FINAL RESTORATION PLAN / ENVIRONMENTAL ASSESSMENT FOR THE EXXONMOBIL FORMER FERTILIZER SITES, CHARLESTON AND PORT ROYAL, SOUTH CAROLINA

August 2023

Prepared by:

National Oceanic and Atmospheric Administration

on behalf of

U.S. Department of Commerce

The United States Fish and Wildlife Service

on behalf of the

U.S. Department of the Interior

Department of Health and Environmental Control

and

Department of Natural Resources

on behalf of the

State of South Carolina

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Executive Summary

The National Oceanic and Atmospheric Administration (NOAA), the U.S. Fish and Wildlife Service (USFWS), the South Carolina Department of Natural Resources (SCDNR) and the South Carolina Department of Health and Environmental Control (SCDHEC) (collectively, the Trustees) have prepared this Final Restoration Plan/Environmental Assessment (Final RP/EA) to identify, evaluate, and propose alternatives to restore injured natural resources, including their supporting ecosystems and the services they provide, in order to compensate the public for the injury to natural resources resulting from releases of hazardous substances at and from nine former fertilizer sites in South Carolina (the Sites). This Final RP/EA was prepared jointly by the Trustees in accordance with Section 111(i) of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and its implementing regulations (43 C.F.R. § 11.93). This Final RP/EA describes the Trustees' restoration planning processes for the Natural Resource Damage Assessment (NRDA) and the restoration alternative that the Trustees propose to compensate the public for the natural resource injuries associated with the Sites.

Fertilizer production at several of the former fertilizer Sites resulted in the release of contaminants, including heavy metals, that were transported from those Sites, through surface and groundwater pathways, to approximately 100 acres of emergent salt marshes in and adjacent to the Sites and to the Ashley and Beaufort Rivers. These heavy metals do not degrade naturally and tend to persist in the environment. They have also been shown to cause a range of toxic responses in marine and estuarine organisms including mortality, reduced growth, and diminished reproductive capacity.

The Trustees conducted an injury assessment in cooperation with the Responsible Party, ExxonMobil. The assessment documented injuries to marine benthic habitats that support a wide variety of species in the South Carolina coastal ecosystem. The impacted estuarine areas are home to many species that are important both culturally and economically, including shrimp, oysters, drum, and blue crab. In addition to an abundance of resident estuarine fish, there are also several anadromous species that use these habitats, including American shad, blueback herring, striped bass, and the endangered shortnose and Atlantic Sturgeon.

On June 26, 2019, the U.S. Department of Justice entered a Consent Decree in United States District Court for the District of South Carolina announcing a settlement for claims for injuries to natural resources resulting from releases of hazardous substances at the Sites. This Final RP/EA is the next step in the restoration planning process. In this Final RP/EA, the Trustees outline potential restoration actions that could compensate the public for the injuries to natural resources resulting from the Sites and identify the Trustees' preferred restoration alternative, which consists of salt marsh and oyster reef creation projects on Edisto Island and Port Royal Sound, respectively.

1 INTRODUCTION

1.1 Overview

Under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), federal and state natural resource agencies are designated to act as Trustees for the public (CERCLA §9607(f)(1)). The Trustees are responsible for recovering damages for injury to natural resources caused by the release of hazardous substances. Damages may include the cost of restoring the resource services to baseline conditions (i.e., conditions without a release) and the value of recreation and ecological service losses from the time of injury until baseline is restored.

This Final Restoration Plan/Environmental Assessment (RP/EA) has been developed jointly by the National Oceanic and Atmospheric Administration (NOAA) of the U.S. Department of Commerce, the South Carolina Department of Health and Environmental Control (SCDHEC) and the South Carolina Department of Natural Resources (SCDNR) on behalf of the State of South Carolina, and the U.S. Fish and Wildlife Service (USFWS) on behalf of the U.S. Department of the Interior (DOI), (collectively, the Trustees) to address natural resources, including ecological services, injured, lost, or destroyed due to releases of hazardous substances at nine former fertilizer sites in South Carolina (the Sites). The nine Sites are: the Atlantic Phosphate Works Site, the Stono Phosphate Site, and the Swift Agri-Chem Site located on the Ashley River in Charleston; the Lambs Fertilizer Site and the Wando Phosphate Site located in Charleston; the Port of Baldwin Mines Site located in Port Royal; the Georgia Chemical Works Ponpon Site located at Pon Pon in Adams Run; the Virginia Carolina Chemical (VCC) Company Site located in Blacksburg; and the VCC Company Site located in Greenville. The U.S. Environmental Protection Agency (EPA) chose to regulate several of these Sites together as a group due to: (1) similar operational backgrounds (former phosphate fertilizer plants), (2) similar legacy pollution (elevated inorganics, low pH), (3) similar habitats (coastal marshlands), and (4) the same responsible party, Exxon Mobil Corporation (ExxonMobil). The Trustees found EPA's collective approach useful and thus decided to consider the Sites as a group for purposes of the Natural Resource Damage Assessment (NRDA) that is the subject of this Final RP/EA. All nine sites are former phosphate fertilizer plants in South Carolina for which ExxonMobil has accepted potential Natural Resource Damages (NRD) liability.

