governing where reef materials may be placed, the impacts to marine management in those cases would be beneficial.

6.6.5 Tourism and Recreational Use

Under Alternative 3, project types that involve the removal and placement of dredged materials and ground or substrate disturbing construction activities including access improvement projects would result in some short-term minor to moderate adverse impacts to wildlife viewing, hunting, beach and waterfront access, fishing and tourism. The intensities of impact to the various resources are highly

dependent on the proximity of projects to the affected resources, with impacts being highly localized to specific project areas. Impacts such as site closures as a result of these project types would be experienced at greater levels in areas with fewer alternate tourism and recreation options, including barrier islands and less populated and/or rural areas leading to short-term minor to moderate adverse impacts in these types of locations. Impacts as a result of these project types could be particularly perceptible to people engaged in hunting, fishing, tourism and beach and waterfront visitation as a result of the temporary displacement of wildlife (particularly waterfowl) due to disturbances from construction. If these closures occur in areas with high levels of hunting, fishing, and tourist activity such as beach and waterfront visitation occurs, adverse impacts would be readily apparent to resource users, who may choose to pursue these recreational activities in different locations.

Project types that include techniques for improving public access would result in long-term beneficial impacts to tourism and recreational experiences by creating new or improved infrastructure and connectedness to these resource areas and amenities. However, increase recreational use could also result in some level of user conflict either for the same resource (e.g., higher recreational fishing pressures closer to infrastructure) or over different recreational activities (e.g. wildlife viewing or hiking and hunting).

Recreational enhancement project types that include techniques such as beach re-nourishment, placing materials to create reef structures, and enhancing recreational infrastructure could provide long-term benefits to tourist and recreational uses by improving wildlife habitat, and increasing recreational amenities (such as beach facilities). As a result, these types of projects would enhance wildlife viewing, hunting, beach and waterfront visitors, fishing and tourist experiences and provide additional areas in which to experience these opportunities.

Project types designed to promote environmental and cultural stewardship, education and outreach are not anticipated to have adverse effects on tourism, other than minor disruptions that could be associated with construction of new facilities. This Alternative is anticipated to lead to long-term beneficial impacts through the expansion of education and stewardship programs.

6.6.6 Fisheries and Aquaculture

Alternative 3 project types intended to enhance recreational experiences, such as those to re-nourish beaches and place stone and materials may result in short-term adverse impacts to nearshore fisheries from construction and restoration activities involving the use of in-water equipment, dredge and placement activities, or creating and placing reef structures. The potential for the displacement of sand and sediment causing increased turbidity and the potential for spills and leaks from equipment could affect water quality and aquatic habitat. The degree to which these effects would create tangible impacts to fisheries is dependent on the actual location of project activities and the proximity to fishery operations, ranging from no short-term impacts to moderate short-term adverse impacts.

Projects to enhance recreational experiences may include stock enhancement, which could result in additional catch for commercial fishing benefitting harvest, landings, sales, and processing industries. In addition, the use of aquaculture operations to rear finfish and shellfish for release could result in refinement and improvement of aquaculture techniques for future use, which would benefit future aquaculture operations.

6.6.7 Marine Transportation

Alternative 3 project types involving dredging, trenching, and ground or substrate disturbing construction activities and debris removal would have short-term minor adverse impacts to marine transportation in the event that shipping routes are blocked or obstructed by dredging equipment or barges or from increases in marine traffic. These impacts would occur in highly localized areas and would be within marine transportation operational capacities to withstand. Project types that enhance or increase public access or enhance recreational experiences could result in long-term minor adverse impacts to marine transit from increased recreational boat traffic and ferry traffic obstructing or slowing of commercial shipping traffic. However, given the low likelihood of recreational use of commercial shipping channels in general, it is anticipated that any such impacts would be minor. In addition, placement of signage, buoys, or other markers to alert recreational boaters to the location of commercial navigation channels would likely reduce these long-term impacts.

Although all of these project types are geared toward recreational rather than purely commercial uses, some could have long-term beneficial impacts to marine transportation if existing navigational infrastructure is improved. The construction of navigational aids, safe harbor improvements, and the dredging of navigational channels in particular would have long-term beneficial impacts on marine transportation.

6.6.8 Aesthetics and Visual Resources

All project types under Alternative 3 would have minor to moderate short-term adverse impacts from the temporary landscape during the construction period from the presence of bulldozers, front-loaders and other large earth moving equipment required for upgrades or new facilities. These impacts would constitute a change in the viewshed that is readily apparent and which would attract attention in the short-term. Although such changes would not dominate the viewscape, they could detract from the current user activities or experiences. Over the long-term, the addition of infrastructure and facilities into the existing setting would present some degree of visual contrast. Long-term adverse effects of these enhancements would range from minor to moderate, depending on the existing aesthetic character of the surrounding landscape. Where the addition of these facility enhancements into the existing setting would present a large degree of visual contrast, impacts would be moderate because they would detract from the current user activities or experiences. Where the additional infrastructure would be incorporated into landscapes that are already characterized by human-made features, impacts would be at most minor.

Projects that enhance public access and recreational experiences may have some long-term visual and aesthetic benefits (e.g., conducting beach renourishment; removal of land-based debris). However, as noted above, other projects may not have benefits to aesthetic resources, and may result in long-term minor to moderate adverse impacts (e.g, infrastructure enhancement such as improvement or expansions of boat ramps).

6.6.9 Public Health and Safety, Including Flood and Shoreline Protection

Project types under Alternative 3 involving construction and construction activities would result in short-term minor adverse impacts to public health and safety as a result of the operation of heavy equipment and construction materials as well as the potential of hazardous waste and materials contaminating

soils, groundwater, and surface waters. Projects would be designed using similar safety-related BMPs to reduce hazards.

Projects centered on enhancing public access of areas would likely lead to long-term beneficial impacts to public safety by providing access to sites that currently lack infrastructure or require infrastructure improvements. However, projects that result in hardening of the shoreline, e.g., boat ramp improvements, would also lead to long-term minor adverse impacts related to flood and shoreline protection. Projects resulting in increased visitor use could cause visitor conflicts and associated safety issues (e.g., increase recreational boat traffic), which result in required additional law enforcement during certain high use times. However, impacts to public health and safety would likely be minor.

Long-term beneficial impacts to public health and safety could be experienced through the promotion environmental and cultural stewardship, education and outreach project types in the event that users of the sites are more knowledgeable about potential harms in the project areas.

6.7 Range of Direct and Indirect Impacts of Alternatives

Previous sections of Chapter 6 assessed the direct and indirect impacts associated with each proposed project type, organized by action alternative. Tables 6-3 and 6-4 provide an overview of the potential impacts to key resource areas for each alternative by project type. Because this PEIS identifies a number of types of potential projects that may occur, a range of impacts is anticipated for each resource. The range presented here represents the range of impacts estimated for each resource (e.g., minor to moderate) that is reported in each of the more specific project-type-level analyses. For example, if analyses for Project Types 1 through 4 report "minor" effects to a particular resource is likely under alternative 2, but Project Types 5 through 9 found that effects were likely to be moderate to major for that resources, Table 6-3 and 6-4 would report "minor to major" impacts for that resource. In a few cases, possible but rare or improbable impacts are described in the text, but are not shown in the table.[8] Specific impacts of Alternatives, when implemented, would depend on where individual projects may occur, the timing of proposed construction and other activities, and the scale of the proposed activities. This table provides a basis for comparing the ranges for the environmental impacts of the alternatives. Section 6.9 describes potential cumulative impacts of the alternatives by resource.

As shown in Table 6-3 and 6-4, most resources are expected to experience benefits across all alternatives. However, Table 6-3 and 6-4 do not capture the magnitude or duration of potential benefits. The Table also does not identify benefits relative to potential adverse impacts, i.e., it is not intended to represent "net" benefits attributed to individual project types or alternatives. As reported in the detailed text in above sections, benefits may include direct benefits, such as habitat improvements that are the focus of a particular restoration activity (e.g., wetland restoration), as well as indirect benefits to other resources that may occur as a result of the habitat improvement (e.g., improvements to water quality and aesthetics). Because of their defined focuses, Alternative 2, in general, has more direct benefits to physical and biological environments, while Alternative 3 has more direct benefits to

[8] In particular, refer to the Hydrology and Water Quality (Enhance Public Access to Natural Resources for Recreational Use), and the Living Coastal and Marine Resources and Habitats discussions for Project Types 10 (Enhance Public Access to Natural Resources for Recreational Use) and 11 (Enhance Recreational Experiences).

human use and socioeconomic environments. Indirect effects vary widely, and are described in more detail in above sections.

Adverse impacts for all Alternatives range from No Effect to Major impacts, depending on the resource. Impacts to habitats, hydrology and water quality, and noise are anticipated to be higher in Alternatives 3 and 4 than in Alternative 2. Adverse impacts that affect socioeconomics are expected to range from minor to moderate under Alternatives 3 and 4, as opposed to minor under Alternative 2. A summary of impacts by resource and alternative is provided below. The Trustees note that there are differences in environmental consequences that could result from recreational use project types as compared to ecological project types. Tables 6-3 and 6-4 present a range of potential impacts (e.g., minor to moderate) for each alternative, as, particularly for Alternative 4, the relative amount of recreational use restoration and ecological restoration that may ultimately occur are not known at this time. Project-specific analyses in Chapters 8 - 12 and in any future tiered analyses will describe the specific impacts associated with the specific proposed projects.

Table 6-3. Benefits and Adverse Impacts of Alternatives by Resource and Project Type

Benefit	No Effect	Minor Adverse Effect	Minor to Moderate Adverse Effect	Moderate Adverse Effect	Minor to Major Adverse Effect	Moderate to Major Adverse Effect	Major Adverse Effect
B	0	1	2	3	4	5	6

Alternative			Alternative 4												
			Alternative 2										Alternative 3		
Resources	**Sub-Resources**	**Short Term / Long Term**	**Create & Improve Wetlands**	**Protect Shorelines / Reduce Erosion**	**Restore Barrier Islands and Beaches**	**Restore & Protect SAV**	**Conserve Habitat**	**Restore Oysters**	**Restore & Protect Finfish & Shellfish**	**Restore & Protect Birds**	**Restore & Protect Sea Turtles**	**Enhance Public Access to Natural Resources for Recreational Use**	**Enhance Recreational Experiences**	**Promote Environmental and Cultural Stewardship, Education, and Outreach**
Geology and Substrates	Upland Geology and Soil; Nearshore Coastal Geology and Sediment	Short Term	2	1	1	1	2	1	1	1	1	2	2	2
		Long Term	2 B	2 B	2 B	1 B	B	1 B	0	B	B	2 B	2 B	2
Hydrology and Water Quality	Freshwater and Coastal Water Environments	Short Term	1	1	1	1	2	1	1	1	1	2	2	2
		Long Term	B	1 B	B	B	B	B	B	B	B	1 B	1	1
Air Quality	–	Short Term	2	2	2	2	2	1	1	2	2	2	2	2
		Long Term	0	0	0	0	0	0	0	0	0	1	1	1
Noise	–	Short Term	2	2	4	2	2	1	2	4	4	4	4	2
		Long Term	0	0	0	0	1	0	0	0	0	2	2	2
Habitats	Wetlands, Barrier Islands; Beaches and Dunes; Submerged Aquatic Vegetation; Other Habitats in the Coastal Environment of the Northern Gulf of Mexico	Short Term	2	2	2	2	2	1	1	2	2	2	2	2
		Long Term	2 B	2 B	2 B	2 B	2 B	B	B	1 B	2 B	2	2	2 B
Living Coastal and Marine Resources	Nearshore Benthic Communities; Oysters; Pelagic Microfaunal Communities; Sargassum; Finfish; Sea Turtles; Marine Mammals; Birds; Terrestrial Wildlife	Short Term	1	2	2	1	2	1	1	1	1	2	2	2
		Long Term	1 B	2 B	2 B	B	2 B	1 B	1 B	B	1 B	2	2	2 B
Socioeconomics and Environmental Justice*	–	Short Term	B	B	B	B	B	B	B	B	B	B	B	B
		Long Term	1 B	1 B	1 B	1 B	1 B	1 B	1 B	1 B	1 B	1 B	1 B	1 B
Cultural Resources **	–	**Short Term**	2	2	2	2	2	2	0	2	2	2	2	2
		Long Term	2 B	2 B	2 B	2 B	2 B	2 B	0	2 B	2 B	2 B	2 B	2 B
Infrastructure	–	**Short Term**	4	4	4	4	4	4	0	4	4	4	4	4
		Long Term	4 B	4 B	4 B	4 B	4 B	4 B	0	4 B	4	1 B	1 B	1 B
Land and Marine Management	National and State Parks; Refuges and WMAs; Land Trusts; Marine Protected Areas	**Short Term**	2	2	2	2	2	2	2	2	2	2	2	2
		Long Term	B	B	B	B	B	B	B	B	B	B	B	B
Tourism and Recreation Use	Wildlife Observation; Hunting; Beach and Waterfront (swimming, sightseeing, etc.); Boating; Recreational Fishing; Tourism; Museums, Cultural Resources, and Education Centers	**Short Term**	2	2	2	2	2	2	0	2	2	2	2	2
		Long Term	B	B	B	B	B	B	0	B	B	B	B	B

Alternative		Alternative 4												
		Alternative 2										Alternative 3		
Resources	**Sub-Resources**	**Short Term / Long Term**	**Create & Improve Wetlands**	**Protect Shorelines / Reduce Erosion**	**Restore Barrier Islands and Beaches**	**Restore & Protect SAV**	**Conserve Habitat**	**Restore Oysters**	**Restore & Protect Finfish & Shellfish**	**Restore & Protect Birds**	**Restore & Protect Sea Turtles**	**Enhance Public Access to Natural Resources for Recreational Use**	**Enhance Recreational Experiences**	**Promote Environmental and Cultural Stewardship, Education, and Outreach**
Fisheries and Aquaculture	Commercial Fishing; Shellfish Fishery; Seafood Processing and Sales; Aquaculture	Short Term	2	2	2	2	2	2	2	2	0	2	2	2
		Long Term	B	B	B	B	0	B	B	0	0	B	B	B
Marine Transportation	–	Short Term	1	1	1	1	0	1	0	1	0	1	1	0
		Long Term	B	B	B	0	0	0	0	B	0	B	B	B
Aesthetics and Visual Res.	–	Short Term	2	2	4	2	2	2	0	4	2	2	2	2
		Long Term	B	1 B	B	1 B	B	0	0	B	0	2 B	2 B	2 B
Public Health and Safety, including Flood and Shoreline	–	Short Term	1	1	1	1	0	1	0	1	1	1	1	1
		Long Term	B	B	B	B	B	B	0	B	B	1 B	1 B	B

Notes: The Trustees note that there are differences in environmental consequences that could result from recreational use project types as compared to ecological project types. Tables 6-3 and 6-4 present a range of potential impacts (e.g., minor to moderate) for each alternative, as, particularly for Alternative 4, the relative amount of recreational use restoration and ecological restoration that may ultimately occur are not known at this time. Project-specific analyses in Chapters 8 - 12 and in any future tiered analyses will describe the specific impacts associated with the specific proposed projects. The rating system reflects the range of impacts that could occur to each resource by project type. It is important to note that all techniques within a project type would not necessarily have the same level of impacts on resources. That is, some techniques could have no effect on the specific resource area. In a few cases, possible but rare or improbable impacts are described in the text, but are not shown in the Exhibit. In particular, refer to the Hydrology and Water Quality section for Project Type 10 (Enhance Public Access to Natural Resources for Recreational Use), and the Living Coastal and Marine Resources and Habitats discussions for Project Types 10 (Enhance Public Access to Natural Resources for Recreational Use) and 11 (Enhance Recreational Experiences). Specific impacts would depend on where individual projects may occur, the timing of proposed construction and other activities, and the scale of the proposed activities. Thus, the above summary describes generally the level and type of effects anticipated from project types to resources. Because this PEIS identifies a number of types of potential projects that may occur, a range of impacts is anticipated. More specific descriptions of impacts can be found in the text.

* Note that Socioeconomics and Environmental Justice are combined under a single heading in this table and the following analysis. However, consistent with EO 12898, benefits to Environmental Justice were not evaluated in this document; hence the findings summarized in this table reflect only socioeconomic considerations.

**Project types under all Alternatives could lead to long-term beneficial impacts through the identification of cultural resources. Cultural or historical sites that may otherwise have been unknown or unprotected may benefit from the NHPA Sectio106 review process that could require it be avoided and preserved in its natural state. In this manner, some information may be retrieved and future impacts could be avoided. Although minor to moderate adverse effects could occur if cultural resources are present at project sites involving dredge, fill or ground-disturbing activities, a Section 106 consultation would be completed prior to implementation of these activities and appropriate avoidance and mitigation measures would be implemented prior to commencement of ground disturbing activities

Table 6-4. Benefits and Adverse Impacts of Alternatives by Resource and Alternative

Resources	Sub-Resources	Duration	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
Geology and Substrates	Upland Geology and Soil; Nearshore Coastal Geology and Sediment	Short Term	**0**	2		2		2	
		Long Term	**0**	2	B	2	B	2	B
Hydrology and Water Quality	Freshwater and Coastal Water Environments	Short Term	**0**	2	B	2		2	
		Long Term	**0**	1	B	1		1	B
Air Quality	-	Short Term	**0**	2		2		2	
		Long Term	**0**	0		1		1	
Noise	-	Short Term	**0**	4		4		4	
		Long Term	**0**	0		2		2	
Habitats	Wetlands, Barrier Islands; Beaches and Dunes; Submerged Aquatic Vegetation; Other Habitats in the Coastal Environment of the Northern Gulf of Mexico	Short Term	**0**	2		2		2	
		Long Term	**0**	2	B	2	B	2	B
Living Coastal and Marine Resources	Nearshore Benthic Communities; Oysters; Pelagic Microfaunal Communities; Sargassum; Finfish; Sea Turtles; Marine Mammals; Birds; Terrestrial Wildlife	Short Term	**0**	2		2		2	
		Long Term	**0**	2	B	2	B	2	B
Socioeconomics and Environmental Justice*	-	Short Term	**0**	B		B		B	
		Long Term	**0**	B		1	B	1	B
Cultural Resources **	-	Short Term	**0**	2		2		2	
		Long Term	**0**	2	B	2	B	2	B
Infrastructure	-	Short Term	**0**	4		4		4	
		Long Term	**0**	4	B	1	B	4	B
Land and Marine Management	National and State Parks; Refuges and WMAs; Land Trusts; Marine Protected Areas	Short Term	**0**	2		2		2	
		Long Term	**0**	B		B		B	

Resources	Sub-Resources	Duration	Alternative 1	Alternative 2		Alternative 3		Alternative 4	
Tourism and Recreation Use	Wildlife Observation; Hunting; Beach and Waterfront (swimming, sightseeing, etc.); Boating; Recreational Fishing; Tourism; Museums, Cultural Resources, and Education Centers	Short Term	**0**	2		2		2	
		Long Term	**0**	B		B		B	
Fisheries and Aquaculture	Commercial Fishing; Shellfish Fishery; Seafood Processing and Sales; Aquaculture	Short Term	**0**	2		2		2	
		Long Term	**0**	B		B		B	
Marine Transportation	-	Short Term	**0**	1		1		1	
		Long Term	**0**	B		B		B	
Aesthetics and Visual Res.	-	Short Term	**0**	4		2		4	
		Long Term	**0**	2	B	2	B	2	B
Public Health and Safety, including Flood and Shoreline	-	Short Term	**0**	1		1		1	
		Long Term	**0**	B		1	B	1	B

Notes: The Trustees note that there are differences in environmental consequences that could result from recreational use project types as compared to ecological project types. Tables 6-3 and 6-4 present a range of potential impacts (e.g., minor to moderate) for each alternative, as, particularly for Alternative 4, the relative amount of recreational use restoration and ecological restoration that may ultimately occur are not known at this time. Project-specific analyses in Chapters 8 - 12 and in any future tiered analyses will describe the specific impacts associated with the specific proposed projects. The rating system reflects the range of impacts that could occur to each resource by project type. It is important to note that all techniques within a project type would not necessarily have the same level of impacts on resources. That is, some techniques could have no effect on the specific resource area. In a few cases, possible but rare or improbable impacts are described in the text, but are not shown in the Exhibit. In particular, refer to the Hydrology and Water Quality section for Project Type 10 (Enhance Public Access to Natural Resources for Recreational Use), and the Living Coastal and Marine Resources and Habitats discussions for Project Types 10 (Enhance Public Access to Natural Resources for Recreational Use) and 11 (Enhance Recreational Experiences). Specific impacts would depend on where individual projects may occur, the timing of proposed construction and other activities, and the scale of the proposed activities. Thus, the above summary describes generally the level and type of effects anticipated from project types to resources. Because this PEIS identifies a number of types of potential projects that may occur, a range of impacts is anticipated. More specific descriptions of impacts can be found in the text.