The Trustees and ExxonMobil reached a cooperative settlement under CERCLA to resolve ExxonMobil's NRD liability for the Sites in 2019. On June 26, 2019, the United States District Court for the District of South Carolina entered a consent decree executing that settlement agreement. Under the Consent Decree, ExxonMobil was required to pay the Trustees $6,374,529 for the joint use and benefit of the Trustees to pay Trustee costs (past and future) and to pay for Trustee-sponsored natural resource restoration to compensate the public for lost or injured natural resources and lost natural resource services resulting from the releases of

hazardous substances at the Sites. Approximately $5,500,000 of the total settlement funds are designated for restoration implementation.

This Final RP/EA describes the Trustees' assessment and restoration planning processes for this NRDA and the Trustees' preferred restoration alternative to compensate the public for the natural resource injuries associated with the Sites. The Trustees anticipate spending the full $5,500,000 of the settlement funds designated for restoration on the preferred restoration projects identified herein.

1.2 Purpose, Need, and Proposed Actions

Purpose. The purpose of the proposed actions is to restore, rehabilitate, replace, or acquire natural resources and their services to compensate for natural resources and natural resource services injured or lost as a result of releases of hazardous substances at the Sites.

Need. In order to achieve this purpose, the Trustees must identify and evaluate potential alternative restoration options in order to determine whether these alternatives would appropriately compensate the public for natural resource injuries associated with the Sites.

Proposed Actions. The Proposed Actions are to create salt marsh and oyster reef habitat to compensate the public for natural resource injuries resulting from releases of hazardous substances at the Sites. The Trustees are proposing separate salt marsh and oyster reef habitat creation projects.

For the salt marsh habitat creation project, the Trustees propose to create approximately 17 acres of salt marsh on property owned and managed by the Charleston County Parks and Recreation Commission (CCPRC) on Edisto Island, South Carolina (Edisto Island Project). The Edisto Island site consists of salt and freshwater wetland separated by an earthen berm. Freshwater wetland and upland areas to the south of the berm were historically used for agriculture and are now mostly forested. The Edisto marsh creation project would restore historic tidal hydrology and salt marsh functions in the impounded freshwater wetland area and establish site restoration protection and performance monitoring requirements.

For the oyster reef creation project, the Trustees propose approximately 3.2 acres of oyster reef restoration at two sites in the Harbor River, near the Port Royal site. The proposed restoration areas were identified by SCDNR as suitable locations for loose shell oyster reef creation.

1.3 Natural Resource Trustees and Authorities

This Final RP/EA was prepared jointly by the Trustees pursuant to their respective authority and responsibilities as natural resource trustees under CERCLA, 42 U.S.C. §§ 9601 *et seq.*; the Federal Water Pollution Control Act, 33 U.S.C. §§ 1251, *et seq*. (also known as the Clean Water Act or CWA), and other applicable federal or state laws, including Subpart G of the National Oil and Hazardous Substances Contingency Plan (NCP), at 40 C.F.R. §§ 300.600 through 300.615, and the CERCLA Natural Resource Damage Assessment and Restoration regulations at 43 C.F.R. Part 11 (CERCLA NRDAR regulations), which provide guidance for this restoration planning process under CERCLA.

Under these regulations, the Trustees are authorized to act on behalf of the public to recover damages for injury to natural resources caused by a release of hazardous substances. Damages may include: (1) the cost of restoring the injured natural resources or ecological services to baseline conditions (i.e., conditions without a release) and (2) the value of recreation and ecological service losses from the time of injury until baseline is restored.

1.4 NEPA Compliance

Actions undertaken by the Trustees to restore natural resources or services under CERCLA and other federal laws are subject to the National Environmental Policy Act (NEPA), 42 U.S.C. §§ 4321 *et seq.*, and the regulations guiding its implementation at 40 C.F.R. Parts 1500 through 1508. NEPA and its implementing regulations outline the responsibilities of federal agencies under NEPA, including the preparation of environmental documentation. In general, federal agencies contemplating implementation of a major federal action must produce an environmental impact statement (EIS) if the action is expected to have significant impacts on the quality of the environment. When it is uncertain whether a contemplated action is likely to have significant impacts, federal agencies prepare an environmental assessment (EA) to evaluate the need for an EIS. If the EA demonstrates that the proposed action will not significantly impact the quality of the environment, the agency issues a Finding of No Significant Impact (FONSI), which satisfies the requirements of NEPA, and no EIS is required.

NOAA is the lead NEPA agency for preparing this RP/EA. In accordance with NEPA and its implementing regulations, this Final RP/EA summarizes the current environmental setting, describes the purpose and need for restoration actions, identifies and evaluates alternative actions, including their applicability and potential impact on the quality of the physical, biological, and cultural environment, and summarizes the outcome of the public review and comment period.

After conducting a NEPA analysis (Section 6), the Trustees conclude the impacts associated with the restoration actions selected herein do not meet the threshold requiring an EIS and, accordingly, issue a FONSI (Available in the Administrative Record, See Section 1.6).

Actions undertaken by the Trustees to restore natural resources or services under CERCLA and other federal laws must comply with other applicable laws and regulations, as outlined in Section 7. At the time of this Final RP/EA's release, consultations have been initiated with the respective agencies.

1.5 Public Participation

The Trustees prepared this Final RP/EA to provide the public with information on the natural resource injuries and service losses associated with the Sites; the restoration objectives that have guided the Trustees in developing this plan; the restoration alternatives that have been considered; the process used by the Trustees to identify preferred restoration alternatives; and the rationale for their proposal. Public review of the restoration actions proposed in this RP/EA is an integral and important part of the restoration planning process and is consistent with all applicable state and federal laws and regulations, including NEPA and its implementing regulations, and the guidance for restoration planning found within 43 C.F.R. Part 11.

The Draft RP/EA was released for review and comment by the public on March 30, 2023. The public comment period ran through April 30, 2023. No public comments were received. The Draft RP/EA remains available to the public on the case webpage:

https://darrp.noaa.gov/hazardous-waste/exxonmobil-former-fertilizer-plants

This Final RP/EA will also be available at that site following publication.

1.6 Administrative Record

The Administrative Record for this NRDA can be accessed at:

https://www.diver.orr.noaa.gov/web/guest/diver-admin-record/6224

2 THE FORMER PHOSPHATE FERTILIZER SITES - OVERVIEW

2.1 Background – Phosphate Mining and Fertilizer Production in South Carolina

All the Sites addressed in this NRDA share a common history of phosphate fertilizer production. In the early 1860s, substantial outcroppings of phosphate rock were discovered in Charleston along the banks of the Ashley River and in other areas of South Carolina. At that time, commercial fertilizers and superphosphates were largely unknown. Instead, farmers used manure, guano, ground-up bone, and other mineral-rich materials to fertilize their crops. The discovery of abundant supplies of easily accessible (near surface) phosphate deposits, combined with a well-developed regional transportation system and increasing demand for superior fertilizers, gave birth to the phosphate fertilizer industry in Charleston and across South Carolina. By 1873, there were six fertilizer companies in the Charleston region with multiple production facilities employing thousands of South Carolinians (ExxonMobil Corp, 2004). By 1884, the phosphate fertilizer industry was arguably the largest and most important industry in South Carolina. The state was considered the world's chief producer of phosphate rock. With the discovery in 1890 of vast deposits of higher quality phosphate rock near Tampa, Florida, phosphate mining in South Carolina began a slow decline and eventually ceased altogether by 1925. Although mining ceased, the production of phosphate fertilizer in South Carolina was still among the highest in the United States.

The production of phosphate fertilizers consisted of two linked processes: sulfuric acid production and extraction/curing/crushing/mixing/bagging. Sulfuric acid was manufactured at a fertilizer production site using the lead chamber process. Sulfur was burned at a high temperature (1,800°F-2,000°F) creating sulfur dioxide which, when reacted with oxygen in air, forms sulfur trioxide. Next, water was passed through packing media in a Glover Tower, where it reacted with the sulfur trioxide, producing sulfuric acid. The sulfuric acid was stored in lead-lined chambers. Periodically, these chambers were cleaned out and the acidic media, with soluble lead, was generally released directly to the environment. As a result, low pH groundwater and elevated lead concentrations are frequently encountered at former phosphate fertilizer sites.

In the early years of operation, sulfuric acid was often produced by burning pyrite ore (iron sulfide). After burning the pyrite ore, the remaining slag (sometimes called "klinker") was commonly used as fill material on-site and elsewhere. It is this "klinker" that is the source of elevated heavy metals observed at many former fertilizer sites. Thus, the contamination at these former plants (elevated metals and low pH) is generally due to the on-site production of sulfuric acid.

In the second part of fertilizer production, sulfuric acid was ordinarily mixed with ground phosphate rock to produce phosphoric acid, the building block of phosphate fertilizers. The

resultant mixture was solidified and cured, producing a bulky phosphate mass. The solidified mass was mechanically crushed to create the final product of appropriate size. The superphosphate product contained only one nutrient, phosphorus (P). To create other products, ammonia (for nitrogen, N) and potash (for potassium, K) were added to produce the familiar P-K-N fertilizers. The finished product was bagged and prepared for distribution.

The phosphate fertilizer industry in South Carolina started to decline in the 1960s due to the emergence of ammonium phosphates and solid/liquid mixed fertilizers. By the 1980s, land occupied by former phosphate fertilizer facilities was redeveloped into a mixture of commercial or light industrial complexes.