* Note that Socioeconomics and Environmental Justice are combined under a single heading in this table and the following analysis. However, consistent with EO 12898, benefits to Environmental Justice were not evaluated in this document; hence the findings summarized in this table reflect only socioeconomic considerations.

**Project types under all Alternatives could lead to long-term beneficial impacts through the identification of cultural resources. Cultural or historical sites that may otherwise have been unknown or unprotected may benefit from the NHPA Sectio106 review process that could require it be avoided and preserved in its natural state. In this manner, some information may be retrieved and future impacts could be avoided. Although minor to moderate adverse effects could occur if cultural resources are present at project sites involving dredge, fill or ground-disturbing activities, a Section 106 consultation would be completed prior to implementation of these activities and appropriate avoidance and mitigation measures would be implemented prior to commencement of ground disturbing activities.

6.7.1 Geology and Substrates

6.7.1.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) include project types such as create wetlands, restore barrier islands and beaches and conserve habitats. These actions 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. Removal of borrow materials would cause long-term minor impacts to localized areas. Construction activities could also cause long-term soil compaction. However, long-term benefits to geology and substrates are also expected, including reduction in sediment runoff decreased soil disturbance, reduction in erosion/loss of wetlands, stabilization of substrates, backfilling of submerged propeller scars. The effects of Alternatives 2 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term beneficial impacts.

6.7.1.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in minor to moderate short-term construction-related adverse impacts to geology and substrates, primarily related to equipment staging and use, and rutting. The placement of new structures such as piers, dune walkovers, or viewing platforms 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. Removal of borrow materials would cause long-term minor impacts to localized areas. Construction activities could also cause long-term soil compaction. However, long-term benefits to geology and substrates are also expected related to sediment deposition on beaches and creation of artificial reefs. Additional benefits could accrue where projects improve existing outdated or degraded infrastructure that cause erosion. The effects of Alternatives 3 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale.

6.7.2 Hydrology and Water Resources

6.7.2.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in 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 effects of Alternatives 2 (and 4) would vary depending on geographic

location, proximity of restoration projects to one another, and spatial scale. Direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term beneficial impacts.

6.7.2.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term construction-related adverse impacts, including increases in turbidity and sedimentation. In addition, these actions may result in minor long-term increases in stormwater runoff and pollutants as a result of conversion of pervious to impervious surfaces, discharge of fish hatchery effluent, and increased presence of boats and equipment in waterways. To the extent that projects replace or improve outdated or failing systems, long-term benefits may also accrue. The effects of Alternatives 3 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale.

6.7.3 Air Quality and Greenhouse Gases

6.7.3.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in short-term construction-related adverse impacts to air quality and GHG. The effects of Alternatives 2 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Project types that protect habitat or increase native vegetation would result in some level of CO_2 absorption; however, the benefits would be difficult to measure.

6.7.3.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term construction-related minor to moderate adverse impacts, including increases in air and greenhouse gas emissions. In addition, project types of Alternatives 3 (and 4) are expected to increase recreational use and visitation which would contribute to air quality and greenhouse gas emission rates in the long-term minor adverse impacts from the use of recreation equipment and vehicles (e.g., boats, cars, RVs) and from the operation and maintenance of certain facilities and services.

6.7.4 Noise

6.7.4.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) include project types such as create wetlands, restore SAV, restore barrier islands and beaches and

conserve habitats. These actions are expected to result in short-term minor to major construction-related adverse impacts to noise. Long-term noise impacts would only be expected in a case where newly conserved land was opened to recreational use. These impacts would be minor. The effects of Alternatives 2 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Alternatives 2 (and 4) are expected to have little long-term impacts to ambient noise conditions.

6.7.4.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term minor to major construction-related adverse impacts to noise. Long-term noise impacts would be expected where additional recreational use, in terms of foot, car, or boat traffic, is expected. These impacts would range from minor to moderate. The effects of Alternatives 3 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale.

6.7.5 Habitats

6.7.5.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast habitats, including sensitive habitats, would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Most Alternatives 2 (and 4) project types would 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.

However, since many of these project types focus on restoring or protecting natural resources, 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 SAV, and reefs. These project types could help reestablish native plant communities, stabilize substrates and support sediment deposition, strengthen shorelines, and reduce erosion.

6.7.5.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short- and long-term adverse impacts to habitats. The effects of Alternatives 3 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale.

Short-term adverse impacts would be related to construction or reconstruction activities such as those necessary for public access facilities, fish hatcheries, artificial reefs, campgrounds and education centers. Long-term adverse impacts include those that result from the operation, use and maintenance of facilities. These short- and long-term adverse impacts could include alteration of wetlands; covering, loss or shading of SAV or other habitats from placement of structures; filling of shallow water areas; localized plant species displacement or loss, introduction of invasive species, and degradation of habitats including potential habitat fragmentation as a result of an increased recreational activity and human use; increased soil erosion; changes in water quality from stormwater runoff associated with the conversion of upland pervious areas to impervious surfaces (parking areas, buildings, etc.) and increased turbidity and substrate disturbance from in-water work with heavy equipment or leaching of construction fluids.

Minor to moderate adverse effects such as habitat trade-offs could result from placement of artificial hard substrate on soft bottom habitat as a transition from naturally occurring soft bottom benthic communities and the managed species that utilize these areas could occur. Placement of artificial reef can also modify water circulation patterns and cause accretion or erosion of the adjacent habitats. Proper siting of artificial structures will minimize these potential impacts.

Some recreational enhancement projects may have long-term beneficial effects on habitats such as wetlands, barrier islands, beaches, coastal transition zones, SAV and shallow water habitats. For example, enhancement projects could reduce degradation and recreation use in habitats by redirecting use to a site that is more appropriate and conducive to recreational activities. These activities could also help stabilize substrates, support sediment deposition, and reduce erosion. In addition, the creation of artificial reefs could benefit sessile and benthic encrusting organisms by providing substrate and interstitial spaces for use as habitat and forage areas. Providing educational programs related to coastal resources could increase public awareness of Gulf Coast habitats by increasing public knowledge of, and support for, preservation and conservation of these habitats, as well as potentially resulting in behavioral changes during future public encounters with sensitive habitats.

6.7.6 Living Coastal and Marine Resources

6.7.6.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast habitats and restoring and protecting oysters and other shellfish, finfish, sea turtles, and birds would be undertaken. Most Alternatives 2 (and 4) 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. 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. Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by construction activity or sediment placement. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas.

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. In addition, construction activities could result in the destruction of sea turtle eggs, or other ground nesters, deposited within the boundaries of the proposed project. Lighting from construction activities could disturb or interfere with female turtles nesting attempts (e.g., false crawls or use of marginal or unsuitable nesting areas) and could disorient hatchling turtles as they emerge from the nest and crawl to the water.

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 bird or terrestrial wildlife that rest, roost, forage or nest in or near the work area could be temporarily disturbed or displaced. Beach nourishment activities can result in short-term and minor to moderate impacts (such as disturbance and reduced foraging efficiency) to shorebirds if the birds are roosting and feeding in the area during a migration stopover or could result in harm or mortality if birds are nesting in the area. Predator control could have an adverse impact to some species, since these efforts such as constructing barriers could also exclude other non-target species that utilize those areas.

Some Alternatives 2 (and 4) project types could result in long-term minor to moderate adverse impacts to living coastal and marine resources. Long-term minor to moderate adverse impacts could occur to living coastal and marine resources inhabiting areas 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. These structures could cause long term displacement of sea turtles as obstacles affecting the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest and crawl to the ocean. In addition, the change in sediment accretion could cause long term impacts to benthic communities including shellfish. Similar habitat impacts to beaches could result in the long term displacement of shorebirds or other animals that use different beach-related habitats.

Alternatives 2 (and 4) project types would result in long-term benefits to living coastal and marine resources. Project types that create or restore habitat, reduce erosion, improve water quality, and protect specific wildlife would have long term benefits for a variety of aquatic and terrestrial species. For example, the creation and restoration of wetlands could provide nesting and/or foraging habitat for birds as well as increasing habitat for terrestrial wildlife. Finfish could also benefit from wetlands restoration, which could provide habitat for foraging, spawning, and shelter. Restoring barrier islands and beaches could contribute to the quantity and quality of adjacent shallow water soft-bottom habitats that serve as nurseries and foraging areas for some finfish, while providing nesting habitat for birds.

6.7.6.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. The effects of Alternatives 3 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. These actions are expected to result in short-term construction-related adverse impacts. Enhancing or constructing infrastructure could require in-water work with heavy equipment and long-term operation and maintenance of these facilities. Some short-term minor adverse effects could occur if resources, including oysters, fish, sea turtles, marine mammals, benthic communities, and pelagic microfaunal communities, were present in the construction area. Possible impacts could include increased turbidity, reduction of water quality, noise pollution, vibration, and disruption to the water column and habitat. 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 communities. Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by equipment, human activity, or sediment. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and alteration or removal of habitat; however, effects would not be expected to reduce local fish populations.

Sensitive species such as sea turtles and marine mammals present in project areas where dredging, underwater use of equipment or reef placement could be subject to temporary increased noise, turbidity, and water quality changes as well as alteration or loss of forage or nesting habitat, all of which could temporarily displace individuals or prey during construction and result in short-term, minor impacts. Sea turtle and marine mammals may be present in project areas where use of explosives may be used to sink a vessel for creation of an artificial reef. Underwater explosions may affect marine life by causing death, injury, or behavioral reactions; depending on the distance an animal is located from a blast. This could result in short to long-term impacts to individuals and may result in minor to moderate impacts.

Some hatcheries/aquaculture operations could result in long-term minor adverse effects to marine mammals or fish through unintentional exposure to disease through release of contaminated effluent or infected fish. Stocking of hatchery-reared finfish could also negatively impact the genetic diversity of the wild stock and affect the balance of the fish community, competing for food and habitat resources with finfish species present in the receiving waters.

Construction in terrestrial habitats could result in short-term minor to moderate adverse 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, bird and terrestrial wildlife individuals that forage or nest in or near the work area could be temporarily disturbed or displaced. Stormwater runoff from impervious surfaces could enter waterways and increase turbidity as well as carry pollutants that could affect benthic organisms, fish or foraging bird species. Long-term minor to moderate adverse effects to species could result from the placement of piers, foundations, or other permanent structures; fill of shallow water areas; increased human traffic, and the conversion of pervious areas to impervious surfaces (parking areas, buildings, etc.). These actions could result in disturbance or displacement of local species. Increase sin visitation could result in noise and other disturbances as well as degradation or fragmentation of habitats and upland areas used by wildlife in the vicinity.

The creation of artificial reefs could provide indirect benefits to marine fish, marine mammals, sea turtles, and potentially oysters and shallow water coral by providing food, shelter, or spawning areas. Whether the availability of new habitat will serve to increase fish and/or invertebrate biomass or will only serve to concentrate organisms at the site, is likely dependent on where the reef is sited and how it is designed. Providing educational features through coastal exhibits and collections, hands-on activities, educational outreach programs related to coastal resources could increase public awareness of marine resources and of their value to the ecosystem. This could result in a long-term benefit to nearshore benthic communities, oysters, marine mammals and other species beyond the lifespan of the project. To the extent that projects replace or improve outdated or failing systems, long-term benefits may also accrue.

6.7.7 Socioeconomics and Environmental Justice

6.7.7.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) include project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions could cause short-term benefits to local economies, depending on the types of activities occurring. Workforce employment in construction, dredging, and barge operation activities would benefit regional economies from projects occurring under Alternatives 2 (and 4). Locally purchased (or rented) equipment and materials would benefit the regional economy, including increased jobs, income, sales, and tax receipts. Increased recreational use associated with Alternatives 3 (and 4) would be expected to lead to long term beneficial economic effects. Short-term minor to moderate adverse impacts, primarily associated with temporary closures of areas to recreational uses could also occur. Long-term minor adverse impacts to socioeconomic conditions are anticipated.

6.7.7.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Similar to Alternatives 2 (and 4), workforce employment in infrastructure construction would benefit regional economies from projects occurring under Alternatives 3 (and 4). Locally purchased (or rented) equipment and materials would benefit the regional economy, including increased jobs, income, sales, and tax receipts. Additional recreational infrastructure and amenities, such as facilities, boat ramps, bathrooms, boardwalks, and amenities would increase access and improve recreational experiences.

6.7.8 Cultural Resources

6.7.8.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) include project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Projects implemented under Alternatives 2 (and 4) 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 effects of Alternatives 2 (and 4) would vary depending on geographic location.

6.7.8.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Projects implemented under Alternatives 3 (and 4) 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 effects of Alternatives 3 (and 4) would vary depending on geographic location.

6.7.9 Infrastructure

6.7.9.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) include project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Projects requiring land-based construction activities and associated movement of construction materials and equipment by road could lead to short and long-term minor to major adverse impacts to infrastructure. Project types that enhance public access to natural resources for recreational use, enhance recreational experiences, and/or promote environmental and cultural stewardship, education, and outreach, may include construction activities such as backfilling of canals and shallow water bodies to create wetlands; removal of bulkheads, rip rap and other structures to restore hydrologic connectivity; dune restoration; or the placement of breakwaters or other engineered erosion control structures on the shoreline. Impacts would result from increases in construction traffic; temporary or permanent closure of roads or parking lots; or damage to roadways. These would range in intensity based on the duration of road or parking lot closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of roadway damage.

6.7.9.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Many of the project types discussed under Alternatives 3 (and 4) would involve the transport of construction vehicles, equipment, and materials. These project types, which include techniques such as placement of artificial reef structures; construction of boardwalks, trails, roads, bridges and other types of public access; and the construction of boat ramps, piers, public bathrooms, lodging facilities and similar amenities, could lead to short and long-term minor to major impacts on infrastructure. The impacts associated with these projects would result from increases in construction traffic; temporary or permanent closure of roads, parking lots, or facilities; or damage to roadways or other infrastructure that provides access to the shoreline. The impacts to existing infrastructure, such as roadways, could also occur from increased

vehicle use as a result of increased visitor use over time. These impacts would range in intensity based on the duration of road, parking lot or public access closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of damage to roadways, facilities or access points. Future infrastructure improvements or increased maintenance could be necessary to address impacts to infrastructure.

6.7.10 Land and Marine Management

6.7.10.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Actions that would result in the temporary or permanent partial or full closure of national, state and local parks, wildlife refuges, wildlife management areas and marine protected areas during construction would result in short-term minor to moderate adverse impacts, primarily from the interruption of operations and use and/or the furlough or reassignment of staff. In the 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. Restoration projects resulting in changes to land ownership and/or permitted uses including the use of fee acquisition could have long-term impacts; however, as the transactions are negotiated or arranged between willing parties it is not anticipated that adverse impacts to land and marine management would occur. The effects of Alternatives 2 (and 4) would vary depending on location, type of activity and existing management but overall direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term beneficial impacts.

6.7.10.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected lead to short-term adverse impacts, stemming from construction and land transfer activities that would result in the temporary full or partial closure of parks and refuges, in the interruption of operations, in furloughs or staff layoffs, or that would interfere with land managers' ability to fulfill management obligations and responsibilities. To the extent that projects better align management goals and assist management and staff to best manage properties for the benefit of the environmental and human environment, long-term benefits may also accrue. The effects of Alternatives 3 (and 4) would vary depending on geographic location, land ownership and project scale.

6.7.11 Tourism and Recreational Use

6.7.11.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), early restoration projects may include creating wetlands, restoring SAV, restoring barrier islands and beaches, and conserving habitats. During the construction and implementation period for projects conducted under Alternatives 2 (and 4), there would be short-term adverse impacts to recreation and tourism from temporary recreational site closures and adverse impacts on recreational experiences associated with noise, wildlife disturbances, view sheds, and other adverse impacts on recreational experiences. The effects of restoration actions would vary depending on their location and the rate of usage by tourists or recreation users. However, Alternatives 2 (and 4)

projects that result in higher quality habitats such as beach nourishment, living shorelines that that may be used for snorkeling, etc. would be expected to provide long-term benefits to tourism and recreational use. Some Alternatives 2 (and 4) projects may restrict some recreational uses such as boating or hiking in certain areas (e.g. SAV restoration sites or dune revegetation project areas). These restrictions would not be expected to substantially contribute to adverse effects to recreational uses because of the small geographic area likely to be restricted and the availability of other areas for those types of recreation. Other ongoing activities described in Appendix 6-B would be expected to continue.

6.7.11.2 Alternatives 3 (and 4)

Alternatives 3 (and 4) actions vary from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities specifically intended to provide educational awareness of Gulf Coast habitats (and associated species and cultural values). Cumulative effects associated with Alterative 3 would vary widely in both scope and severity depending on the location of specific actions. Alternatives 3 (and 4) projects may result in construction-related, short-term adverse impacts to recreation and tourism from temporary recreational site closures and adverse impacts on recreational experiences associ ated with noise, wildlife disturbances, visual impacts and other adverse impacts on recreational experiences. Impacts from ongoing and future actions would be similar to those described above for the No Action alternative. When combined there would likely be some short term adverse impacts to tourism and recreation during project construction, though timing of activities would likely avoid high visitation times if possible.

6.7.12 Fisheries and Aquaculture

6.7.12.1 Alternatives 2 (and 4)

Similar to the cumulative impacts described under Alternative 1, commercial fisheries would likely experience short-and long-term cumulative impacts depending on the particular species and harvest being impacted. Under Alternatives 2 (and 4), Early Restoration Programmatic Plan projects may include creating wetlands, restoring SAV, restoring barrier islands and beaches, and conserving habitats or protecting species. These actions could cause short-term adverse impacts to commercial fishing by limiting allowable catch. However, overall long-term benefits to commercial fisheries would be anticipated because of improved habitats that are important to a number of fish and shellfish species and potential for increased populations and species stability. These projects are unlikely to impact aquaculture. Other ongoing activities described in Appendix 6-B would be expected to continue.