2.2 The Former Phosphate Fertilizer Sites Addressed in this NRDA

2.2.1 Charleston Area Sites

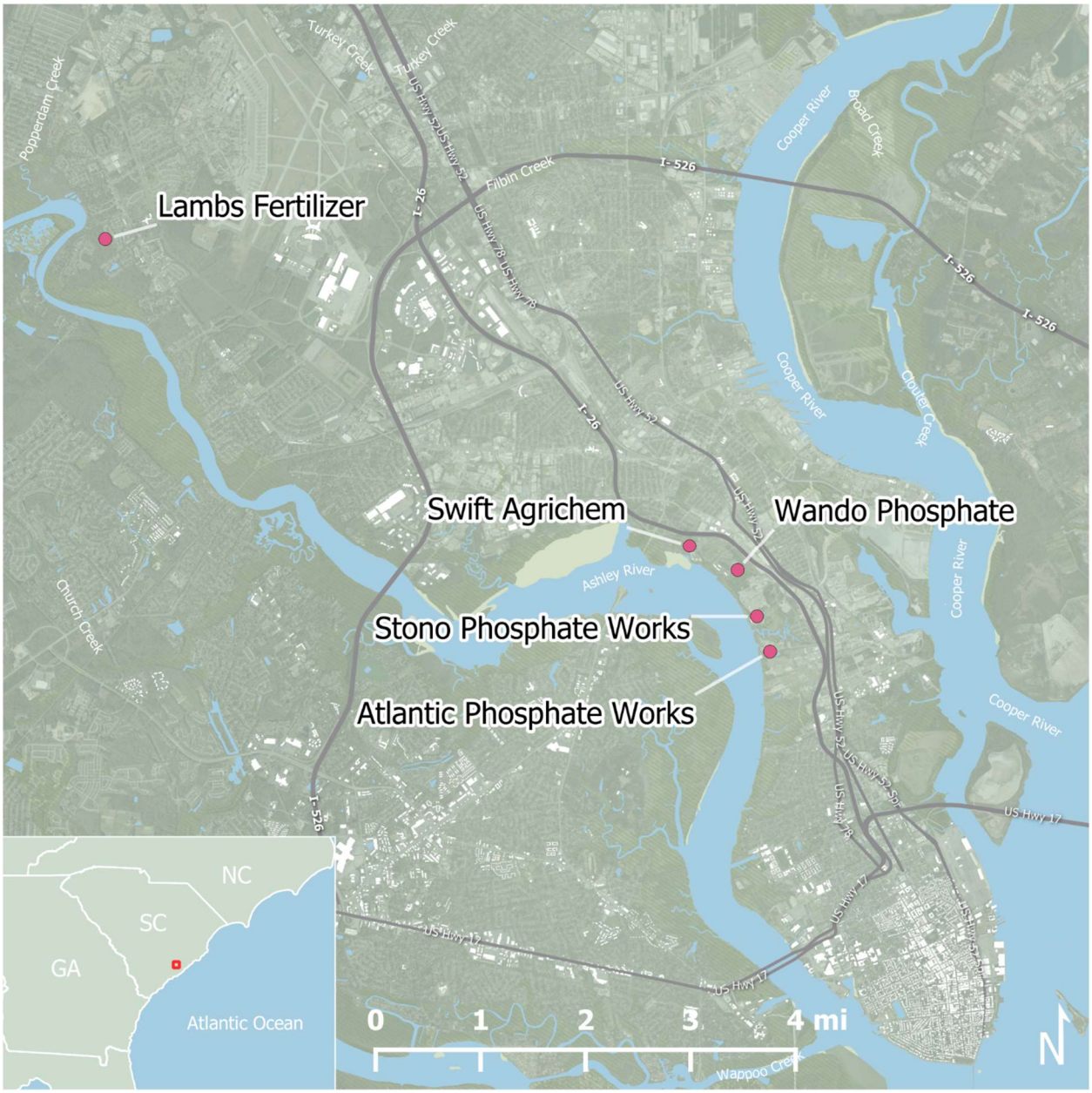

FIGURE 2.1. CHARLESTON AREA SITES

2.2.1.1 Atlantic Phosphate Works Site

The Atlantic Phosphate Works Site (Site Identification Number [Site ID]: SC20002332815, formerly identified as SCD0008221711) is located in the Charleston Heights area north of downtown Charleston, South Carolina on the west side of the peninsula formed by the Ashley and Cooper Rivers. This site encompasses approximately 65 acres, of which approximately 31 acres are salt marsh. From approximately 1900 until 1943, the site was used for the production of phosphate fertilizer. All structures relating to the fertilizer works were removed by February 1945. In the mid-1940s, South Carolina Electric & Gas (SCE&G) constructed an electric generation plant (Hagood Station) at the site. SCE&G dismantled the original Hagood Station steam plant in the 1990s and replaced it with a new gas turbine electric generation plant. The Hagood Station facilities occupy a significant portion of the Site.

The Atlantic Phosphate Works Site is located immediately south of and adjacent to the Stono Phosphate Works Site (see below). The two sites share a common and contiguous 39-acre salt marsh.

2.2.1.2 Stono Phosphate Works Site

The Stono Phosphate Works Site (Site ID: SC0002316404) is located in the Charleston Heights area north of downtown Charleston, South Carolina on the west side of the peninsula formed by the Ashley and Cooper Rivers. This 15-acre site is bounded to the south by the Atlantic Phosphate Works Site. From 1900 to the late 1950s, the site was used for the production of fertilizer using locally mined phosphate and sulfuric acid produced on-site. All structures related to fertilizer production were removed by 1973. Dolphin Cove Marina has occupied the site since 1978, where it currently operates a marina and recreational boat repair and storage facility.

The Stono Phosphate Works Site shares a common and contiguous 39-acre salt marsh with the Atlantic Phosphate Works Site, which is immediately to its south.

2.2.1.3 Swift Agrichem Site

The Swift Agrichem Site (Site ID: SCD058181991) is located in the Charleston Heights area north of downtown Charleston, South Carolina on the west side of the peninsula formed by the Ashley and Cooper Rivers. This 44-acre site is bounded to the north by Interstate 26, to the west by salt marsh, and to the south by the Ashley River. Between 1890 and 1975, the site was

1 These numbers (and the similar numbers provided for the other former phosphate fertilizer sites) are the hazardous waste site numbers used by the SCDHEC and EPA to identify the sites.

used for the production of fertilizer. All structures related to fertilizer production were removed by 1979. At present, the southeast corner of the site is occupied by the Palmetto Behavioral Health Center.

The Swift Agrichem Site is located adjacent to the Wando Phosphate Site (see below), which is located on the Ashley River immediately downstream of the Swift Agrichem Site. The two sites share common and contiguous salt marsh habitat.

2.2.1.4 Wando Phosphate Site

Wando Phosphate Site (Site ID: SCS123457104) is located in the Charleston Heights area north of downtown Charleston, South Carolina on the west side of the peninsula formed by the Ashley and Cooper Rivers. The boundaries of this 74-acre site are defined by King Street Extension to the northeast, the Ashley River to the southwest, and the Swift Agrichem Site to the northwest. Fertilizer was produced on an 11-acre portion of the site from around 1884 to 1924. The acid production structure was removed prior to 1924, and the remainder of the fertilizer plant structures were removed in 1945. The site is partially developed for residential and commercial purposes.

The Wando Phosphate Site is located immediately downstream of the Swift Agrichem Site, on the Ashley River. The two sites share a common and contiguous salt marsh.

2.2.1.5 Lambs Fertilizer Site

The Lambs Fertilizer Site (Site ID: SCS123457011) is located on Lambs Road in North Charleston, South Carolina, in an area that was historically strip-mined for phosphate rock and later redeveloped for residential use. This site encompasses approximately 334 acres and is bounded to the east by Dorchester Road, to the west by the Ashley River, to the north by a residential area, and to the south by a shopping plaza, apartments, and undeveloped land. Processing of locally mined phosphate rock was conducted on the site from 1868 to 1920. A significant portion of the site is now occupied by residences, apartments, and a shopping plaza.