6.7.12.2 Alternatives 3 (and 4)

Cumulative impacts to commercial fishing associated with Alternatives 3 (and 4), would be similar to Alternative 1. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities specifically intended to provide educational awareness of Gulf Coast habitats (and associated species and cultural values). Cumulative effects associated with Alterative 3 would vary widely in both scope and severity depending on the location of specific actions. Alternatives 3 (and 4) projects may result in adverse impacts during construction as a result of in-water disturbances such as pile driving and dredging. These potential adverse impacts would be offset to some degree by

the implementation of natural resource stewardship, water quality, and other NRDA and non-NRDA projects that result in benefits to the marine environment.

6.7.13 Marine Transportation

6.7.13.1 Alternatives 2 (and 4)

The effects of Alternatives 2 (and 4) would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Potential exists for multiple Alternatives 2 (and 4) projects to be conducted in a single water body. This may lead to additive effects such as limiting marine traffic in certain areas during construction that may be more readily apparent at the smaller spatial scale. Other impacts to marine transportation would be similar to those described under the No Action alternative. Over the long-term, Alternatives 2 (and 4) would not contribute to cumulative adverse impact to marine transportation based on the scale of projects and limited areas likely to be affected. Cumulative impacts to regional resources related to currently proposed Phase III Early Restoration projects proposed as part of this ERP/PEIS under Alternatives 2 (and 4) are discussed in Chapters 8 through 12.

6.7.13.2 Alternatives 3 (and 4)

Similar to Alternative 2, on-going and future activities such as those related to resource stewardship activities, water quality improvement programs, military operations, energy activities, and tourism and recreation, and construction activities associated with stewardship, NRDA, and non-NRDA restoration activities would impact marine transportation. Alternatives 3 (and 4) actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities specifically intended to provide educational awareness of Gulf Coast habitats (and associated species and cultural values). Cumulative effects associated with Alterative 3 would vary widely in both scope and severity depending on the location of specific actions. Alternatives 3 (and 4) projects may result in adverse impacts to marine transportation during construction if travel in certain areas is restricted, but these would not be expected to persist beyond construction. Therefore, Alternatives 3 (and 4) would not be expected to contribute incrementally to cumulative adverse impacts in the long-term.

6.7.14 Aesthetics and Visual Resources

6.7.14.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Construction-related actions 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. The effects of Alternatives 2 (and 4) would vary to a large degree on the location of the proposed projects, the degree to which these activities would be visible, and the duration of construction activities and how commonplace these activities are. 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. Direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term beneficial impacts.

6.7.14.2 Alternatives 3 (and 4)

Under Alternatives 3 (and 4), proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in minor to moderate short-term construction related adverse impacts as a result 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. The addition of infrastructure and facilities into the existing landscape would present some degree of visual contrast, with long-term impacts ranging from minor to moderate dependent on the existing visual quality of the area. Long-term benefits to aesthetics and visual resources are also expected for projects that while enhancing recreational opportunities while also improving habitat such as beach renourishment and removal of land based debris. Direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term minor to moderate adverse impacts.

6.7.15 Public Health and Safety, Including Flood and Shoreline Protection

6.7.15.1 Alternatives 2 (and 4)

Under Alternatives 2 (and 4), proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternatives 2 (and 4) includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions 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 could also result in 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. It is anticipated the effects of Alternatives 2 (and 4) would vary depending on the type of activity, the proximity of the public and measures in place to reduce the potential or to avoid these impacts. Direct and indirect effects of Alternatives 2 (and 4) would largely result in long-term beneficial impacts.

6.7.15.2 Alternatives 3 (and 4)

Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short-term construction-related minor adverse impacts, stemming from the operation of heavy-equipment and construction materials as well as from the potential of hazard waste and materials contaminating the environment. Increased visitor use stemming could cause visitor use conflicts, leading to short-term minor adverse impacts. Projects centered on enhancing public access of areas would likely lead to long-term beneficial impacts to public safety by providing access to sites that currently lack infrastructure or require infrastructure improvements. Similarly, long-term benefits could be experienced through the promotion environmental and cultural stewardship, education and outreach project types in the event that users of the sites are more knowledgeable about potential harms in the project areas.

6.8 Potential Cumulative Impacts

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). As stated in the CEQ handbook, "Considering Cumulative Effects" (CEQ 1997), cumulative impacts need to be analyzed in terms of the specific resource, ecosystem, and human community being affected and should focus on effects that are truly meaningful. Cumulative impacts should be considered for all alternatives, including Alternative 1 - No Action.

The cumulative impacts analysis considers past, present and reasonably foreseeable future actions and their associated effects throughout the northern Gulf of Mexico region (Appendix 6-B). Because examining impacts at the scale of the Gulf of Mexico is so broad as to dilute any potentially measurably cumulative impacts, the evaluation in this PEIS focuses on areas where Early Restoration projects would likely occur.

The following analysis considers cumulative impacts from a programmatic perspective (see section 6.8 for discussion of proposed Early Restoration Programmatic Plan cumulative impact analyses). The following section describes the multi-step approach used for evaluating cumulative impacts in this document.

6.8.1 Methodology for Assessing Cumulative Impacts

The analyses of cumulative impacts are typically accomplished using four steps:

Step 1 — Identify Resources Affected

In this step, each resource affected by the alternatives is identified. It is important to note that when direct and indirect impact analyses conclude that a particular resource is not affected, a cumulative impact analysis for that resource is not required. This approach is relevant to the cumulative impact analyses in Chapters 8 through 12, and would be considered in future phases of Early Restoration. The following cumulative impact analysis is organized in tables corresponding to specific affected resources.

Step 2 — Establish Boundaries

In order to identify the past, present, and reasonably foreseeable actions to consider in the cumulative impact analysis, affected resource-specific spatial and temporal boundaries must be identified. The spatial boundary is the area where past, present, and reasonably future actions have, are, or could take place and result in cumulative impacts to the affected resource when combined with the impacts of the alternatives being considered. The temporal boundary describes how far into the past and forward into the future actions should be considered in the impact analysis. Appropriate spatial and temporal boundaries may vary for each resource.

Step 3 — Identify Cumulative Action Scenario

In this step, the past, present, and reasonably foreseeable future actions to be included in the impact analysis for each specific affected resource are identified. These actions fall within the spatial and temporal boundaries established in Step 2. The following programmatic analysis groups specific actions

by cumulative action categories. These action categories are listed and described below. The more specific actions within each action category are listed in Appendix 6-B.

Step 4 — Cumulative Impact Analysis

This final step develops the analysis in the context of the affected environment of the incremental impact of the proposed action (X) when added to the impacts from applicable past, present, and reasonably foreseeable future actions (Y) to understand the potential cumulative impacts to an affected resource (Z), or, where the affects may interact and/or be additive, X+Y=Z.

6.8.2 Identification of Resources Affected and Boundaries of Analysis (Steps 1 and 2)

Resources Affected

The following section describes identifies the affected resources evaluated for cumulative impacts. In this Programmatic ERP/PEIS, cumulative impacts include all of the resources identified in the environment/affected resources sections. Specifically, the affected resources assessed include:

- Geology and Substrates
- Hydrology and Water Quality
- Air Quality
- Noise
- Habitats
- Living and Coastal Marine Resources
- Socioeconomics and Environmental Justice
- Cultural Resources
- Infrastructure
- Land and Marine Management
- Tourism and Recreation Use
- Fisheries and Aquaculture
- Marine Transportation
- Aesthetics and Visual Resources
- Public Health and Safety

Spatial Boundary of Analysis

As discussed above, the spatial boundaries used to provide the necessary context for the cumulative impact analysis typically are defined based on the particular resource being assessed. For the purpose of this analysis, the spatial boundary includes those areas where project types described in each alternative could likely occur, which is assumed to be the northern Gulf of Mexico region. More specifically, the study area includes coastal and adjacent counties/parishes and associated nearshore and marine environments where Early Restoration project types could occur. Chapters 8 through 12 describe more specific areas of analysis based on affected resources and project groupings for Phase III Early Restoration.

Temporal Boundary of Analysis Guidance on determining what actions to consider in the cumulative impact analysis comes from a variety of sources. The CEQ has produced several guidance documents, including a memorandum entitled "Guidance on Consideration of Past Actions in Cumulative Effects Analysis" (CEQ 2005). This CEQ document states that consideration of past actions is only necessary in so far as it informs agency decision-making. Typically the only types of past actions considered are those that continue to have present effects on the affected resources.[9] This present effect will dictate how far

[9] Note that the proposed Early Restoration actions are specifically intended to contribute to restoring for injuries resulting from this Spill. In addition, work continues on the injury assessment, as described in Chapter 4, and the actions proposed in this document consider the assessment described in Chapter 4. Therefore, the cumulative impact assessments (both programmatic and project-level) appropriately do not separately analyze the effects of the Spill itself.

into the past actions are considered and how typically the impacts of these past actions are largely captured in the discussion of the affected environment Chapter for each resource. The guidance states that "[a]gencies are not required to list or analyze the effects of individual past actions unless such information is necessary to describe the cumulative effect of all past actions." Agencies are allowed to aggregate the effects of past actions without delving into the historical details of individual past actions. Courts have agreed with this approach giving deference to CEQ's interpretation of NEPA and stating that, as it relates to past actions, NEPA requires "adequate cataloging of relevant past projects in the area" (Ecology Center v. Castaneda, 574 F.3d 652, 667 (9th Cir. 2009)).

Present actions are those that are currently occurring and also result in impacts to the same resources within the same spatial boundary that the alternatives impact. Reasonably foreseeable future actions are those actions that are likely to occur and affect the same resource as the proposed alternatives. The determination of what future actions should be considered requires a level of certainty that they will occur to ensure that the consideration of future actions is not overly speculative. This level of certainty could be met by a number of factors such as the completion of permit applications, the subject of approved proposals or planning documents, or other similar evidence.

Determining how far into the future to consider actions is based on the impact of the alternatives being considered. Once the impacts of the alternatives are no longer experienced by the affected resource then future actions beyond that need not be considered. For this ERP/PEIS, future actions were identified as those actions likely to be initiated prior to finalization of the DARP. Additional future actions were also identified that may occur beyond finalization of the final, comprehensive damages assessment and restoration plan that were determined to be reasonably foreseeable and likely to contribute to the overall cumulative impacts.

6.8.3 Categories of Cumulative Actions in the Northern Gulf of Mexico Region (Step 3)

In order to effectively consider the potential cumulative impacts at a programmatic level, categories of similar actions have been identified. Within these categories, examples of actual past, present, and reasonably foreseeable future actions are described (see also Appendix 6-B). There may be additional small scale activities not currently identified; however, the categories and their associated described actions provide the necessary information to fully understand the potential cumulative impacts that may be experienced by specific affected resources.

6.8.3.1 Restoration Related to the Deepwater Horizon Spill

There are a number of past, present or future restoration efforts and actions related to the Spill. Although the full extent of these restoration actions are not known at this time, multiple large-scale restoration efforts occurring in the Gulf are anticipated in coming years, and coordination between DWH Early Restoration will be important. A brief description of some of these programs is below.

Emergency Restoration and Phase I and II Early Restoration. Partial resolution of the *Deepwater Horizon* litigation has resulted in funding that has contributed to NRDA specific restoration activities in the Gulf including Emergency and Early Restoration. Emergency restoration actions are those taken by the Trustees prior to the completion of the NRDA and restoration planning process to prevent or reduce continuing natural resource injuries and avoid potentially irreversible loss of natural resources (15 CFR §990.26). In 2010, the trustees approved three emergency restoration projects focused on SAV, shorebird habitats, and sea turtles (USDOI 2011). In addition, the trustees and BP entered into an

agreement whereby BP set aside funds for early restoration projects agreed to by BP and the Trustees, and in accordance with applicable laws. These early restoration projects included eight early restoration projects developed in the *Deepwater Horizon Oil Spill Phase I Early Restoration Plan and Environmental Assessment* (USDOI 2012a) to address injuries to resources and services located throughout the Gulf of Mexico. Two additional restoration projects that were undertaken by the Trustees were described in the *Deepwater Horizon Oil Spill Phase II Early Restoration Plan and Environmental Review (2012).*[10]

RESTORE Act. The Resources and Ecosystems Sustainability, Tourist Opportunities, and Revived Economies of the Gulf Coast States Act of 2012, or the RESTORE Act, was passed by Congress on June 29, 2012, and signed into law by President Obama on July 6, 2012. The RESTORE Act envisions a regional approach to restoring the long-term health of the natural ecosystems and economy of the northern Gulf of Mexico region. The RESTORE Act dedicates 80 percent of any civil and administrative penalties paid under the Clean Water Act, after the date of enactment, by responsible parties in connection with the *Deepwater Horizon* oil spill to the Gulf Coast Ecosystem Restoration Trust Fund for ecosystem restoration, economic recovery, and tourism promotion in the Gulf Coast region. Due to uncertainty around a variety of factors associated with ongoing litigation, the ultimate amount of administrative and civil penalties that may be available to the Trust Fund and the timing of their availability are unknown. However, as a result of the settlement of Clean Water Act civil claims against Transocean Deepwater Inc. and related entities, a total of $800 million, plus interest, will be deposited in the Trust Fund within the next two years – approximately $320 million of which has already been deposited. Thus, based upon the RESTORE Act and the payment schedule agreed to by the court for the Transocean settlement, by February 20, 2015, thirty percent of that total amount – $240 million, plus interest – will be deposited in the Trust Fund for allocation by the Gulf Coast Ecosystem Restoration Council under the Council-selected Restoration Component. Additional funding is dependent upon settlement or adjudication of civil or administrative claims against other parties responsible for the oil spill. A Draft Initial Comprehensive Plan (Gulf Coast Ecosystem Restoration Council 2013), developed by the Council, provides a framework to implement a coordinated, Gulf Coast region-wide restoration effort in a way that restores, protects, and revitalizes the Gulf Coast.[11]

Gulf Environmental Benefit Fund. In early 2013, a U.S. District Court approved two plea agreements resolving the criminal cases against BP and Transocean which arose from the Spill. The agreements direct a total of $2.544 billion to the National Fish and Wildlife Foundation (NFWF) to fund projects benefiting the natural resources of the northern Gulf of Mexico region that were impacted by the spill. NFWF is a non-profit organization created by Congress in 1984 "to protect and restore fish and wildlife and their habitats." Over the next five years, NFWF's newly established Gulf Environmental Benefit Fund will receive a total of $1.272 billion for barrier island and river diversion projects in Louisiana, $356 million each for natural resource projects in Alabama, Florida, and Mississippi, and $203 million for

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[10] *Deepwater Horizon* Natural Resource Trustees. 2012. *Deepwater Horizon* Oil Spill Phase II Early Restoration Plan and Environmental Review. Available at: http://www.doi.gov/deepwaterhorizon/upload/Phase-II-ERP-ER-12-21-12-2.pdf.

[11] "Draft Initial Comprehensive Plan: Restoring the Gulf Coast's Ecosystem and Economy." Gulf Ecosystem Restoration Council. May 2013. Accessed at: http://www.restorethegulf.gov/sites/default/files/Gulf%20Restoration%20Council%20Draft%20Initial%20Comprehensive%20Plan%205.23.15.pdf

similar projects in Texas. The first 22 projects supported through the Fund were announced in November 2013 after consultation with state and federal resource agencies, and are distributed across the 5 Gulf States (a list of projects by state is included at the end of Chapters 8 through 12). The total value of the initial projects is more than $100 million.[12] The initial NFWF projects were announced in November 2013; as more information becomes available the Trustees will continue to consider the potential implications of these projects that may contribute to cumulative impacts of proposed Early Restoration.

North American Wetlands Conservation Fund. The North American Wetlands Conservation Fund (NAWCF) provides funding for wetlands conservation projects. As part of a criminal fine that BP agreed to pay for one misdemeanor count of violating the Migratory Bird Treaty Act, NAWCF will receive a total of $100 million over the next five years. The money will be used to fund "wetlands restoration and conservation projects" located in the Gulf or projects that would "benefit migratory bird species and other wildlife and habitat affected by" the oil spill. Specific projects are not yet identified. As more information becomes available, the Trustees will consider the potential for cumulative impacts associated with Early Restoration proposed actions**.**

National Academy of Sciences. The National Academy of Sciences (NAS) is a private, non-profit institution created by Congress in 1863 "to provide independent advice to the government on matters related to science and technology." NAS includes the National Research Council, the National Academy of Engineering, and the Institute of Medicine. NAS will receive a total of $500 million over the next five years. This includes other criminal recoveries to be paid by BP ($350 million) and Transocean ($150 million) under their respective criminal settlements. The money will be used for a 30-year "program focused on human health and environmental protection, including issues relating to offshore oil drilling" and the production and transportation of hydrocarbons in the Gulf and the outer continental shelf. More specificity on the program will be considered by the Trustees as the information becomes available.

6.8.3.2 Additional Relevant Environmental Stewardship and Restoration Activities

Resource Stewardship Activities. Stewardship activities within the Gulf of Mexico region include a diverse range of Federal, State, local governmental, non-governmental, and private coastal and marine habitat protection and restoration projects. These stewardship activities are intended to provide benefits to Gulf of Mexico resources, many of which are the same resources and services impacted by the *Deepwater Horizon* oil spill. Similarly, implementation of some stewardship activities would have impacts to many of the same resources components being evaluated under the *Deepwater Horizon* restoration. This section includes programs that focus on land protections and conservation easements and those that focus on habitat restoration. For information on examples of specific past, present and future actions see Appendix 6B.

Water Quality Improvement Programs. The condition of the Gulf of Mexico ecosystem reflects water quality impacts from urban development, industry, transportation, agricultural runoff, atmospheric deposition, and other sources throughout the Gulf of Mexico watershed. A number of authorities are in

[12] National Fish and Wildlife Foundation, accessed at: http://www.nfwf.org/gulf/Pages/home.aspx

place to reduce the discharge of contaminants that enter the Gulf of Mexico, e.g., OPA, CAA, CWA, the Farm Bill, The National Park Service Organic Act, and the Marine Protection, Research and Sanctuaries Act. Water quality improvement programs and authorities seek to address human uses that result in water quality impairment in the Gulf of Mexico in an effort to restore water quality conditions and are expected to continue into the foreseeable future.

Appendix 6B describes many of the Federal, State, and local projects and programs related to habitat restoration that have occurred in the past and present, and are expected to continue into the future.

6.8.3.3 Military Operations

Military operations in the Gulf of Mexico are undertaken primarily by the U.S. Air Force and the U.S. Navy within federally designated areas for the purposes of training personnel and research, design, testing, and evaluation activities. There are 18 U.S. military bases along the northern Gulf of Mexico and more than 40 military warning areas designated by the U.S. Air Force for conducting various testing and training missions, and by the U.S. Navy for various naval training and testing operations (BOEM 2011).

The Gulf of Mexico Range Complex is a combined air, land, and sea space that provides realistic training areas for U.S. Navy personnel. In coastal and marine areas, the Gulf of Mexico Range Complex includes military operations areas and overlying special use airspaces, the Naval Support Activity Panama City Demolition Pond, security group training areas, and supporting infrastructure. Four offshore operating areas located in the northern Gulf of Mexico—Corpus Christi, New Orleans, Pensacola, and Panama City—define where the U.S. Navy conducts surface and subsurface training and operations. The Security group training areas are also located in marine waters of the Gulf of Mexico Range Complex. There are two group training areas: off the coast of Panama City, Florida, and off the coast of Corpus Christi, Texas. These areas are used for machine gun and explosives training. Naval Support Activity, Panama City, Florida, conducts diver training and underwater research as well as ship salvage and submarine rescue exercises.