2.2.2 Non-Charleston Area Sites

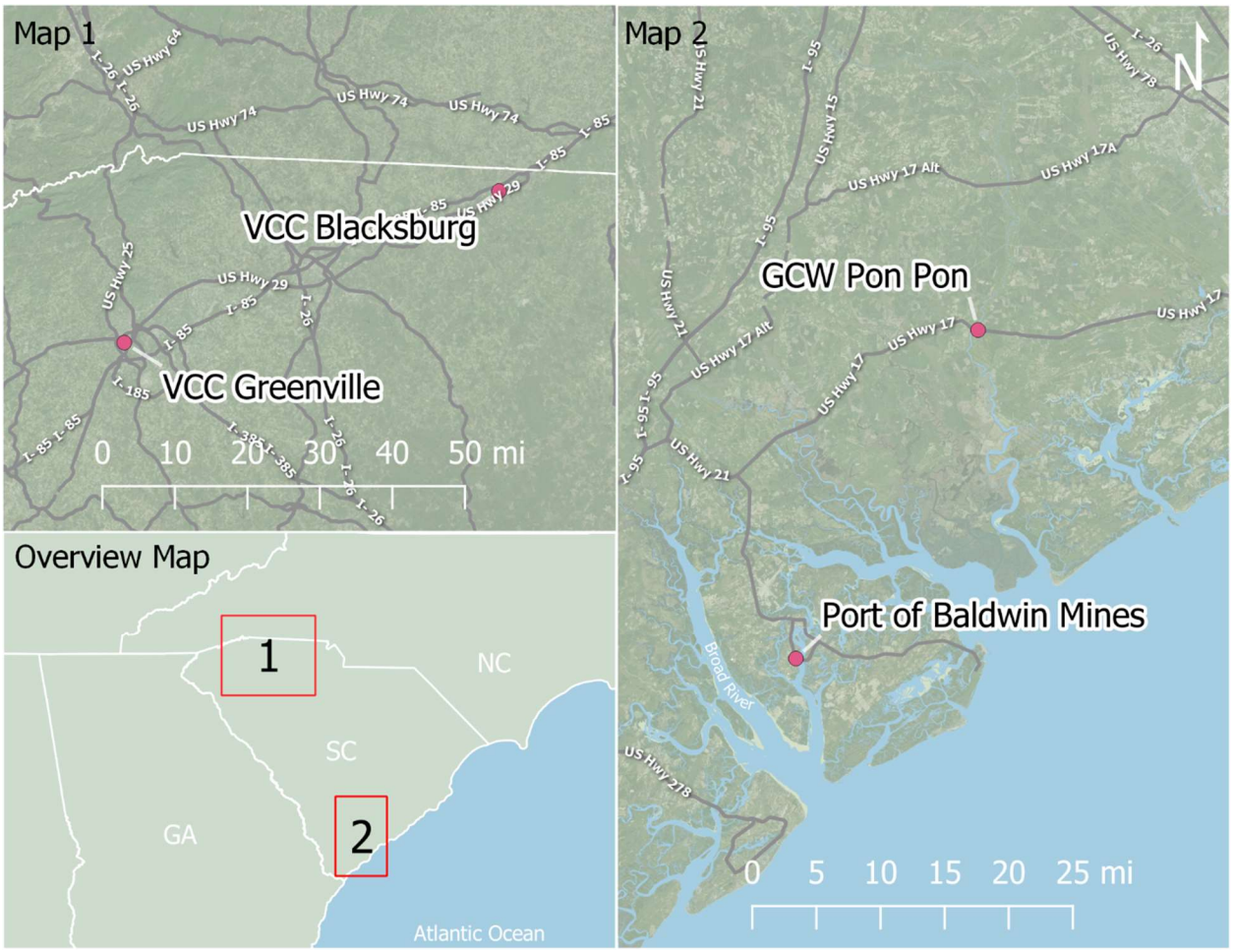

FIGURE 2.2. NON-CHARLESTON AREA SITES

2.2.2.1 Port of Baldwin Mines Site

The Port of Baldwin Mines Site (Site ID: SCN000407725) is located on the west bank of the Beaufort River along Ladys Island Drive in Port Royal, South Carolina. This site covers approximately 29 acres. The site was occupied by a phosphate fertilizer manufacturing plant, which operated as early as 1884 until the 1940s. The site is currently occupied by a residential community (with 65 individual lots and a marina), two condominium complexes, an assisted living facility, and an office building. The Port of Baldwin Mines Site is adjacent to and part of approximately 39 acres of salt marsh habitat along the Beaufort River.

2.2.2.2 GCW Pon Pon Site

The GCW Pon Pon Site (Site ID: SCN000410142) is located along US Highway 17 and the east bank of the Edisto River at Pon Pon in Adams Run, South Carolina. This site lies in a predominantly rural area that was historically used for phosphate mining until the 1930s, and for quarrying of sand and gravel until the 1950s. The abandoned sand and gravel pits remain as significant features both on and near the site. In the early 1900s, a phosphate fertilizer plant operated at the site. Historical documents suggest that the plant was located in the north-central portion of the site. The site is currently occupied by scattered residences that are mostly used for vacation purposes.

2.2.2.3 VCC Blacksburg Site

The VCC Blacksburg Site (Site ID: SCS123457103) is located in a rural area west of Blacksburg, South Carolina. An abandoned Norfolk Southern Railroad spur traverses the site on the north, and North Shelby Road bounds the site to the south. Fertilizer production occurred on the site from 1886 to 1932, on a 5-acre portion of the 66-acre property. Between 1940 and 1947, all structures relating to the fertilizer works were removed. Currently, a few scattered residences and a restaurant occupy the east, south, and west borders of the site.

2.2.2.4 VCC Greenville Site

The VCC Greenville Site (Site ID: SCN000407814) is located northeast of the intersection of Anderson Road and Somerset Street in Greenville, South Carolina. This 44-acre site is bounded to the west by Anderson Road, and to the east by the Norfolk Southern Railroad. Fertilizer was produced at the Site from 1913 to 1963. According to aerial photographs, the fertilizer plant structures were demolished or removed between 1965 and 1978. The site has since been subdivided and partially developed. Current occupants are a construction company and a women's rehabilitation center.

3 INJURY ASSESSMENT

This background section describes the Trustees' assessment strategy, including the approaches used to determine potential injuries to resources affected by hazardous substance releases from the Sites.

The Trustees undertook this NRDA in cooperation with the Potentially Responsible Party (PRP), ExxonMobil, with the goals of minimizing costs, reducing the need for independent and possibly duplicative studies, avoiding litigation, and allowing for a restoration-based settlement. In a restoration-based assessment, injuries to and/or losses of natural resources and ecological services are quantified in ways that facilitate the identification of restoration projects and serve to compensate the public with a similar level, type, and quality of resources or services as were lost. The restoration-based assessment approach is consistent with the CERCLA NRDAR regulations.

The Trustees' injury assessment for this NRDA began with an assessment of four former phosphate fertilizer sites in South Carolina: the Atlantic Phosphate Works Site, the Stono Phosphate Works Site, the Swift Agrichem Site, and the Port of Baldwin Site. All of these sites either contain salt marsh habitat, are adjacent to salt marsh habitat, or both. Accordingly, the Trustees' assessment focused on injuries to natural resources found in and provided by salt marsh habitat.

3.1 Injury determination and restoration-based quantification

3.1.1 The Pathways of Contamination to Trust Resources

A first step in an assessment of natural resource injuries is to identify the pathways of contamination to trust resources. A pathway is the route or medium (for example, water or soil) through which hazardous substances are transported from the source of contamination to the natural resource of concern (43 C.F.R. § 11.14). The Trustees concluded that the primary transport pathways of concern in this NRDA were surface water/soil transport to salt marsh as well as the likely discharge of shallow ground water to marsh. Waste disposal practices at several of the Sites resulted in the presence of contamination in areas utilized by wildlife and other ecological receptors of interest. Moreover, the results of field investigations and laboratory analyses indicated that soils, sediments, and water were contaminated with phosphate fertilizer production-related constituents.