U.S. Fleet Aircraft operated by all Department of Defense (DoD) units train within a number of special use airspace locations that overlie the military operations areas, as designated by the Federal Aviation Administration. Special use airspaces are largely located offshore, extending from 3.5 miles out from the coast over international waters and in international airspace (BOEM 2011). Examples of actions considered in this cumulative action category are found in Appendix 6-B.

6.8.3.4 Marine Transportation

When considering the potential cumulative impacts associated with marine transportation, port development, shipping and maritime services, and associated navigation, channel construction, and maintenance are important. The Gulf of Mexico coast encompasses a comprehensive system of ports and waterways that provide the facilities and logistics for import and export of foreign and domestic goods, as well as intermodal transport between vessels, trucks, and railroads. Major shipping lanes run throughout the Gulf ecosystem and the volume and value of shipping and port activities is continually increasing. Marine transportation planning has been occurring to improve traffic congestion and other shipping issues. Additional examples of actions considered in this cumulative action category are found in Appendix 6-B. Some of these include:

- **Present Action**: The M-10 Marine Highway Corridor includes the Gulf of Mexico, the Gulf Intracoastal Waterway, and connecting commercial navigation channels, ports, and harbors from Brownsville, Texas, to Jacksonville and Port Manatee, Florida. The M-10 connects to other Marine Highway Corridors: the M-49 Corridor at Morgan City, Louisiana; the M-65 Corridor in Mobile, Alabama; and the M-55 in New Orleans, Louisiana.
- **Future Action**: For example, U.S. Department of Transportation's Maritime Administration (MARAD) has identified marine corridors, projects, and initiatives to establish all water routes to serve as extensions of the surface transportation system. These corridors are planned to ease traffic congestion and reduce air emissions resulting from truck traffic along the interstates and other roadways, particularly within the major cities along established transportation routes (MARAD n.d.).
- **Future Action**: Corridor traffic via land is expected to grow significantly by 2025 and the M-10 route would provide a maritime route that could ease congestion (including freight rail congestion) around Houston and along 400 miles of the corridor already operating at an unacceptable level of service (MARAD n.d.). The M-10 route is expected to provide public benefits by reducing congestion on roadways, reducing greenhouse gas emissions, and reducing road maintenance costs (MARAD n.d.).
- **Future Action**: Two projects are associated with the M-10 Marine Highway Corridor. The Cross Gulf Container Expansion Project will expand the frequency and capacity of container-on-barge traffic. The Gulf Atlantic Marine Highway Project is a public-private venture that would distribute containers between the Gulf, mid-Atlantic, and south Atlantic coasts of the U.S via the M-10 and M-95 Corridors from Brownsville, Texas, to South Carolina. Estimated load volumes between Brownsville and Port Manatee are expected to increase from approximately 300 in 2011 to 345-405 in 2020; connecting transport service to the M-95 corridor (Delaware to Houston) is estimated to increase from 500 to 675 (MARAD 2011). To accommodate the planned traffic for distribution of containers, 10 vessels could be manufactured (MARAD n.d.).
- **Ongoing and Future Actions**: In anticipation of the potential for increased maritime commerce as a result of the 2014 expansion of the Panama Canal, ports along the Gulf of Mexico have signed Memoranda of Use with the Panama Canal Authority and are expanding and upgrading their infrastructure. Memoranda of Use have been signed between the ports of Freeport, Galveston, Houston, and the Port of Corpus Christi Authority, Texas; Port of New Orleans, Louisiana; Alabama State Port Authority; Mississippi State Port Authority at Gulfport; and Broward County (Port Everglades Department), Manatee County Port Authority, and Tampa Port Authority, Florida (Panama Canal Authority 2012). Many of the ports are deepening and widening channels, improving existing facilities and developing new terminals, berths, and container storage areas in order to attract additional markets and maintain competitiveness.

6.8.3.5 Energy Activities

The Gulf of Mexico is one of the most important regions for energy and chemical resources. This sector is supported by numerous facilities including: platform fabrication yards, shipyards, support and transport facilities, pipelines, pipe coating yards, liquefied natural gas (LNG) processing and storage facilities, refineries, petrochemical plants, and waste management facilities, among others. Examples of actions considered in this cumulative action category are found in Appendix 6-B.

Offshore Oil Production. Management of the oil and gas resources of the outer continental shelf (OCS) is governed by the Outer Continental Shelf Lands Act, which sets forth procedures for leasing, exploration, and development and production of those resources. The BOEM within the Department of the Interior is responsible for implementing the requirements of the Act related to preparing the leasing program (BOEM 2011). Pursuant to the OCS Lands Act, BOEM has prepared *A Proposed Outer Continental Shelf Oil and Gas Leasing Program for 2012-2017.* The five-year proposed program includes a schedule of offshore oil and gas lease sales on the U.S. OCS. Of the 15 proposed lease sales included in the proposed program, 12 are in the Gulf of Mexico and include:

- Western Gulf of Mexico: A total of five annual area-wide lease sales began in the fall of 2012 that made available all un-leased acreage.
- Central Gulf of Mexico: A total of five annual area-wide lease sales beginning in the spring of 2013 that make available all un-leased acreage.
- Eastern Gulf of Mexico: A total of two sales, in 2014 and 2016, in areas of the Eastern Gulf of Mexico.

Transportation for most oil and gas from the Gulf of Mexico Proposed Planned Leasing Program is anticipated to be accomplished by extending and expanding existing offshore pipeline systems with some transport from barge and shuttle tankers.

Offshore Natural Gas Facilities. LNG facilities on the OCS are currently in various stages of the permitting process. The Bienville Offshore Energy Terminal approved in 2010, is a planned LNG facility located 63 mi south of Mobile Point, Alabama. In Louisiana, the Main Pass Block 299 mine, operated by Freeport-McMoRan, is leased to mine sulphur and salt in Federal waters of the Gulf of Mexico (lease OCS-G9372). The mine is located about 26 km (16 mi) offshore, east of Plaquemines Parish, Louisiana. Currently, the mine site is under development by Freeport-McMoRan and United LNG as the Main Pass Energy Hub (United LNG 2012). The development will contain a LNG liquefaction facility, and hydrocarbon and LNG storage in the salt caverns (United LNG 2012). It is expected to be operational by 2017.

State Oil and Gas Activities. All Gulf States, with the exception of Florida, have active oil and natural gas programs in offshore State waters and onshore areas. Texas and Louisiana have the highest levels of oil and gas activity in the Gulf of Mexico, and this is predicted to continue into the foreseeable future. Oil production in Texas in recent years has increased from 443 thousand barrels (Mbbl) in 2000 to 727 Mbbl in 2012. Texas's natural gas withdrawals increased from 5.6 billion cubic feet in 2000 to 7.1 billion cubic feet in 2012. Over 167,000 oil wells and over 102,000 gas wells are active in the State. Louisiana oil and gas production increased from 2010 to 2011 by 6 percent (68.1 Mbbl) in oil and 33.4 percent (2.9 trillion cubic feet (Tcf)) of natural gas. Oil production is forecasted to decrease slightly through 2030; however, natural gas production is expected to increase through 2020 to over 3 Tcf and then decrease to approximately 2.5 Tcf by 2030 (Louisiana Department of Natural Resources 2012). Mississippi Development Authority (MDA) has issued proposed rules for seismic exploration and state leasing for offshore oil and gas drilling in the State's coastal waters. Drilling of new wells for oil and gas has increased substantially from 1999 to present, and the number of producing wells increased to 6929 in 2010, up from 564 wells in 1970 (Alabama Oil and Gas Board 2011). Expansion of offshore oil and gas production is increasing shipbuilding along the Alabama coast due to demand for offshore supply and

rig-tending vessels and infrastructure associated with repairing drilling rigs (GCERTF 2011). Examples of actions considered in this cumulative action category are found in Appendix 6-B.

6.8.3.6 Marine Mineral Mining, Including Sand and Gravel Mining

BOEM has authority to lease mineral resource deposits within coastal Gulf waters for phosphate, oyster shell, limestone, sand and gravel, and magnesium (MMS 2004). However, sand and gravel are the minerals that are primarily mined in Gulf of Mexico. Limitations of sand, both the correct composition and quantity, can be an issue in many areas of the Gulf. The BOEM Marine Minerals Program (MMP) is observing an increase in the requests for outer continental shelf sand because suitable state resources are becoming depleted. Examples of actions considered in this cumulative action category are found in Appendix 6-B.

6.8.3.7 Coastal Development and Land Use

The landscape of the northern Gulf of Mexico has been altered and will continue to be altered as a result of land use activities that include coastal development and redevelopment for residential, commercial, industrial, recreational, agricultural, and forestry purposes. Changes in land use patterns that result from a need for economic development, such as tourism-related coastal development, intensify demand on coastal resources and can lead to environmental degradation and natural hazard risks. Increasing populations within coastal communities such as resort and retirement communities can change the historic water-dependent land uses, which include public access for recreation, commercial and recreational fishing, and ship-building. Examples of actions considered in this cumulative action category are found in Appendix 6-B.

Based on building permit numbers, construction of single-family homes in Louisiana and Texas decreased after 2006. Mississippi and Alabama continue to have a low, but consistent level of building permits issued (NOAA 2011g). Development within the South Padre Island and Port Aransas areas of Texas and the Tampa Bay region of Florida is principally residential and mixed use development; however, many construction projects have been cancelled, reduced in scope, or timeframes extended to build-out as a result of the post 2008 economy.

Seasonal and retirement communities have also grown within the Gulf of Mexico region, especially in Gulf communities of Florida and Texas. Over 500,000 seasonal homes are located within the region, distributed as follows: Texas (14 percent); Louisiana (7 percent); Mississippi (1 percent); Alabama (4 percent) and Florida (74 percent) (NOAA 2011g).

6.8.3.8 Fisheries and Aquaculture

The Gulf of Mexico Fishery Management Council (GMFMC or Council) is one of eight regional Fishery Management Councils established by the Fishery Conservation and Management Act of 1976. The Council prepares fishery management plans which are designed to manage fishery resources within the 200-mile limit of the Exclusive Economic Zone (EEZ) in the Gulf of Mexico. The GMFMC has authority to regulate fisheries in federal waters, including aquaculture. Federal waters begin three to nine nautical miles offshore and extend to outer edge of the 200 mile EEZ. From Texas and Florida federal waters begin nine nautical miles out, and from Mississippi, Louisiana and Alabama, federal waters begin three nautical miles out (Gulf of Mexico Fishery Management Council 2013).

The Council manages and regulates commercial and recreational fishing in federal waters. It sets closures for sensitive and marine sanctuaries, quotas, trip limits, and minimum size limits for coastal migratory fish, reef fish, shellfish, and other fish. For recreational fishing, the Council regulates fishing activities, including setting seasons and closure; permitting activities; and setting daily and bag limits, and minimum size requirements. Currently no aquaculture activity occurs within federal waters, although an Aquaculture Fishery Management Plan (FMP) has been developed that would permit and regulate these operations. Examples of actions considered in this cumulative action category are found in Appendix 6-B.

The Council and NOAA National Marine Fisheries Service (NMFS) developed the Aquaculture FMP to maximize benefits to the Nation by establishing a regional permitting process to manage the development of an environmentally sound and economically sustainable aquaculture industry in federal waters of the Gulf of Mexico. The primary goal of the proposed aquaculture permitting program is to increase the maximum sustainable yield and optimum yield of federal fisheries in the Gulf of Mexico by supplementing the harvest of wild caught species with cultured products. While the Aquaculture FMP has been approved, it has not been implemented. Implementation regulations are currently being developed for the Aquaculture FMP.

If the Aquaculture FMP is implemented, an estimated 5 to 20 offshore aquaculture operations would be permitted in the Gulf over the next 10 years, with an estimated annual production of up to 64 million pounds (NOAA 2009). The plan prohibits shrimp farming, and only allows the raising of native Gulf species.

Various state agencies are responsible for regulating recreational, commercial, and aquaculture activities within state waters, including: Florida Fish and Wildlife Conservation Commission, Florida Department of Environmental Protection, Florida Department of Agriculture and Consumer Service Division of Aquaculture; Alabama Department of Conservation and Natural Resources Marine Resources Division; Louisiana Department of Wildlife and Fisheries; Mississippi Department of Environmental Quality; Mississippi Department of Marine Resources ; Mississippi Department of Agriculture and Commerce; Mississippi Department of Wildlife, Fisheries, & Parks; and Texas Parks and Wildlife Department. These agencies manage, monitor, and regulate commercial fisheries and aquaculture within their state waters. Requirements from the agencies include licensing and permitting activities and operations; leasing of coastal submerged land for aquaculture; setting catch limits, quotas, and seasons, regulating harvesting and processing; and providing technical assistance.

As described on their website, the Gulf States Marine Fisheries Commission was established by an act of Congress (P.L. 81-66) in 1949 as a compact of the five Gulf States. Its charge is: "to promote better utilization of the fisheries, marine, shell and anadromous, of the seaboard of the Gulf of Mexico, by the development of a joint program for the promotion and protection of such fisheries and the prevention of the physical waste of the fisheries from any cause." The Commission is composed of three members from each of the five Gulf States. Those members include the head of the marine resource agency of each state, a member of the legislature, and a citizen with knowledge of marine fisheries appointed by the governor.

6.8.3.9 Tourism and Recreation

The tourism industry in the Gulf region offers a wide variety of activities such as golfing, gambling, beach recreation, boating, ecotourism (wildlife watching, birding, visiting parks, beaches and wildlife refuges, scenic viewing), hunting and fishing. Many of these activities are directly dependent upon the coastal ecosystems of the Gulf of Mexico. Access to the waters, beaches, wildlife and scenic views in each of the five Gulf States supports a multi-billion dollar regional tourism industry (GCERTF 2011). Examples of actions considered in this cumulative action category are found in Appendix 6-B.

Efforts to promote and increase tourism in the Gulf States include marketing and advertising incentives, casino resort development, wildlife and cultural festivals, and golf tournaments. There are activities for increasing and diversifying passive recreation and tourism in the Gulf. These activities include birding, wildlife viewing, cultural heritage enjoyment, and water trails that can be traversed by canoe or kayak.

6.8.4 Cumulative Impact Analysis (Step 4)

The following section and associated tables describe the cumulative impacts of the alternatives being considered when combined with other past, present, and reasonably foreseeable future actions. The analysis provided below considers the impacts of the cumulative action categories and their corresponding actions identified above and in Appendix 6-B. The analysis recognizes that in most cases the contribution to the cumulative impacts for a given resource from implementing the action alternatives would be difficult to discern, at a broad programmatic level across the Gulf of Mexico, given the context and intensity of impacts from the other past, present, and future actions. In many situations, implementation of one of the action alternatives would likely help reduce overall long-term adverse impacts by providing a certain level of offsetting benefits, especially when considered in concert with other actions of similar nature (e.g., stewardship programs, non-NRDA restoration, etc.). The cumulative impact analysis is evaluated by affected resource.

There are several ways in which effects may come together to result in cumulative effects. For purposes of the following analysis, cumulative effects have been identified and may fall under one or more of the following categories, which are defined, for purposes of this analysis, as:

- **Additive adverse or beneficial effect**: Occurs when the negative or beneficial impact on a resource adds to effects from other actions;
- **Synergistic (Interactive) adverse effect**: Occurs when the net adverse impact on a resource is greater than the sum of the adverse impacts from individual actions (this could also result in a different type of impact than the impact of the individual impacts; e.g., increased temperature discharges in water when added to increased nutrient loading can result in reduced dissolved oxygen—a different impact) ; and
- **Synergistic (Interactive) beneficial effect**: Occurs when the net beneficial impact on a resource is greater than the sum of the benefits from individual actions (this could also result in a different type of impact than the impact of the individual impacts);
- **Countervailing effect**: Occurs when the net effect of two or more actions, when combined have an overall effect that is less than the sum of their individual effects.

In the following sections, the analysis is organized by resource and alternative. The analysis follows the pattern below:

- direct and indirect effects of the proposed action (X);
- the impacts to the resources from applicable past, present, and reasonably foreseeable future actions (Y); and
- potential cumulative impacts of the alternative and applicable actions on an affected resource (Z), where the effects may interact and be additive, more simply, X+Y=Z.

6.8.4.1 Physical Environment

As described in Chapter 3, the nearshore, marine environment is comprised of the coastline and the inner continental shelf, extending to depths of 600 feet. The offshore, marine environment consists of portions of the Gulf of Mexico that are more than 600 feet deep including the outer shelf, continental slope, and abyssal plain. Coastal transition areas typically include tidally influenced areas (e.g., marshes, estuaries, and coastal wetlands). Finally, upland environments are those habitats that are adjacent to coastal transition, but are not subject to a tidal regime or regularly inundated by water.

Construction and operation of energy and mining facilities (offshore and onshore), marine transportation facilities, commercial, industrial and residential development in coastal habitats, corridor improvements, etc. are detailed in Appendix 6-B (hereinafter "ongoing activities"). These actions may alter, damage or destroy elements in the physical environment through impacts including water quality degradation, substrate disturbances, and conversion of habitats to residential, commercial or industrial uses or other human disturbances. There are also many environmental stewardship and restoration projects that have occurred or are underway in the region (see Appendix 6-B) that may affect the physical environment.

6.8.4.1.1 Geology and Substrates

The northern Gulf of Mexico region includes upland surface soils, subsurface rock features, and submerged coastal and oceanic sediments. Sediment resources are particularly important along the areas dominated by deltaic processes (e.g., Mississippi River Delta), and where land building and erosion are dynamic and dependent on the availability of sediment resources. Table 6-4 analyzes cumulative impacts of the Programmatic ERP/PEIS Alternatives on geology and substrates.

Table 6-4. Cumulative Impacts to Geology and Substrates

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to geology and substrates from past, present, and reasonably foreseeable future actions, such as military activities, marine transportation, energy and mining activities, coastal development and land use would occur. The magnitude of these effects would vary by activity and location. For example, marine oil and gas exploration and extraction adversely affects the nearshore coastal areas from pipeline construction and marine transportation, but also affects upland areas as a result of shoreside-associated infrastructure including marine terminals, pipelines and transportation corridors through soil compaction and removal, reduced soil stability, and soil contamination. Coastal development and land use effects are largely confined to upland and nearshore coastal areas and include adverse effects such as rutting, removal of substrates, compaction, and erosion. In addition to these adverse effects, countervailing impacts associated with reduced erosion or increasing sediment availability from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration.

ALTERNATIVES	CUMULATIVE IMPACTS
	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast geology or substrates.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore barrier islands and beaches and conserve habitats. These actions 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. Removal of borrow materials would cause long-term minor impacts to localized areas. Construction activities could also cause long-term soil compaction. However, long-term benefits to geology and substrates are also expected, including reduction in sediment runoff decreased soil disturbance, reduction in erosion/loss of wetlands, stabilization of substrates, backfilling of submerged propeller scars. The effects of Alternative 2 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other past, present, and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these impacts would include soil compaction and removal, reduced soil stability, soil contamination, rutting, removal of substrates, compaction, and erosion. In addition to these adverse effects, countervailing impacts associated with reduced erosion or increasing sediment availability from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. 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 geology and substrates. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in minor to moderate short-term construction-related adverse impacts to geology and substrates, primarily related to equipment staging and use, and rutting. The placement of new structures such as piers, dune walkovers, or viewing platforms 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. Removal of borrow materials would cause long-term minor impacts to localized areas. Construction activities could also cause long-term soil compaction. However, long-term benefits to geology and substrates are also expected related to sediment deposition on beaches and creation of artificial reefs. Additional benefits could accrue where projects improve existing outdated or degraded infrastructure that cause erosion. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale.

ALTERNATIVES	CUMULATIVE IMPACTS
	Other past, present, and reasonably foreseeable future actions described above under the No Action alternative would be expected to continue. As described above, these impacts would include soil compaction and removal, reduced soil stability, soil contamination, rutting, removal of substrates, compaction, and erosion. In addition to these adverse effects, countervailing impacts associated with reduced erosion or increasing sediment availability from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. When Alternative 3 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. However Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to geology and substrates in localized areas. Alternative 3 would not contribute substantially to cumulative adverse impacts.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast geology and substrates under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these impacts would include soil compaction and removal, reduced soil stability, soil contamination, rutting, removal of substrates, compaction, and erosion. In addition to these adverse effects, countervailing impacts associated with reduced erosion or increasing sediment availability from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. When Alternative 4 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. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to geology and substrates.

6.8.4.1.2 Hydrology and Water Quality

Gulf Coast hydrology and water quality are mainly affected by freshwater inputs (from inland waters of the Gulf of Mexico Watershed) and the movement of salt water. As stated in Chapter 3, the quantity and rate of freshwater inputs through contributing rivers can be altered by a number of natural and anthropogenic factors such as changes in rainfall and land cover; flood control practices; spillway operation; navigation structures such as locks, dams, weirs and other water control structures; consumption of freshwater by agriculture, municipal, and industrial interests; and the development of stormwater infrastructure. Freshwater inflows to the northern Gulf of Mexico contribute nutrients, sediments, and pollutants from upstream agriculture, stormwater runoff, industrial activities, and wastewater discharges. The influx of these constituents is further affected by currents and surface winds. In addition, the nearshore environment, including tidal marsh areas, has been physically modified (e.g., through channelization and canal construction), allowing saltwater intrusion, which impacts both surface and sub-surficial groundwater resources. These alterations can affect the influx of freshwater into the northern Gulf of Mexico resulting in alterations to salinity regimes in nearshore areas potentially increasing the frequency and magnitude of hypoxic events. On balance, the inflow of freshwater provides the freshwater and sediment inputs necessary for maintaining healthy nearshore

salinity regimes and coastal landscapes, and offshore currents generally improve water quality through mixing and dilution. However, offshore currents can also serve as a conduit for pollution that can contribute to water quality degradation.

Table 6-5 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on hydrology and water quality.

Table 6-5. Cumulative Impacts to Hydrology and Water Quality

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to hydrology and water quality from past, present, and reasonably foreseeable future actions, such as military activities, marine transportation, energy and mining activities, coastal development and land use would occur. The magnitude of these effects would vary by activity and location. For example, drilling, pipeline construction, and marine transportation activities could affect offshore hydrology and water quality. Infrastructure associated with shoreside infrastructure, such as marine terminals, pipelines, transportation corridors, could lead to adverse impacts to hydrology and water quality in nearshore coastal and freshwater environments. These impacts would include disruption of sediments, increased turbidity, industrial, or other polluted stormwater runoff, saltwater intrusion or changes in the hydrologic regimes of waterbodies. In addition to these adverse effects, countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast hydrology and water quality.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in 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 effects of Alternative 2 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 water quality and hydrology. 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

ALTERNATIVES	CUMULATIVE IMPACTS
	synergistic effects of Alternative 2 project types with these other environmental stewardship and restoration activities.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term construction-related adverse impacts, including increases in turbidity and sedimentation. In addition, these actions may result in minor long-term increases in stormwater runoff and pollutants as a result of conversion of pervious to impervious surfaces, discharge of fish hatchery effluent, and increased presence of boats and equipment in waterways. To the extent that projects replace or improve outdated or failing systems, long-term benefits may also accrue. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to hydrology and water quality would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to water quality in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast hydrology and water quality under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to hydrology and water quality would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to hydrology and water quality.

6.8.4.1.3 Air Quality and Greenhouse Gases

All of the Gulf Coast counties meet the NAAQS for nitrogen dioxide, sulfur dioxide, carbon monoxide, particulate matter, and lead. However, the Houston-Galveston-Brazoria area has been listed by EPA as nonattainment for existing ozone standards (U.S. EPA 2013) (IPCC 2013). Greenhouse gas emissions over a recent five year period (2007-2011) for the five state area has varied by state and overtime from 1,364.6 – 1,316.9 million metric tons of CO2 Eq. (U.S. EPA 2013). National emissions in 2011 totaled

6,702 million metric tons CO2 Eq. (U.S. EPA 2013). This was a 1.6 percent reduction from 2010. Globally, greenhouse gas emissions rose by 4.6% in 2010 and increased by 1.3 gigaton (Gt) of CO2 Eq. between 2009 and 2010 (IEA 2012) reaching 30.3 Gt. of CO2 Eq.

Table 6-6 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on air quality and greenhouse gas emissions.

Table 6-6. Cumulative Impacts to Air Quality and Greenhouse Gas Emissions

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to air quality and greenhouse gas emissions from past, present and reasonably foreseeable future actions, such as emissions from vehicles, military activities, marine transportation, energy and mining activities, and coastal development and land use would continue. Largely due to its regulated nature, air quality would likely remain stable; however, it could decline over the short- and long terms in certain areas. Similarly, many of these same sources of emissions would contribute greenhouse gas emissions. These emissions add to global greenhouse gas levels, which are projected to rise up to 37 Gt. by 2035 (IEA 2012). Construction activities associated with natural resource restoration would also contribute to impacts to air quality and greenhouse gas emissions in the short-term. However, some level of countervailing beneficial impacts associated with restoration, conservation and recovery efforts from other environmental stewardship and restoration activities in the Gulf of Mexico that increase the ability of the region's natural resources to absorb emissions would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to air quality and greenhouse gas emissions.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in short-term construction-related adverse impacts to air quality and GHG. The effects of Alternative 2 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Project types that protect habitat or increase native vegetation would result in some level of CO_2 absorption; however, the benefits would be difficult to measure. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these actions would result in short- and long-term adverse impacts to air quality in certain areas and would contribute greenhouse gases to global greenhouse gas levels. Construction activities associated with natural resource restoration would also contribute short term adverse impacts to air quality and greenhouse gas emissions; though some level of countervailing beneficial impacts could occur if they increase ability of the Region's natural resources to absorb emissions. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 air quality or greenhouse gas emissions. To the extent that they increase CO_2 absorption, Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in some long-term beneficial cumulative impacts to greenhouse gas emissions because of the potential for synergistic effects of Alternative 2 project types with these

ALTERNATIVES	CUMULATIVE IMPACTS
	other environmental stewardship and restoration activities.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term construction-related minor to moderate adverse impacts, including increases in air and greenhouse gas emissions. In addition, project types of Alternative 3 are expected to increase recreational use and visitation which would contribute to air quality and greenhouse gas emission rates in the long-term minor adverse impacts from the use of recreation equipment and vehicles (e.g., boats, cars, RVs) and from the operation and maintenance of certain facilities and services. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these actions would result in short- and long-term adverse impacts to air quality in certain areas and would contribute greenhouse gases to global greenhouse gas levels. Construction activities associated with natural resource restoration would also contribute short term adverse impacts to air quality and greenhouse gas emissions; though some level of countervailing beneficial impacts could occur if they increase ability of the Region's natural resources to absorb emissions. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to air quality and greenhouse gas emissions would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. It is unlikely that there would be any beneficial cumulative impacts associated with Alternative 3.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts air quality and greenhouse gas emissions under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these actions would result in short- and long-term adverse impacts to air quality in certain areas and would contribute greenhouse gases to global greenhouse gas levels. Construction activities associated with natural resource restoration would also contribute short term adverse impacts to air quality and greenhouse gas emissions; though some level of countervailing beneficial impacts could occur if they increase ability of the Region's natural resources to absorb emissions. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to air quality and greenhouse gas emissions would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. To the extent that they increase CO_2 absorption, Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts may result in some long-term beneficial cumulative impacts to greenhouse gas emissions because of the potential for synergistic effects of Alternative 4 project types with these other environmental stewardship and restoration activities. However, the contribution from Alternative 4 would be difficult to measure.

6.8.4.1.4 Noise

Noise levels in areas of the Gulf Coast region are affected by a number of ongoing activities (Appendix 6-B). The primary sources of terrestrial noise in the coastal environment are transportation and construction-related activities. In the marine environment, sounds are also introduced from marine

transportation, military activities, energy development and mineral-related activities (e.g., oil and gas exploration, drilling and production), among others.

Table 6-7 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on noise.

Table 6-7. Cumulative Impacts to Noise

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Past, present, and reasonably foreseeable future actions are likely to affect ambient noise in the Gulf Coast region, including energy and mining, coastal development, land use, military activities, and marine transportation. The magnitude (duration as well as decibel level) of these disruptions to existing ambient noise levels would vary by activity and location. For example, construction-related impacts would likely be limited in duration, while drilling activities, marine transportation, and coastal development could lead to long-term increases in ambient noise levels. New activity occurring in previously undisturbed areas would increase ambient noise levels, while disruptions in more industrial and heavily used areas would cause less increases to ambient noise levels given existing conditions. In addition to these adverse effects, some countervailing impacts to noise associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur, as lands are conserved from development, or new areas are vegetated that were previously bare. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse effects to noise levels in the Gulf Coast.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in short-term minor to major construction-related adverse impacts to noise. Long-term noise impacts would only be expected in a case where newly conserved land was opened to recreational use. These impacts would be minor. The effects of Alternative 2 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Alternative 2 is expected to have little long-term impacts to ambient noise conditions. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these impacts would include short-term effects associated with construction activities, as well as longer term impacts associated with drilling activities, marine transportation, and coastal development. Some countervailing impacts associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. 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 noise. Because it has little effect on noise over the long-term, Alternative 2 is not expected to substantially contribute to beneficial cumulative impacts to noise in the Gulf Coast region.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. These actions are expected to result in short-term minor to major construction-related adverse impacts to noise.

ALTERNATIVES	CUMULATIVE IMPACTS
	Long-term noise impacts would be expected where additional recreational use, in terms of foot, car, or boat traffic, is expected. These impacts would range from minor to moderate. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these impacts would include short-term effects associated with construction activities, as well as longer term impacts associated with drilling activities, marine transportation, and coastal development. Some countervailing impacts associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. When analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 3 would not contribute substantially to short-term or long-term cumulative adverse impacts to noise. Because it has little effect on noise over the long-term, Alternative 3 is not expected to substantially contribute to beneficial cumulative impacts to noise in the Gulf Coast region.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to noise under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Past, present and reasonably foreseeable future actions described above under the No Action would be expected to continue. As described above, these impacts would include short-term effects associated with construction activities, as well as longer term impacts associated with drilling activities, marine transportation, and coastal development. Some countervailing impacts from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to noise would likely occur. However, Alternative 4 would not contribute substantially to cumulative or beneficial or adverse impacts.

6.8.4.2 Biological Resources

Biological resources include habitats, as well as the plant and animal species (living coastal and marine resources) that utilize those habitats. Gulf Coast habitats and living coastal and marine resources vary throughout the region. Habitats discussed in Chapter 3 are important to protected species (e.g. SAV is considered a sensitive habitat that has declined and is protected that provides foraging for listed manatees) and have experienced degradation and losses over time.

6.8.4.2.1 Habitats

The Gulf Coast habitats are a mosaic of environments that include wetlands (marshes, mangrove stands, tidal wetlands, etc.), beaches, barrier islands and coastal transition zones (terrestrial and riparian areas, bottomland forests, etc.). These habitats (described fully in Chapter 3) provide key functions and resources required by the high diversity of plants and animals that depend on these habitats and their interconnections. Sensitive habitats include SAV, wetlands, turtle and bird nesting beaches, barrier islands, estuaries, coastal dunes, and reefs, among others. These sensitive habitats are widely dispersed along the Gulf Coast. Impacts to one habitat may result in cascading adverse effects to an array of other habitat types. For example, development in coastal transition zones may affect stormwater runoff,

increased volume and rates of stormwater runoff and excessive sedimentation in receiving water bodies. This in turn, can result in sedimentation and impacts to coastal wetlands which, when intact, can protect shorelines and beaches from excessive erosion by slowing wave action, reducing storm surges and providing water surface area for high tides. Table 6-8 analyses the cumulative impacts of the Programmatic ERP/PEIS on habitats.

Table 6-8. Cumulative Impacts to Habitats

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to habitat from past, present, and reasonably foreseeable future actions would occur. The magnitude of these effects would vary by activity and location. Sensitive habitats would be more vulnerable to adverse impacts compared to more general habitat, though both would be impacted. Impacts to habitats would include habitat degradation through reduced quality (e.g., reduced water quality or introduction of invasive species), habitat fragmentation, and habitat loss. For example, marine oil and gas exploration and extraction adversely affects marine habitats through as a result of drilling, pipeline construction and marine transportation. Associated actions also similarly affect terrestrial habitats as a result of infrastructure development (marine terminals, pipelines, transportation corridors). Coastal development and land use impacts to habitats are largely confined to nearshore marine and terrestrial habitats. In addition, infrastructure improvements, terrestrial energy and mining development, and military operations all have associated construction and operation activities that impacted habitat through placement of facilities, roadways, airports, energy corridors and other land developments. Countervailing impacts associated with habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new or restore degraded habitats, protect habitats from fragmentation, and preserve unaffected quality habitats, especially sensitive habitats. For example, Phase I and Phase II efforts focused on marsh and dune habitat restoration as well as nesting bird and sea turtle habitat restoration. These actions provide benefits to sensitive habitats. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast habitats.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast habitats, including sensitive habitats, would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Most Alternative 2 project types would 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. Long-term minor to moderate adverse impacts may also occur from habitat restoration projects where one habitat type is permanently converted to another target habitat type (e.g. displacement of unvegetated openwater habitat to restore wetlands or oyster reef).

ALTERNATIVES	CUMULATIVE IMPACTS
	However, since many of these project types focus on restoring or protecting natural resources, 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 SAV, and reefs. These project types could help reestablish native plant communities, stabilize substrates and support sediment deposition, strengthen shorelines, and reduce erosion. Past, present and reasonably foreseeable future actions described above under the No Action alternative would be expected to continue. As described above, activities including energy and mining, coastal development and land use, military activities, and marine transportation would result in short- and long-term adverse impacts to habitats including habitat degradation through reduced quality (e.g., reduced water quality or introduction of invasive species), habitat fragmentation, and habitat loss. Construction activities from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities would also contribute short term adverse impacts. However, countervailing beneficial impacts from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new or restore degraded habitats, protect habitats from fragmentation, and preserve unaffected quality habitats, especially sensitive habitats. 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 habitats. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts would result in long-term beneficial cumulative impacts to habitats 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short- and long-term adverse impacts to habitats. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Short-term adverse impacts would be related to construction or reconstruction activities such as those necessary for public access facilities, fish hatcheries, artificial reefs, campgrounds and education centers. Long-term adverse impacts include those that result from the operation, use and maintenance of facilities. These short- and long-term adverse impacts could include alteration of wetlands; covering, loss or shading of SAV or other habitats from placement of structures; filling of shallow water areas; localized plant species displacement or loss, introduction of invasive species, and degradation of habitats including potential habitat fragmentation as a result of an increased recreational activity and human use; increased soil erosion; changes in water quality from stormwater runoff associated with the conversion of upland pervious areas to impervious surfaces (parking areas, buildings, etc.) and increased turbidity and substrate disturbance from in-water work with heavy equipment or leaching of construction fluids. Some recreational enhancement projects may have long-term beneficial effects on habitats such as wetlands, barrier islands, beaches, coastal transition zones, SAV and shallow water habitats. For example, enhancement projects could reduce degradation and recreation use in habitats by redirecting use to a site that is more appropriate and conducive to recreational activities. These activities could also help stabilize substrates, support sediment deposition, and reduce erosion. In addition, the creation of artificial reefs could benefit sessile and benthic encrusting organisms by providing substrate and interstitial spaces for use as habitat and forage areas. Providing educational programs related to coastal resources could increase public awareness of Gulf Coast habitats by increasing public knowledge of, and support for, preservation and conservation of these habitats, as well as potentially resulting in behavioral changes during future public encounters with sensitive habitats.

ALTERNATIVES	CUMULATIVE IMPACTS
	Past, present and reasonably foreseeable future actions described above under the No Action alternative would be expected to continue. As described above, activities including energy and mining, coastal development and land use, military activities, and marine transportation would result in short- and long-term adverse impacts to habitats including habitat degradation through reduced quality (e.g., reduced water quality or introduction of invasive species), habitat fragmentation, and habitat loss. Construction activities from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities would also contribute short term adverse impacts. However, countervailing beneficial impacts from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new or restore degraded habitats, protect habitats from fragmentation, and preserve unaffected quality habitats, especially sensitive habitats. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to habitat would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to habitat in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast habitats under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Past, present and reasonably foreseeable future actions described above under the No Action alternative would be expected to continue. As described above, activities including energy and mining, coastal development and land use, military activities, and marine transportation would result in short- and long-term adverse impacts to habitats including habitat degradation through reduced quality (e.g., reduced water quality or introduction of invasive species), habitat fragmentation, and habitat loss. Construction activities from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities would also contribute short term adverse impacts. However, countervailing beneficial impacts from habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new or restore degraded habitats, protect habitats from fragmentation, and preserve unaffected quality habitats, especially sensitive habitats. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to habitat would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts would likely result in long-term beneficial cumulative impacts to habitats in the Gulf Coast region because of the potential for synergistic effects of Alternative 4 project types with these other environmental stewardship and restoration activities.

6.8.4.2.2 Living Coastal and Marine Resources

The Gulf Coast is home to a host of living coastal and marine resources that includes a diversity of plant and animal species. Some Gulf Coast species spend the vast majority of their live-cycle in a single habitat type (e.g., oysters on a reef). These species may be more vulnerable to habitat destruction than other species that utilize this habitat type intermittently. Certain species utilize a variety of Gulf Coast habitats for portions of their lifecycle (e.g. many juvenile fish species utilize estuaries until they reach maturity when they migrate to the open waters of the Gulf of Mexico). Other species, such as migratory birds,

spend only part of the year in the Gulf Coast. More detail on species and their habitat needs is located in Chapter 3.

Impacts to Gulf Coast habitats from past, present, and reasonably foreseeable future actions, as described in Table 6-9, would also affect those living coastal and marine resources that rely on them. Actions that reduce/degrade habitat or increase/restore habitat would have corresponding impacts to the species that use those habitats. Therefore, the following cumulative impact analysis focuses on impacts to living coastal and marine resources.