3.1.2 Contaminants of Concern (COCs)

Another step in the injury assessment process is to identify which chemicals should be included on the list of contaminants of concern (COCs). To this end, the Trustees reviewed information in EPA's Contaminants of Potential Concern (COPC) for the Sites and concluded the contaminants from former fertilizer plants that were likely to threaten trust natural resources at or near the Sites were inorganic compounds, especially arsenic, copper, lead, mercury, and zinc. These

hazardous substances were found to be present in the surface soils, surface waters, sediments, groundwater, and adjacent wetlands at or near the Sites studied.

3.1.3 Physical Habitat – Natural Resources and Services at or Adjacent to the Sites

The Trustees focused their assessment on injuries to the benthic community within salt marshes found on and/or adjacent to the Sites. The benthic community includes organisms that live on, in, or near the marsh soils and sediments.

The Charleston area (Atlantic Phosphate Works, Stono Works, Swift Agrichem, Wando Phosphate, and Lambs Fertilizer) and Port of Baldwin Sites either contain salt marsh habitat, are adjacent to salt marsh habitat, or both. Salt marshes represent physical habitat for many organisms. Ecological services provided by these physical habitats include refugia from predation, shelter from high-energy storm events, forage areas, and nursery areas for the growth and development of larval/juvenile life stages. Sediments, in particular, provide essential physical habitat for numerous salt marsh organisms. Many spend their lives entirely within or closely associated with the sediment substrate. Primary producers in the marsh (emergent plants, macroalgae, and benthic diatoms) require sediments to physically grow and reproduce. The shells of live and dead oysters provide substrate for large populations of non-reef building encrusting organisms such as bryozoans, sponges, barnacles, mussels, anemones, worms, slipper shells, and algae. Some species of fish (e.g., gobies, blennies, oyster toad) reproduce only in the open shells of recently deceased oysters. These small resident fish, in turn, represent secondary production and provide important forage stock for larger predators such as flounder, red drum, and striped bass.

The lower Ashley River and Charleston Harbor, in particular, are tidal estuaries supported by benthic communities that provide important habitat for a wide variety of trust resources. Resident estuarine fish species include bay anchovy, killifish, sheepshead minnow, and silversides. All life stages of these species exist within the estuary and several species are considered abundant. Fish species such as bluefish, mullets, pinfish, and the sciaenids (Atlantic croaker, black drum, spot, spotted seatrout, weakfish) spend much of their life in the estuary but move offshore as sexually mature adults to spawn. Their eggs and larval stages drift offshore, and juvenile stages migrate back into the protective estuary where they grow and develop. After several years, they migrate to coastal waters to spawn, completing the life cycle. Several anadromous species, including American shad, blueback herring, striped bass, and white perch, live in the estuary but move into freshwater upstream of the site to spawn. The catadromous American eel is also present in the estuary.

Many invertebrate species are present in this estuary, including blue crab (*Callinectes sapidus*), daggerblade grass shrimp *(Palaemonetes pugio)*, Eastern oyster (*Crassostrea virginica*),

Northern quahog (*Mercenaria mercenaria*), and penaeid shrimp (*Penaeidae* spp.). Juvenile and adult blue crabs are abundant. Following mating, female blue crabs usually migrate to higher salinity coastal waters to brood their eggs and release their larvae. Daggerblade grass shrimp, Eastern oyster, Northern quahog, and penaeid shrimp are also very abundant and spend all or most of their life in the estuary. Many other species of macro- and meiofaunal invertebrates constitute a strong and viable benthic (sediment-associated) community. This community is critically important in the cycling of nutrients and the flow of carbon through the detritus-based food webs in the salt marshes within the Ashley River and in Charleston Harbor.

Endangered and threatened species known to occur in the Ashley River include the bald eagle (*Haliaeetus leucocephalus*), wood stork (*Mycteria americana*), piping plover (*Charadrius melodus*), green sea turtle (*Chelonia mydas*), Kemp's ridley sea turtle (*Lepidochelys kempii*), loggerhead sea turtle (*Caretta caretta*), and West Indian manatee (*Trichechus manatus*). The protected bottlenose dolphin (*Tursiops truncatus*) is frequently seen throughout the estuary. Both the Cooper and Edisto Rivers have been identified as critical habitat for the Atlantic Sturgeon (*Acipenser oxyrinchus*). Although critical habitat has not been designated for the endangered shortnose sturgeon (*Acipenser brevirostrum*), the Cooper and Edisto Rivers serve as an important migratory corridor for both species.