Table 6-9. Cumulative Impacts to Living Coastal and Marine Resources

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to living coastal and marine resources from past, present, and reasonably foreseeable future actions would occur. The magnitude of these effects would vary by activity and location. Sensitive species would be more vulnerable to adverse impacts compared to more common species, though both would be impacted. Adverse impacts to living and coastal marine resources would include loss or degradation of nesting/spawning/rearing/resting/foraging areas (i.e., habitat degradation or loss as discussed in Table 6-8), reduced prey abundance, overfishing, incidental catch, reduced water quality, introduction of invasive species/competition, loss of movement corridors, and disturbance from increased human presence and activity. For example, military activities, marine transportation, energy and mining activities, commercial and recreational fishing, and coastal development would likely adversely impact marine species. Common species in the marine environment such as benthic organisms (mollusks, gastropods, etc.), fish from the sea bass, mackerel and bonefish families, are less susceptible to impacts from these actions because of their relative abundance and the availability of habitat. Marine species such as the endangered manatee, protected marine mammals, and listed fish could be affected by noise (construction equipment, drilling, military operations), water quality and substrate disturbances and degradation, vessel operation and habitat loss. Species such as manatees, sea turtles and listed fish have been adversely affected by habitat loss (nesting/spawning/rearing, foraging), reduced prey abundance, overfishing, incidental catch, and increased human presence and activity. In many cases these effects have prompted jurisdictional agencies to provide additional protections either through the ESA, MMPA or designating EFH or Critical Habitat for individual species or groups of species. Because protected species have already experienced population declines and their current populations are considered unstable, adverse impacts from past, present and reasonably foreseeable future actions would likely have a more substantial effect. Coastal development and land use, military activities, marine transportation facilities and corridor improvements, energy development, and infrastructure development all have associated construction and operation activities that have removed terrestrial species habitats (breeding/nesting, foraging), reduced prey abundance, and increased species mortality through placement of facilities, roadways, corridors for moving goods and services and residential and commercial development. Terrestrial protected species have also been indirectly affected by increases in human presence, habitat fragmentation, loss of wildlife movement corridors and water quality degradation from urban development and polluted runoff. For example, activities that fill wetland/aquatic habitat would reduce available nursery and foraging areas for some aquatic and terrestrial species, which could cause species to relocate such as migratory birds. Common terrestrial species such as white ibis, king rails, raccoons, box turtles, etc. are less susceptible to development pressures and tend to adapt to human presence and disturbances more readily than many protected species. However, development activities such as those

ALTERNATIVES	CUMULATIVE IMPACTS
	described above have resulted in cumulative adverse impacts to even common wildlife species. Countervailing impacts associated with habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new, or restore, degraded habitats; increase species populations; and decrease species stressors. For example, Phase I and Phase II Early Restoration efforts focused on marsh and dune habitat restoration as well as nesting bird and sea turtle habitat restoration. These actions provide benefits to both common and sensitive species. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast living coastal and marine resources.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast habitats and restoring and protecting oysters and other shellfish, finfish, sea turtles, and birds would be undertaken. Most Alternative 2 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. 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. Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by construction activity or sediment placement. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and removal of benthos from dredged areas. 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. In addition, construction activities could result in the destruction of sea turtle eggs, or other ground nesters, deposited within the boundaries of the proposed project. Lighting from construction activities could disturb or interfere with female turtles nesting attempts (e.g., false crawls or use of marginal or unsuitable nesting areas) and could disorient hatchling turtles as they emerge from the nest and crawl to the water. 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 bird or terrestrial wildlife that rest, roost, forage or nest in or near the work area could be temporarily disturbed or displaced. Beach nourishment activities can result in short-term and minor to moderate impacts (such as disturbance and reduced foraging efficiency) to shorebirds if the birds are roosting and feeding in the area during a migration stopover or could result in harm or mortality if birds are nesting in the area. Predator control could have an adverse impact to some species, since these efforts such as constructing barriers could also exclude other non-target species that utilize those areas. Some Alternative 2 project types could result in long-term minor to moderate adverse impacts to living coastal and marine resources. Long-term minor to moderate adverse impacts could occur to living coastal and marine resources inhabiting areas adjacent to new breakwaters or other

ALTERNATIVES	CUMULATIVE IMPACTS
	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. These structures could cause long term displacement of sea turtles as obstacles affecting the ability of female turtles to nest, the suitability of the nest incubation environment, and the ability of hatchlings to emerge from the nest and crawl to the ocean. In addition, the change in sediment accretion could cause long term impacts to benthic communities including shellfish. Similar habitat impacts to beaches could result in the long term displacement of shorebirds or other animals that use different beach-related habitats. Alternative 2 project types would result in long-term benefits to living coastal and marine resources. Project types that create or restore habitat, reduce erosion, improve water quality, and protect specific wildlife would have long term benefits for a variety of aquatic and terrestrial species. For example, the creation and restoration of wetlands could provide nesting and/or foraging habitat for birds as well as increasing habitat for terrestrial wildlife. Finfish could also benefit from wetlands restoration, which could provide habitat for foraging, spawning, and shelter. Restoring barrier islands and beaches could contribute to the quantity and quality of adjacent shallow water soft-bottom habitats that serve as nurseries and foraging areas for some finfish, while providing nesting habitat for birds. Impacts to living coastal and marine resources from past, present, and reasonably foreseeable future actions would occur. The magnitude of these effects would vary by activity and location. Sensitive species would be more vulnerable to adverse impacts compared to more common species, though both would be impacted. Adverse impacts to living and coastal marine resources would include loss or degradation of nesting/spawning/rearing/resting/foraging areas, reduced prey abundance, overfishing, incidental catch, reduced water quality, introduction of invasive species/competition, loss of movement corridors, and disturbance from increased human presence and activity. For example, military activities, marine transportation, energy and mining activities, commercial and recreational fishing, and coastal development would likely adversely impact marine species. Marine species such as the endangered manatee, protected marine mammals, and listed fish could be affected by noise, water quality and substrate disturbances and degradation, vessel operation and habitat loss. Because protected species have already experienced population declines and their current populations are considered unstable, adverse impacts from past, present and reasonably foreseeable future actions would likely have a more substantial effect. Coastal development and land use, military activities, marine transportation facilities and corridor improvements, energy development, and infrastructure development all have associated construction and operation activities that have removed terrestrial species habitats (breeding/nesting, foraging), reduced prey abundance, and increased species mortality through placement of facilities, roadways, corridors for moving goods and services and residential and commercial development. Terrestrial protected species have also been indirectly affected by increases in human presence, habitat fragmentation, loss of wildlife movement corridors and water quality degradation from urban development and polluted runoff. Countervailing impacts associated with habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new, or restore, degraded habitats; increase species populations; and decrease species stressors. For example, Phase I and Phase II Early Restoration efforts focused on marsh and dune habitat restoration as well as nesting bird and sea turtle habitat restoration. These actions provide benefits to both common and sensitive species. 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

ALTERNATIVES	CUMULATIVE IMPACTS
	adverse impacts to living coastal and marine resources. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. These actions are expected to result in short-term construction-related adverse impacts. Enhancing or constructing infrastructure could require in-water work with heavy equipment and long-term operation and maintenance of these facilities. Some short-term minor adverse effects could occur if resources, including oysters, fish, sea turtles, marine mammals, benthic communities, and pelagic microfaunal communities, were present in the construction area. Possible impacts could include increased turbidity, reduction of water quality, noise pollution, vibration, and disruption to the water column and habitat. 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 communities. Fish present in the work area could be temporarily displaced, or eggs and larvae could be killed due to smothering or crushing by equipment, human activity, or sediment. Fish could also be subject to a temporary increase in sound pressure levels, a decrease in water quality, entrainment in dredge sediments, and alteration or removal of habitat; however, effects would not be expected to reduce local fish populations. Sensitive species such as sea turtles and marine mammals present in project areas where dredging, underwater use of equipment or reef placement could be subject to temporary increased noise, turbidity, and water quality changes as well as alteration or loss of forage or nesting habitat, all of which could temporarily displace individuals or prey during construction and result in short-term, minor impacts. Sea turtle and marine mammals may be present in project areas where use of explosives may be used to sink a vessel for creation of an artificial reef. Underwater explosions may affect marine life by causing death, injury, or behavioral reactions; depending on the distance an animal is located from a blast. This could result in short to long-term impacts to individuals and may result in minor to moderate impacts. Some hatcheries/aquaculture operations could result in long-term minor adverse effects to marine mammals or fish through unintentional exposure to disease through release of contaminated effluent or infected fish. Stocking of hatchery-reared finfish could also negatively impact the genetic diversity of the wild stock and affect the balance of the fish community, competing for food and habitat resources with finfish species present in the receiving waters. Construction in terrestrial habitats could result in short-term minor to moderate adverse 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, bird and terrestrial wildlife individuals that forage or nest in or near the work area could be temporarily disturbed or displaced. Stormwater runoff from impervious surfaces could enter waterways and increase turbidity as well as carry pollutants that could affect benthic organisms, fish or foraging bird species. Long-term minor to moderate adverse effects to species could result from the placement of piers, foundations, or other permanent structures; fill of shallow water areas; increased human traffic, and the conversion of pervious areas to impervious surfaces (parking areas, buildings, etc.). These actions could result in disturbance or displacement of local species. Increase site visitation could result in noise and other disturbances as well as degradation or fragmentation of habitats and upland areas used by wildlife in the vicinity.

ALTERNATIVES	CUMULATIVE IMPACTS
	The creation of artificial reefs could provide indirect benefits to marine fish, marine mammals, sea turtles, and potentially oysters and shallow water coral by providing food, shelter, or spawning areas. Whether the availability of new habitat will serve to increase fish and/or invertebrate biomass or will only serve to concentrate organisms at the site, is likely dependent on where the reef is sited and how it is designed. Providing educational features through coastal exhibits and collections, hands-on activities, educational outreach programs related to coastal resources could increase public awareness of marine resources and of their value to the ecosystem. This could result in a long-term benefit to nearshore benthic communities, oysters, marine mammals and other species beyond the lifespan of the project. To the extent that projects replace or improve outdated or failing systems, long-term benefits may also accrue. Impacts to living coastal and marine resources from past, present, and reasonably foreseeable future actions would occur. The magnitude of these effects would vary by activity and location. Sensitive species would be more vulnerable to adverse impacts compared to more common species, though both would be impacted. Adverse impacts to living and coastal marine resources would include loss or degradation of nesting/spawning/rearing/resting/foraging areas, reduced prey abundance, overfishing, incidental catch, reduced water quality, introduction of invasive species/competition, loss of movement corridors, and disturbance from increased human presence and activity. For example, military activities, marine transportation, energy and mining activities, commercial and recreational fishing, and coastal development would likely adversely impact marine species. Marine species such as the endangered manatee, protected marine mammals, and listed fish could be affected by noise, water quality and substrate disturbances and degradation, vessel operation and habitat loss. Because protected species have already experienced population declines and their current populations are considered unstable, adverse impacts from past, present and reasonably foreseeable future actions would likely have a more substantial effect. Coastal development and land use, military activities, marine transportation facilities and corridor improvements, energy development, and infrastructure development all have associated construction and operation activities that have removed terrestrial species habitats (breeding/nesting, foraging), reduced prey abundance, and increased species mortality through placement of facilities, roadways, corridors for moving goods and services and residential and commercial development. Terrestrial protected species have also been indirectly affected by increases in human presence, habitat fragmentation, loss of wildlife movement corridors and water quality degradation from urban development and polluted runoff. Countervailing impacts associated with habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new, or restore, degraded habitats; increase species populations; and decrease species stressors. For example, Phase I and Phase II Early Restoration efforts focused on marsh and dune habitat restoration as well as nesting bird and sea turtle habitat restoration. These actions provide benefits to both common and sensitive species. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to living coastal and marine resources would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to living coastal and marine resources, primarily as a result of increased education and awareness of resources and reef development.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast living coastal and marine resources under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Impacts to living coastal and marine resources from past, present, and reasonably foreseeable future actions would occur. The magnitude of these effects would vary by activity and location. Sensitive species would be more vulnerable to adverse impacts compared to more common species, though both would be impacted. Adverse impacts to living and coastal marine resources would include loss or degradation of nesting/spawning/rearing/resting/foraging areas, reduced prey abundance, overfishing, incidental catch, reduced water quality, introduction of invasive species/competition, loss of movement corridors, and disturbance from increased human presence and activity. For example, military activities, marine transportation, energy and mining activities, commercial and recreational fishing, and coastal development would likely adversely impact marine species. Marine species such as the endangered manatee, protected marine mammals, and listed fish could be affected by noise, water quality and substrate disturbances and degradation, vessel operation and habitat loss. Because protected species have already experienced population declines and their current populations are considered unstable, adverse impacts from past, present and reasonably foreseeable future actions would likely have a more substantial effect. Coastal development and land use, military activities, marine transportation facilities and corridor improvements, energy development, and infrastructure development all have associated construction and operation activities that have removed terrestrial species habitats (breeding/nesting, foraging), reduced prey abundance, and increased species mortality through placement of facilities, roadways, corridors for moving goods and services and residential and commercial development. Terrestrial protected species have also been indirectly affected by increases in human presence, habitat fragmentation, loss of wildlife movement corridors and water quality degradation from urban development and polluted runoff. Countervailing impacts associated with habitat restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. These actions would likely create new, or restore, degraded habitats; increase species populations; and decrease species stressors. For example, Phase I and Phase II Early Restoration efforts focused on marsh and dune habitat restoration as well as nesting bird and sea turtle habitat restoration. These actions provide benefits to both common and sensitive species. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to living coastal and marine resources would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to living coastal and marine resources.

6.8.4.3 Human Use and Socioeconomics

As described in Chapter 3, millions of people live, work, and recreate in the northern Gulf of Mexico region, and therefore, rely on the natural and physical resources the Gulf's environment provides. Land use in the region comprises a heterogeneous mix of industrial activities: manufacturing, marine, shipping, agricultural, and petrochemical industry activities; recreation; and tourism. Along the northern Gulf Coast there are numerous state-managed, protected areas and recreational sites (such as State Parks and beaches) as well as units of both the National Park Service (NPS) and the USFWS.

Construction and operation of energy and mining facilities (offshore and onshore), marine transportation facilities, commercial, industrial and residential development in coastal habitats, corridor improvements, etc. are detailed in Appendix 6-B (hereinafter "ongoing activities"). These actions may provide benefits to a number of Human Use Resources while also potentially adversely affecting other resources such as commercial fisheries and recreation.

There are also many environmental stewardship and restoration projects that have occurred or are underway in the Gulf Coast region (see Appendix 6-B) that may affect the human use and socioeconomics.

6.8.4.3.1 Socioeconomics and Environmental Justice

The population of the Gulf coastal counties and parishes was nearly 17 million in 2010 according to the U.S. Census. In 2009, the total economy of the Gulf of Mexico region supported over 22 million jobs (17.2% of all jobs in the U.S.), and produced over $2 trillion in GDP (16.7% of all GDP produced in the U.S.). In the same year, six ocean-dependent sectors of the regional economy (living marine resources, marine construction, marine transportation, offshore mineral extraction, ship and boat building, and marine-related tourism and recreation) accounted for 480,000 jobs (2.2% of all jobs in the region) and produced about $100 billion in GDP (4.3% of total regional GDP) (NOAA 2012).

Executive Order 12898 (Feb. 11, 1994) states that, to the greatest extent practicable, federal agencies must "identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." None of the alternatives presented below would contribute to adverse cumulative impacts to environmental justice issues.

Table 6-10 analyzes cumulative impacts of the Programmatic ERP/PEIS Alternatives on socioeconomics.

Table 6-10. Cumulative Impacts to Socioeconomics.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to socioeconomics from past, present, and reasonably foreseeable future actions, such as military activities, coastal development and land use, commercial and recreational fishing and aquaculture, tourism, marine mineral mining, and energy development including offshore and state oil and gas exploration and production—as well as construction activities associated with stewardship, NRDA, and non-NRDA restoration activities—are expected. All of these activities have the potential to affect employment and spending in the region. The magnitude of these effects to local and regional economies would vary by activity and location. Impacts of resource production activities would be dependent on whether materials, labor, equipment and supplies are sourced locally. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to the Gulf Coast economies.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions could cause short-term benefits to local economies, depending on the types of activities occurring. Workforce employment in construction, dredging,

ALTERNATIVES	CUMULATIVE IMPACTS
	and barge operation activities would benefit regional economies from projects occurring under Alternative 2. Locally purchased (or rented) equipment and materials would benefit the regional economy, including increased jobs, income, sales, and tax receipts. Increased recreational use associated with Alternative 3 would be expected to lead to long term beneficial economic effects. Short-term minor to moderate adverse impacts, primarily associated with temporary closures of areas to recreational uses could also occur. Long-term minor adverse impacts to socioeconomic conditions are anticipated. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, current and future activities such as those related to ongoing coastal development and land use, commercial and recreational fishing and aquaculture, tourism, marine mineral mining, and energy development, as well as construction activities associated with stewardship, NRDA, and non-NRDA restoration activities, would result in adverse and beneficial effects to local economies. These impacts would depend on regional economic conditions, the types of activities occurring, their economic impacts, and their location with respect to regional economies. 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 Gulf Coast economies. Some projects may result in increased regional spending.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Similar to Alternative 2, workforce employment in infrastructure construction would benefit regional economies from projects occurring under Alternative 3. Locally purchased (or rented) equipment and materials would benefit the regional economy, including increased jobs, income, sales, and tax receipts. Additional recreational infrastructure and amenities, such as facilities, boat ramps, bathrooms, boardwalks, and amenities would increase access and improve recreational experiences. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, current and future activities such as those related to ongoing coastal development and land use, commercial and recreational fishing and aquaculture, tourism, marine mineral mining, and energy development, as well as construction activities associated with stewardship, NRDA, and non-NRDA restoration activities, would result in adverse and beneficial effects to local economies. These impacts would depend on regional economic conditions, the types of activities occurring, their economic impacts, and their location with respect to regional economies. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to economies of the Gulf Coast would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to economies of the Gulf Coast in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf economies under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, current and future activities such as those related to ongoing coastal development and land use, commercial and recreational

ALTERNATIVES	CUMULATIVE IMPACTS
	fishing and aquaculture, tourism, marine mineral mining, and energy development, as well as construction activities associated with stewardship, NRDA, and non-NRDA restoration activities, would result in adverse and beneficial effects to local economies. These impacts would depend on regional economic conditions, the types of activities occurring, their economic impacts, and their location with respect to regional economies. Although the impacts would vary based on regional economic conditions, the types of activities, their economic impacts, and their location, when Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, it is not expected to contribute substantially to cumulative adverse impacts. As described above, Alternative 4 would be expected to provide at least short-term incremental contributions to cumulative benefits to socioeconomics on a local level as a result of employment and other economic gains associated with the activities. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to economies of the Gulf Coast.

6.8.4.3.2 Cultural Resources

As stated in Chapter 3, people have lived in the coastal region of the Gulf of Mexico for more than 10,000 years. Today many unique and diverse cultures call the Gulf coast home. These cultures, past and present, are often closely linked to the environmental and natural resources that comprise the Gulf Coast ecosystem, and which these projects seek to help restore. Cultural resources encompass a range of traditional, archeological, and built assets. Historic properties in the affected coastal communities date from both the prehistoric and historic periods. Ongoing activities (Appendix 6-B) have resulted in varying degrees of damage to cultural resources. Table 6-11 analyzes cumulative impacts of the Programmatic ERP/PEIS Alternatives on cultural resources.

Table 6-11. Cumulative Impacts to Cultural Resources

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to cultural resources from past, present, and reasonably foreseeable future actions, such as marine transportation, energy and mining activities, fishing, coastal development and land, and construction activities as a result of non-federal restoration actions would continue to impact known and not yet documented cultural resources. The magnitude of these effects would vary by activity and location. For example, impacts would be higher for those currently unknown resources that are submerged, buried and/or undocumented. Impacts to these resources could occur as a result of incidental disturbance or damage from activities that drag (such as commercial fishing) or otherwise disturb (such as marine mineral mining, energy activities and coastal development) these resources. In addition to these adverse effects, countervailing impacts to cultural resources of restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. These beneficial impacts could include the identification and subsequent protection of cultural resources that may otherwise have been unknown or unprotected. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast cultural resources.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Projects implemented under Alternative 2 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 effects of Alternative 2 would vary depending on geographic location. Past, present, and reasonably foreseeable future activities described above under the No Action would be expected to continue. As described above, these impacts would include impacts on known as well as not-yet-documented cultural resources, and would vary by activity and location. In addition to adverse effects, countervailing impacts to cultural resources of restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. These beneficial impacts could include the identification and subsequent protection of cultural resources that may otherwise have been unknown or unprotected. When analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 is not expected to contribute substantially to short-term or long-term adverse or beneficial cumulative impacts to cultural resources.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Projects implemented under Alternative 3 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 effects of Alternative 3 would vary depending on geographic location. Past, present, and reasonably foreseeable future activities described above under the No Action would be expected to continue. As described above, these impacts would include impacts on known as well as not-yet-documented cultural resources, and would vary by activity and location. In addition to adverse effects, countervailing impacts to cultural resources of restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. These beneficial impacts could include the identification and subsequent protection of cultural resources that may otherwise have been unknown or unprotected. When analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 is not expected to contribute substantially to short-term or long-term adverse or beneficial cumulative impacts to cultural resources.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast cultural resources under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Past, present, and reasonably foreseeable future activities described above under the No Action would be expected to continue. As described above, these impacts would include impacts on known as well as not-yet-documented cultural resources, and would vary by activity and location. In addition to adverse effects, countervailing impacts to cultural resources of restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico could occur. These beneficial impacts could include the identification and subsequent protection of cultural resources that may otherwise have been unknown or unprotected. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to cultural resources would likely occur. However, Alternative 4 is not expected to contribute substantially to short-term or long-term adverse or beneficial cumulative impacts to cultural resources.

6.8.4.3.3 Infrastructure

The amount and placement of infrastructure and public service development depend heavily on population and migration patterns, and employment trends. Ongoing activities (Appendix 6-B) have resulted in varying degrees of damages and benefits to infrastructure, benefits are derived from a variety of infrastructure improvements. Table 6-12 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on infrastructure.

Table 6-12. Cumulative Impacts to Infrastructure

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to infrastructure from past, present, and reasonably foreseeable future actions, such as coastal development, military activities, energy activities, resource stewardship activities, water quality improvement programs, scientific research programs, and tourism and recreation would occur. The magnitude of these effects would vary by activity and location and would be highly dependent on the pressures on existing infrastructure (such as increased tourism or recreational use pressures on existing roads). In addition to these effects, infrastructure restoration, replacement, and expansion is likely to occur. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast infrastructure.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Projects requiring land-based construction activities and associated movement of construction materials and equipment by road could lead to short and long-term minor to major adverse impacts to infrastructure. Project types that enhance public access to natural resources for recreational use, enhance recreational experiences, and/or promote environmental and cultural stewardship, education, and outreach, may include construction activities such as backfilling of canals and shallow water bodies to create wetlands; removal of bulkheads, rip rap and other structures to restore hydrologic connectivity; dune restoration; or the

ALTERNATIVES	CUMULATIVE IMPACTS
	placement of breakwaters or other engineered erosion control structures on the shoreline. Impacts would result from increases in construction traffic; temporary or permanent closure of roads or parking lots; or damage to roadways. These would range in intensity based on the duration of road or parking lot closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of roadway damage. Similarly, projects requiring the permanent removal or relocation of infrastructure, such as the alteration of land cover for habitat conservation or the removal of piers or other coastal fixtures that are affecting SAV beds targeted for restoration, could lead to short and long-term minor to major adverse impacts on infrastructure. Projects that stabilize and protect shorelines, reduce erosion, or reduce the effects of wave activity, such as the construction of groins or breakwaters; beach re-nourishment; oyster reef placement; and restoration of SAV beds would have potential long-term beneficial impacts for infrastructure. These would result from the protection of roadways, parking lots, utilities, and other nearshore infrastructure from the effects of storm waves and associated shoreline erosion. Impacts to infrastructure from past, present, and reasonably foreseeable future actions, such as coastal development, military activities, energy activities, resource stewardship activities, water quality improvement programs, scientific research programs, and tourism and recreation would occur. The magnitude of these effects would vary by activity and location and would be highly dependent on the pressures on existing infrastructure (such as increased tourism or recreational use pressures on existing roads). In addition to these effects, infrastructure restoration, replacement, and expansion is likely to occur. 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 infrastructure. Alternative 2 carried out in conjunction with other infrastructure improvement projects may result in long-term beneficial cumulative impacts to infrastructure in the Gulf Coast region because of the potential for synergistic effects of Alternative 2 project types with these other activities.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. Alternative 3 actions vary widely from construction of recreation and public access facilities (boat ramps, promenades, dune walkovers, parking facilities, artificial reef, etc.) to educational and cultural facilities. Many of the project types discussed under Alternative 3 would involve the transport of construction vehicles, equipment, and materials. These project types, which include techniques such as placement of artificial reef structures; construction of boardwalks, trails, roads, bridges and other types of public access; and the construction of boat ramps, piers, public bathrooms, lodging facilities and similar amenities, could lead to short and long-term minor to major impacts on infrastructure. The impacts associated with these projects would result from increases in construction traffic; temporary or permanent closure of roads, parking lots, or facilities; or damage to roadways or other infrastructure that provides access to the shoreline. The impacts to existing infrastructure, such as roadways, could also occur from increased vehicle use as a result of increased visitor use over time. These impacts would range in intensity based on the duration of road, parking lot or public access closure, the importance of individual roadways as regional transportation arterials; and the extent and duration of damage to roadways, facilities or access points. Future infrastructure improvements or increased maintenance could be necessary to address impacts to infrastructure. Impacts to infrastructure from past, present, and reasonably foreseeable future actions, such as coastal development, military activities, energy activities, resource stewardship activities, water quality improvement programs, scientific research programs, and tourism and recreation would occur. The magnitude of these effects would vary by activity and location and would be highly dependent on the pressures on existing infrastructure (such as increased tourism or recreational use pressures on existing roads). In addition to these effects, infrastructure restoration, replacement, and expansion are likely to occur. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 3 would not be expected to result in a substantial incremental contribution to cumulative adverse impacts to infrastructure, though infrastructure would likely be affected by ongoing and future activities requiring future investment. Alternative 3 project types may contribute to some long-term beneficial cumulative impacts to water quality in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast infrastructure under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Impacts to infrastructure from past, present, and reasonably foreseeable future actions, such as coastal development, military activities, energy activities, resource stewardship activities, water quality improvement programs, scientific research programs, and tourism and recreation would occur. The magnitude of these effects would vary by activity and location and would be highly dependent on the pressures on existing infrastructure (such as increased tourism or recreational use pressures on existing roads). In addition to these effects, infrastructure restoration, replacement, and expansion are likely to occur. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to infrastructure would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with infrastructure improvement projects has the potential to result in some long-term beneficial cumulative impacts to infrastructure.

6.8.4.3.4 Land and Marine Management

As stated in Chapter 3, land and marine areas may be set aside for a variety of active and passive recreational purposes. Land may be managed for wildlife and habitat protection and conservation, and/or scenic, cultural, and historical values. Land management may be at the Federal, State, local government levels, or by private organizations.

Ongoing activities (Appendix 6-B) have resulted in varying degrees of impacts to land and marine management. Table 6-13 analyzes cumulative impacts of the Programmatic ERP/PEIS Alternatives on land and marine management.

Table 6-13 Cumulative Impacts to Land and Marine Management.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to land and marine management from past, present, and reasonably foreseeable future actions, such as resource stewardship, water quality improvement projects, marine transportation, energy activities, and tourism and recreation would occur. The magnitude of these effects would vary by activity and location and could impact land and marine management at the Federal, State, local and private areas in the event that actions result in area closures, and associated interruption of operations, increased management responsibilities, or furloughs or layoffs of staff. In addition to these adverse effects, countervailing beneficial impacts associated with the alignment of management goals and assistance provided to management and staff to best manage properties from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to land and marine management in the Gulf Coast.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Actions that would result in the temporary or permanent partial or full closure of national, state and local parks, wildlife refuges, wildlife management areas and marine protected areas during construction would result in short-term minor to moderate adverse impacts, primarily from the interruption of operations and use and/or the furlough or reassignment of staff. In the 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. Restoration projects resulting in changes to land ownership and/or permitted uses including the use of fee acquisition could have long-term impacts; however, as the transactions are negotiated or arranged between willing parties it is not anticipated that adverse impacts to land and marine management would occur. The effects of Alternative 2 would vary depending on location, type of activity and existing management but overall direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include area closures and associated interruption of operations, increased management responsibilities, or furloughs or layoffs of staff. Countervailing beneficial impacts associated with the alignment of management goals and assistance provided to management and staff to best manage properties from restoration,

ALTERNATIVES	CUMULATIVE IMPACTS
	conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected lead to short-term adverse impacts, stemming from construction and land transfer activities that would result in the temporary full or partial closure of parks and refuges, in the interruption of operations, in furloughs or staff layoffs, or that would interfere with land managers' ability to fulfill management obligations and responsibilities. To the extent that projects better align management goals and assist management and staff to best manage properties for the benefit of the environmental and human environment, long-term benefits may also accrue. The effects of Alternative 3 would vary depending on geographic location, land ownership and project scale. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include area closures and associated interruption of operations, increased management responsibilities, or furloughs or layoffs of staff. Countervailing beneficial impacts associated with the alignment of management goals and assistance provided to management and staff to best manage properties from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 3 would not contribute substantially to short-term or long-term cumulative adverse impacts to land and marine management. Alternative 3 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 3 project types with these other environmental stewardship and restoration activities leading to the alignment of management goals and assistance provided to management and staff to best manage properties from restoration, conservation and recovery efforts
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast land and marine management under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include area closures and associated interruption of operations, increased management responsibilities, or furloughs or layoffs of staff. Countervailing beneficial impacts associated with the alignment of management goals and assistance provided to management and staff to best manage properties from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being

ALTERNATIVES	CUMULATIVE IMPACTS
	conducted under Phase I and Phase II Early Restoration. When Alternative 4 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. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to land and marine management.

6.8.4.3.5 Tourism and Recreational Use

Outdoor recreation, broadly defined, is any leisure time activity conducted outdoors for pleasure or sport, including activities from wilderness camping to watching outdoor performances. Other examples of recreational pursuits in the region include onshore and offshore wildlife observation, hunting, beach and other waterfront use, boating, and recreational fishing.

Ongoing activities (Appendix 6-B) have resulted in varying degrees of adverse impacts and benefits to tourism and recreational use. Table 6-14 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on tourism and recreational use.

Table 6-14. Cumulative Impacts to Tourism and Recreational Use

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to tourism and recreational use from past, present, and reasonably foreseeable future actions, such as marine transportation, energy and mining activities, coastal development and land use would occur. Adverse effects would include reduced recreational opportunities and visitor experience due to use conflicts. The magnitude of these effects would vary by activity and location. For example, industrial activities such as additional off-shore energy development or port construction may have limited effects on recreation or tourism if it is located in an industrial coastal location with little recreational activity. By contrast, construction or industrial development or activities in popular recreational areas would result in increased adverse impacts to tourism and recreational use due to restrictions or closures to areas or disturbances or other adverse impacts to visitor experience (e.g., noise) that would cause visitors to choose another location to visit. In addition to these adverse effects, countervailing impacts to tourism and recreational use associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast tourism and recreational use.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Construction-related short-term adverse impacts to recreation and tourism from temporary recreational site closures and adverse impacts on recreational experiences associated with noise, wildlife disturbances, view sheds, and other adverse impacts on recreational experiences would occur and would be expected to be minor to moderate. The effects of restoration actions would vary depending on their location and the rate of usage by tourists or recreation users. Long-term beneficial impacts would be expected for projects that would result in higher quality habitats on increases in wildlife populations that could then be used for tourism and recreational use. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include reduced recreational opportunities and visitor experience due to use conflicts. Countervailing impacts to tourism and recreational use associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 tourism and recreational use. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to tourism and recreational use 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short-term minor to moderate construction-related adverse impacts, from temporary recreational site closures and adverse impacts on recreational experiences associated with noise, wildlife disturbances, visual impacts and other adverse impacts on recreational experiences. The effects of restoration actions would vary depending on their location and the rate of usage by tourists or recreation users. Long-term beneficial impacts would be expected for projects that would result in improved infrastructure and connectedness to resource areas or those projects that lead to higher quality habitats on increases in wildlife populations that could then be used for tourism and recreational use. Other long-term beneficial impacts could occur as a result of expanded educational and stewardship programs. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include reduced recreational opportunities and visitor experience due to use conflicts. Countervailing impacts to tourism and recreational use associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to tourism and recreational use would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial

ALTERNATIVES	CUMULATIVE IMPACTS
	cumulative impacts to tourism and recreational use in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast tourism and recreational use under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include reduced recreational opportunities and visitor experience due to use conflicts. Countervailing impacts to tourism and recreational use associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to tourism and recreational use would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to tourism and recreational use.

6.8.4.3.6 Fisheries and Aquaculture

Commercial fisheries represent a multi-billion dollar industry to the northern Gulf Coast region and have traditionally included finfish, shrimp, oysters, and crabs. State, federal, and international agencies regulate fishery resources within their jurisdictions. NMFS (2011) defines aquaculture as "…the propagation and rearing of aquatic organisms in controlled or selected aquatic environments for any commercial, recreational, or public purpose." The Census of Aquaculture targets, "all commercial or noncommercial places from which $1,000 or more of aquaculture products were produced and either sold or distributed during the census year" (USDA National Agricultural Statistics Service 2005). Noncommercial operations include Federal, State, and tribal hatcheries (USDA National Agricultural Statistics Service 2005).

Ongoing activities (Appendix 6-B) have resulted in varying degrees of impacts to commercial fisheries and aquaculture. Table 6-15 summarizes cumulative impacts of the Programmatic ERP/PEIS Alternatives on fisheries and aquaculture.

Table 6-15. Cumulative Impacts to Fisheries and Aquaculture

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to fisheries and aquaculture from past, present, and reasonably foreseeable future actions, such as military activities, marine transportation, energy and mining activities, water quality improvement programs, restoration projects, resource stewardship projects, coastal development and land use and climate change would occur. The magnitude of these effects would vary by species, activity and location. For example, additional marine management could result in stricter harvest or gear requirements and lower harvest quotas depending on stock assessment and projects involving construction or dredging would have adverse impacts to water turbidity and quality. These types of impacts would depend on the particular species being harvested, the condition of the stock and the specific type of habitat. These potential adverse impacts would be offset to some degree by the implementation of natural resource stewardship, water quality, and

ALTERNATIVES	CUMULATIVE IMPACTS
	other NRDA and non-NRDA projects that result in benefits to the marine environment. In addition to these adverse effects, countervailing impacts associated with fisheries and aquaculture from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast fisheries and aquaculture.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions could cause short-term adverse impacts to commercial fishing by limiting allowable catch. However, overall long-term benefits to commercial fisheries would be anticipated because of improved habitats that are important to a number of fish and shellfish species and potential for increased populations and species stability. These projects are unlikely to impact aquaculture. Actions under Alternative 2 are expected to result in 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 effects of Alternative 2 would vary depending on location, type of activity and existing management but overall direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing beneficial impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 fisheries or aquaculture. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to fisheries and aquaculture 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.

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short-term construction-related adverse impacts, including increases in turbidity and sedimentation. In addition, these actions may result in minor long-term increases in stormwater runoff and pollutants as a result of conversion of pervious to impervious surfaces, discharge of fish hatchery effluent, and increased presence of boats and equipment in waterways. To the extent that projects replace or improve outdated or failing systems, long-term benefits may also accrue. The effects of Alternative 3 would vary depending on geographic location, proximity of restoration projects to one another, and spatial scale. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to fisheries and aquaculture would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to fisheries and aquaculture in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast fisheries and aquaculture under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable future activities described above under the No Action Alternative would be expected to continue. As described above, these impacts would include disruption of sediments, increased turbidity, and increased releases of contaminants. Countervailing impacts associated with water quality improvement from restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would also occur. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to fisheries and aquaculture would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to fisheries and aquaculture.

6.8.4.3.7 Marine Transportation

Marine transportation is an important component of the northern Gulf of Mexico regional economy, and the Gulf Coast is a major shipping center. The U.S. economy relies heavily on the ports in the northern Gulf of Mexico region for the import and export of both foreign and domestic goods.

Ongoing activities (Appendix 6-B) have resulted in varying degrees of impacts to marine transportation. Table 6-16 summarizes cumulative impacts of the Phase III ERP/PEIS Alternatives on marine transportation.

Table 6-16. Cumulative Impacts to Marine Transportation

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to marine transportation from past, present, and reasonably foreseeable future actions, such as military activities, energy and mining activities, water quality improvement programs, scientific research programs and tourism and recreation would occur as a result of transportation restrictions. . The magnitude and type of these effects would vary by activity and location. For example, resource stewardship activities and water quality improvement programs could affect access either through restrictions or emission controls whereas military operations, energy activities, and tourism and recreation would have beneficial impacts to marine transportation, due to an increase in shipping, maritime service, the expansion of the Panama Canal, and ridership from tourists. In addition to these effects, countervailing impacts to marine transportation associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast marine transportation.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Impacts from increases in shipping traffic in congested areas stemming from barge use of shipping lanes for the transportation of dredge and fill materials would be short-term and minor. Long-term beneficial impacts would occur as a result of reduced erosion from restoration and shoreline projects that would provide wave attenuation in areas such as the Gulf Intercoastal Waterway, ports, and harbors. Other long-term beneficial impacts could occur as a result of proper planning and coordination of dredging activities so to allow for dredging and fill from borrow sites that would work in improving navigational channels. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would be long-term and beneficial from the increase in shipping, maritime service, the expansion of the Panama Canal, and ridership from tourists. Countervailing impacts to marine transportation associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When analyzed in combination with other past, present, and reasonably foreseeable future actions, Alternative 2 would not contribute substantially to short or long-term cumulative adverse impacts to marine transportation. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to marine transportation 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short-term construction-related minor adverse impacts, in the event that shipping routes are blocked or obstructed by dredging equipment or barges or from increases in marine traffic from dredging, trenching or ground disturbing activities. Projects centered on the enhancement or increase of public access or recreational

ALTERNATIVES	CUMULATIVE IMPACTS
Opportunities	enhancements would similarly result in short-term minor impacts from increased recreational boat traffic or ferry traffic that would obstruct or slow commercial shipping traffic. In the event that existing navigational infrastructure is improved long-term beneficial impacts would be expected. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would be long-term and beneficial from the increase in shipping, maritime service, the expansion of the Panama Canal, and ridership from tourists. Countervailing impacts to marine transportation associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to marine transportation would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to marine transportation in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast marine transportation under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would be long-term and beneficial from the increase in shipping, maritime service, the expansion of the Panama Canal, and ridership from tourists. Countervailing impacts to marine transportation associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to marine transportation would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to marine transportation.

6.8.4.3.8 Aesthetics and Visual Resources

The current Gulf of Mexico coastal region is characterized by thousands of miles of shoreline, which is bordered by a variety of landscapes, including natural and maintained beaches, mangroves and other wetlands, developed areas such as towns and urban centers, as well as heavily industrialized areas including ports and infrastructure related to energy production.

Ongoing activities (Appendix 6-B) have resulted in varying changes and associated impacts to aesthetics and visual resources. Table 6-17 summarizes cumulative impacts of the Phase III ERP/PEIS Alternatives on aesthetics and visual resources.

Table 6-17. Cumulative Impacts to Aesthetics and Visual Resources

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to aesthetics and visual resources from past, present, and reasonably foreseeable future actions, such as military activities, marine transportation, energy and mining activities, coastal development and land use would occur. The magnitude of these detractions to the natural viewshed would vary by activity and location. For example, construction-related impacts would likely be limited in duration, while drilling activities, marine transportation, and coastal development could lead to long-term intrusions into the natural viewshed. New developments or activities occurring in previously undisturbed areas would continue to detract from natural viewsheds in otherwise undisturbed areas and likely create atmospheric pollution leading to reduced visibility. However, these same impacts in more industrial areas would have lower impacts to aesthetics and visual quality given the existing conditions. In addition to these adverse effects, countervailing impacts to aesthetics and visual resources associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast aesthetics and visual resources.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. Construction-related actions 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. The effects of Alternative 2 would vary to a large degree on the location of the proposed projects, the degree to which these activities would be visible, and the duration of construction activities and how commonplace these activities are. 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. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would include introductions of construction equipment or long-term structures or signage, all of which would detract from natural viewshed. Countervailing impacts to aesthetics and visual resources associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 aesthetics and visual resources. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial

ALTERNATIVES	CUMULATIVE IMPACTS
	cumulative impacts to aesthetics and visual 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in minor to moderate short-term construction related adverse impacts as a result 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. The addition of infrastructure and facilities into the existing landscape would present some degree of visual contrast, with long-term impacts ranging from minor to moderate dependent on the existing visual quality of the area. Long-term benefits to aesthetics and visual resources are also expected for projects that while enhancing recreational opportunities while also improving habitat such as beach renourishment and removal of land based debris. Direct and indirect effects of Alternative 2 would largely result in long-term minor to moderate adverse impacts. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would include introductions of construction equipment or long-term structures or signage, all of which would detract from natural viewshed. Countervailing impacts to aesthetics and visual resources associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to aesthetics and visual resources would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to aesthetics and visual resources in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast aesthetics and visual resources under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other past, present, and reasonably foreseeable activities described above under the No Action would be expected to continue. As described above, these impacts would include introductions of construction equipment or long-term structures or signage, all of which would detract from natural viewshed. Countervailing impacts to aesthetics and visual resources associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to aesthetics and visual resources would likely occur. However, Alternative 4 would not contribute substantially to cumulative adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to aesthetics and visual resources.

6.8.4.3.9 Public Health and Safety, Including Flood and Shoreline Protection

Provision of public health and safety can be complicated by large storm events such as tropical storms and hurricanes (and associated storm surges, winds, and battering waves) that have historically caused extensive damage to the shoreline as well as infrastructure such as roadways, bridges and buildings. The Gulf's coastal communities are at increased risk for severe shoreline damage and storm surges. In addition, construction activities and increased human uses of resources can also pose risks to public health and safety.

Ongoing activities (Appendix 6-B) have resulted in varying degrees of impacts to public health and safety. Table 6-18 summarizes cumulative impacts of the Phase III ERP/PEIS Alternatives on public health and safety, including flood and shoreline protection.

Table 6-18. Cumulative Impacts to Public Health and Safety, Including Flood and Shoreline Protection

ALTERNATIVES	CUMULATIVE IMPACTS
Alternative 1 - No Action	Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Impacts to public health and safety from past, present, and reasonably foreseeable future actions, such as military activities, marine transportation, energy and mining activities, coastal development and land use and construction related activities would occur. The magnitude of these effects would vary by activity and location. For example, construction related activities would have a greater potential to impact public health and safety if these activities were to occur in areas experiencing higher levels of use or more dangerous activities. It is anticipated most activities would have safety plans in place to reduce risks to the public. In addition to these adverse effects, countervailing impacts to public health and safety associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. Under Alternative 1, proposed Early Restoration actions and their impacts would not occur. Therefore, Alternative 1 would not contribute to cumulative adverse or beneficial effects to Gulf Coast public health and safety.
Alternative 2 - Contribute to Restoring Habitats and Living Coastal and Marine Resources	Under Alternative 2, proposed Early Restoration project types specifically directed at restoring, enhancing and conserving Gulf Coast sensitive habitats would be undertaken. Alternative 2 includes project types such as create wetlands, restore SAV, restore barrier islands and beaches and conserve habitats. These actions are expected to result in short-term construction-related adverse impacts to public health and safety, 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 could also result in 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. It is anticipated the effects of Alternative 2 would vary depending on the type of activity, the proximity of the public and measures in place to reduce the potential or to avoid these impacts. Direct and indirect effects of Alternative 2 would largely result in long-term beneficial impacts. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would occur as a result of operation of heavy equipment and construction materials as well as through the potential release of contaminants into the environment in the event that they are used. Countervailing impacts to public health and safety associated with restoration, conservation and recovery efforts associated with other

ALTERNATIVES	CUMULATIVE IMPACTS
	environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. 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 public health and safety. Alternative 2 carried out in conjunction with other environmental stewardship and restoration efforts may result in long-term beneficial cumulative impacts to public health and safety 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.
Alternative 3 - Contribute to Providing and Enhancing Recreational Opportunities	Under Alternative 3, proposed Early Restoration specifically directed at providing and enhancing recreational opportunities would be undertaken. These actions are expected to result in short-term construction-related minor adverse impacts, stemming from the operation of heavy-equipment and construction materials as well as from the potential of hazard waste and materials contaminating the environment. Increased visitor use could cause visitor use conflicts, leading to short-term minor adverse impacts. Projects centered on enhancing public access of areas would likely lead to long-term beneficial impacts to public safety by providing access to sites that currently lack infrastructure or require infrastructure improvements. Similarly, long-term benefits could be experienced through the promotion of environmental and cultural stewardship, education and outreach project types, so that, for example, users of the sites are more knowledgeable about potential hazards in the project areas (e.g., ocean currents, coastal storms and flooding, etc.). Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would occur as a result of operation of heavy equipment and construction materials as well as through the potential release of contaminants into the environment in the event that they are used. Countervailing impacts to public health and safety associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 3 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to public health and safety would likely occur. However, Alternative 3 would not contribute substantially to cumulative adverse impacts. Alternative 3 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to public health and safety in localized areas.
Alternative 4 - Contribute to Restoring Habitats, Living Coastal and Marine Resources, and Recreational Opportunities	The magnitude of adverse and beneficial impacts to Gulf Coast public health and safety under Alternative 4 would fall within the range of the impacts described above for Alternatives 2 and 3. Other ongoing and future activities described above under the No Action would be expected to continue. As described above, these impacts would occur as a result of operation of heavy equipment and construction materials as well as through the potential release of contaminants into the environment in the event that they are used. Countervailing impacts to public health and safety associated with restoration, conservation and recovery efforts associated with other environmental stewardship and restoration activities in the Gulf of Mexico would occur. These efforts include those being conducted under Phase I and Phase II Early Restoration. When Alternative 4 is analyzed in combination with other past, present, and reasonably foreseeable future actions, short and long-term cumulative adverse impacts to public health and safety would likely occur. However, Alternative 4 would not contribute substantially to cumulative

ALTERNATIVES	CUMULATIVE IMPACTS
	adverse impacts. Alternative 4 carried out in conjunction with other environmental stewardship and restoration efforts has the potential to result in some long-term beneficial cumulative impacts to public health and safety.

6.8.5 Cumulative Impact Analysis of Proposed Phase III Projects

Chapters 8 -12 provide more specific analyses based on the Phase III ERP projects being proposed by the Trustees. Overall, the proposed Phase III ERP projects represent relatively small areas of potential disturbance distributed across the very large geographic area of the northern Gulf of Mexico. The Trustees considered whether a cumulative impact analysis of the more specific issues associated with project level impacts would be best organized by project type or by geography. Given the very large distance between similar projects (e.g., living shoreline projects in Florida, Alabama and Mississippi), the Trustees determined that analysis of potential project-level cumulative impacts based on their spatial proximity is a rational approach, such that different types of projects occurring in proximity to each other would be evaluated together. The initial spatial sorting of Phase III projects for cumulative impact analysis is therefore organized by each of the five Gulf States. Additional rational assemblages of projects within each state are described in Chapters 8 through 12 to group projects with a potential for cumulative impacts together for purposes of cumulative impact analysis.

6.9 Other NEPA Considerations

6.9.1 Unavoidable Adverse Impacts

Section 102(2)(c)(ii) of NEPA requires that an EIS include information on any adverse environmental effects that cannot be avoided, should the proposed action be implemented. Unavoidable adverse impacts are the effects on human environment that would remain after mitigation measures have been applied. Unavoidable adverse impacts do not include temporary or permanent impacts that would be mitigated. While these impacts do not have to be avoided by the planning agency, they must be disclosed, considered and mitigated where possible (40 C.F.R. 1500.2(e)). For some restoration techniques, mitigation measures are identified as options that can be used to avoid, reduce, minimize or mitigate these impacts. However these mitigation options are provided for consideration in future project development and selection, vary based on site-specific conditions, and are not required mitigations as part of the action alternatives. Therefore, future tiered Early Restoration projects will consider appropriate mitigation measures. Unavoidable adverse impacts associated with conversion of habitat and built infrastructure are disclosed for relevant project types and Phase III projects where reasonably foreseeable. In addition, future Early Restoration planning phases and associated NEPA analyses would consider the extent to which adverse impacts can be avoided, including consideration of appropriate mitigation, and would describe those adverse impacts that are unavoidable. Many examples of mitigation measures are identified in Appendix 6-A.

6.9.2 Relationship Between Short-Term Uses Of The Human Environment And The Maintenance And Enhancement Of Long-Term Productivity

Section 102(2)(c)(iv) of NEPA requires that an EIS "discuss … the relationship between local short-term uses of man's environment and the maintenance and enhancement of long-term productivity…." This section describes how the action alternatives would affect the short-term uses of the human environment and how that would affect the maintenance or enhancement of long-term productivity.

As described in Chapter 1, the purpose of this Programmatic ERP/PEIS is to accelerate meaningful restoration of injured natural resources and their services resulting from the Spill. This Plan would complement previous investments in Early Restoration in accordance with the Oil Pollution Act (OPA) and funds made available in the Framework Agreement. In order to meet this purpose, the Trustees have proposed alternatives intended to improve certain aspects of the human environment which would result in the maintenance and enhancement of the long-term productivity of a number of natural resources. Chapters 8 through 12 describe in detail the types of short- and long-term adverse impacts and/or benefits that would be expected for the different resource categories.

For a number of project types under Alternatives 2 and 4, such as creating and improving wetlands, protecting shorelines and reducing erosion, and restoring barrier islands and beaches, short-term adverse impacts generally include those associated with construction or implementation of restoration activities. Many of these impacts would be temporary and would not be expected to reduce long-term productivity. However, these project types are intended to enhance long-term productivity.

Some project types, particularly those in Alternatives 3 and 4, intend to provide and enhance recreational opportunities that would increase access to, and the recreational use of, resources. Dependent on how those uses are managed, these project types could result in both short-term and long-term impacts to habitats and resources. However, those impacts are not expected to degrade long-term productivity. Overall, the alternatives considered here are expected to enhance long-term productivity.

6.9.3 Irreversible and Irretrievable Commitment of Resources

Section 102(2)(c)(v) of NEPA requires that an EIS "discuss … any irreversible and irretrievable commitment of resources which would be involved in the proposed action should it be implemented" (40 C.F.R. §1502.16). However, NEPA and the CEQ regulations do not define "irreversible and irretrievable." For purposes of this analysis, a commitment of a resource incudes such things as agency funding or staff necessary to undertake a project. .

Implementation of any of the action alternatives would require an irreversible and irretrievable commitment of resources including staff time for project planning and development and the associated funding necessary to go through the consultation, coordination and decision-making processes. Other resource use that would be irreversible and irretrievable would be the use of energy through the combustion of fossil fuels and material resources for construction. However, the level of commitment would vary based on project type. For example the construction of a fish hatchery or aquaculture facility would require more resources than an action that replants vegetation on beaches as part of the "Restore Barrier Island and Beaches" project type.

6.9.4 Climate Change and NEPA

In 2010, the Council on Environmental Quality (CEQ) issued draft guidance on considering the effects of climate change and greenhouse gas emissions in their analysis of proposed action under NEPA (CEQ 2010). The draft climate change guidance also suggests ways that federal agencies should consider effects of climate change in developing projects that are resilient in nature and able to adapt to changes in the existing environmental conditions over time.

6.9.4.1 Current Climate Change Projections

The Intergovernmental Panel on Climate Change (IPCC) projects a rise of the world's oceans from 0.26 to 0.82 m by the end of the century, depending on the level of greenhouse gas emissions (IPCC 2013). In addition, the IPCC has concluded that "each of the last three decades has been successively warmer at the Earth's surface than any preceding decade since 1850" (IPCC 2013).

Climate change is projected to lead to a number of impacts in the southeastern United States, including increases in air and water temperatures, decreased water availability, an increase in the frequency of severe weather events, and ecosystem change. Average annual temperatures are predicted to increase 4 to 9 degrees F (USGCRP 2009). It is suggested that heavier rainfall is expected separated by increased dry periods, which would result in increased risk of flooding and drought (USGCP 2009).

Coastal environments are expected to be at increasing risk due to sea-level rise and increases in hurricane intensity and storm surge. Figure 6-1 illustrates the projected changes in sea level. Areas experiencing little-to-no change in mean sea level are illustrated in green. Areas illustrated with positive sea level trends (yellow-to-red) are experiencing both global sea level rise, and lowering or sinking of the local land, causing an apparently exaggerated rate of relative sea level rise. For example, some areas in Texas and Louisiana are experiencing subsiding land elevations further exacerbating effects of sea level rise (CCSP 2008).

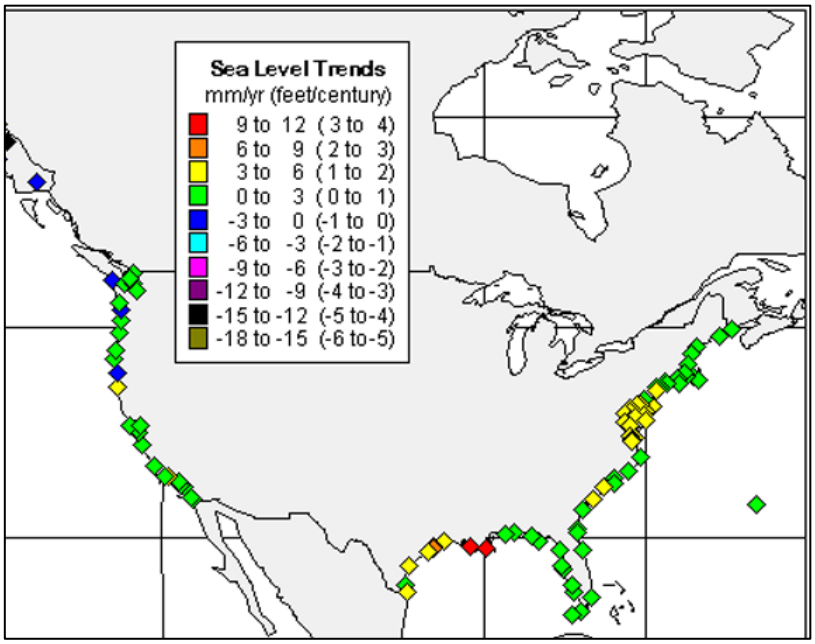

Figure 6-1. Regional Mean Sea Level Trends (NOAA 2013).

Climate change will likely have a number of impacts on the aquatic ecosystems of the northern Gulf. Higher ocean temperatures are expected to increase coral bleaching (Scavia et al. 2002). Sea-level rise and increasingly frequent coastal storms and hurricanes and associated storm surges will impact shorelines, altering coastal wetland hydrology, geomorphology, biotic structure, and nutrient cycling (Michener et al. 1997). Furthermore, an increase in atmospheric CO_2 concentrations is projected to increase freshwater discharge from the Mississippi River to the coastal ocean, decrease aquatic oxygen content, and expand the hypoxic zone in the northern Gulf of Mexico (Justic et al. 1997). Sea level rise could result in more frequently flooding low-lying areas which would permanently alter some ecological communities (USGCP 2009).

In addition to effects to natural resources, climate change effects will likely cause damage to transportation infrastructure affecting travel and damaging roads and bridges (USGCP 2009). Hurricanes

and storms will continue to damage property. Long term development will need to consider climate related effects in design stages to improve structure resiliency.

6.9.4.2 Climate Change Considerations in Planning

The Council on Environmental Quality (CEQ 2011) provides the following general definition of Climate Change Adaptation:

> Climate change adaptation means adjusting to a changing climate to reduce the negative impacts already occurring and taking advantage of new opportunities. In general, planning in advance for climate change impacts will help avoid disruptions to Federal agency operations and allow the Government to design and implement programs that are capable of achieving their missions across a range of future climate conditions.

CEQ encourages preemptive planning to the extent practicable, and consideration of climate change adaptations designed to reduce the vulnerability of a system to the effects of climate change. An example would be designing projects that are resilient across a range of future climate scenarios. In their recent draft guidance, the CEQ relies on 40 C.F.R. §1502.24 when it states that "[w]ith regard to the effects of climate change on the design of a proposed action and alternatives, Federal agencies must ensure the scientific and professional integrity of their assessment of the ways in which climate change is affecting or could affect environmental effects of the proposed action" (CEQ 2010).

A recent Executive OrderOrder reinforces the direction to undergo planning efforts to develop projects that are more resilient to changes in the environment over time as a result of climate change effects. It states that:

The Federal Government must build on recent progress and pursue new strategies to improve the Nation's preparedness and resilience. In doing so, agencies should promote: (1) engaged and strong partnerships and information sharing at all levels of government; (2) risk-informed decision-making and the tools to facilitate it; (3) adaptive learning, in which experiences serve as opportunities to inform

Figure 6-2. Gulf Coast Vulnerability to Sea Level Rise Index (USGS National Index of Coastal Vulnerability to Sea-Level Rise, Data Basin 2014).

Yellow areas have moderate vulnerability to seas level rise, orange areas have high vulnerability and red areas have very high vulnerability.

and adjust future actions; and (4) preparedness planning. (Executive Order -- Preparing the United States for the Impacts of Climate Change, November 1, 2013)

Projects associated with the project types evaluated in this Programmatic ERP/PEIS are not inconsistent with the Executive Order and CEQ Guidance on climate change.

Consideration of coastal vulnerability from climate change factors is important in planning. The IPCC defines vulnerability as "the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes" (IPCC 2007). Factors affecting coastal vulnerability include the physical characteristics of a particular setting and climate and non-climate drivers (Burkett and Davidson 2012). Climate drivers include sea level change, waves and currents, winds, storminess, atmospheric CO2, atmospheric temperature, water properties, sediment supply, and groundwater availability (Burkett and Davidson 2012). Figure 6-2 illustrates coastal vulnerability as a result of projected sea level rise for the northern Gulf Coast. Consideration of factors such as sea level rise, changes to shorelines and altered hydrology at the project design stage has allowed, and will allow, for the anticipation of a range of environmental changes and the development of Early Restoration projects that would be more resilient over time.

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