The Beaufort River (near the Port of Baldwin Site) and its associated salt marsh also provide important habitat for a wide variety of trust resources. Trust resources of concern are similar to those in the Ashley River and Charleston Harbor, and include all fishery resources dependent on the area, both transient and permanent species, benthic sediments, and organisms that rely on the benthic sediments. Specific biological trust resources include spotted sea trout (*Cynoscion nebulosus*), Atlantic croaker (*Micropogonias undulates*), red drum (*Sciaenops ocellatus*), black drum (*Pogonias cromis*), summer flounder (*Paralichthys dentatus*), sheepshead (*Archosargus probatocephalus*), Eastern oyster, blue crab, grass shrimp, and penaeid shrimp. Additionally, benthic resources such as copepods, polychaetes, mollusks, and amphipods occupy vegetated and open water areas. The Beaufort River and Port Royal Sound are also considered nursery and forage habitat for the endangered shortnose sturgeon (*Acipenser brevirostrum*) which is protected under the Endangered Species Act (U.S. Fish & Wildlife Service 2005).

Many of the specific trust resources and ecological services described above are provided by or are directly affected by the benthic community within a habitat. The benthic community is composed of populations of organisms living in or closely associated with bottom sediments. The community is dominated by microbes, meiofaunal and macrofaunal invertebrates, such as annelid worms (e.g., polychaetes and oligochaetes), crustaceans (e.g., shrimp and crabs), mollusks (e.g., oysters and clams), and certain finfishes. These animals live within the sediment (infaunal invertebrates), on the surface of sediments or hard substrate (epifaunal invertebrates), or near the sediment-water interface (demersal fishes and crustaceans). The benthic community provides and/or directly affects essential ecological services related to

carbon flow, nutrient cycling and standing stock in the salt marsh, as well as in downstream habitats. Loss or reduction of these services, therefore, would likely have adverse effects on other biological communities and ecological service flows in the salt marsh habitats of the Sites.

3.1.4 Sediment Benchmarks

The Trustees quantified injuries, in part, using sediment benchmarks. Sediment benchmarks are chemical concentrations demonstrated by the scientific community to be associated with adverse impacts (e.g., toxicity) to aquatic biota (Burton 1992, EPA 1992, Ingersoll et al. 1997). Two sets of benchmarks that appear in scientific literature and in project reports for hazardous waste sites were used in reports for the Sites addressed in this NRDA (e.g., sediment quality triad investigations, Chapman et al. 1997, BBL 2004a, 2004b, 2004c). Specifically, the Florida Department of Environmental Protection (FLDEP) has developed two sediment benchmarks called the Threshold Effect Level (TEL) and Probable Effect Level (PEL) (MacDonald, 1994) and NOAA has developed two analogous sediment benchmarks, which are called Effects Range-Low (ERL) and Effects Range-Median (ERM) (Long et al. 1995, 1998). These two sets of sediment benchmarks were used for the assessment.

3.1.5 Habitat Equivalency Analysis for the Former Phosphate Fertilizer Sites

Habitat Equivalency Analysis, or HEA (NOAA, 2006), is an accounting tool that can be used to determine the amount of compensatory restoration required to replace lost services that would have been provided by the injured habitat. The goal is to identify a restoration project(s) that provide ecological service gains to offset service losses resulting from the injury.

In general, the HEA is a technique that balances “debits” (injured habitat or other resource service losses) against compensatory “credits” (habitat restoration projects). Because the losses occur in different time periods the relevant losses are not directly comparable. Therefore, a discount factor is used to account for these time differences. Losses that are discounted over time are quantitatively expressed as “discounted-service-acre-years” or DSAYs.

The HEA for this NRDA focused on four of the former phosphate fertilizer sites addressed in the settlement with ExxonMobil: the Atlantic Phosphate Works Site, the Stono Phosphate Works Site, the Swift Agrichem Site, and the Port of Baldwin Site. For the HEA, the four Sites were divided into areas where no removal was planned and where sediment excavation followed by re-vegetation were planned. The distinction was made between the removal and non-removal areas because each carried with it a different set of HEA assumptions. Within each area, a median concentration for each of the five inorganics was calculated based on sediment

chemistry results. To account for baseline, the baseline chemical concentration was subtracted from these median concentrations. An injury was calculated from these baseline-adjusted concentrations and percent service loss calculated using sediment benchmarks. Because the Stono Phosphate Works and Atlantic Phosphate Works Sites share a common and contiguous 39-acre salt marsh, this area was treated as a single entity for purposes of the HEA.

Inputs to the HEA for the Sites were based on benthic community service losses estimated by the benchmark approach and the following set of assumptions:

1) Injury levels were assumed to be constant from 1981 until the time of the removal action;
2) Removal actions occurred in 2007 (base year);
3) Ten-year recovery to 80% functional value in removal areas;
4) Twenty-five-year recovery to 100% functional value in non-removal areas; and
5) Three percent discount rate.

In the second part of HEA, compensatory habitat restoration provides "credit" inputs that are used to project the amount of services generated over time by a restoration activity such as salt marsh creation. Credit inputs may include parameters such as the number of years to maturity, how long a project is expected to last, and rate of natural recovery. For purposes of this NRDA, a HEA was used to estimate the size of tidal salt marsh restoration necessary to compensate the public. The following assumptions were used for the compensatory portion of the HEA:

1) Salt marsh creation project completed in 2009;
2) Eight years until created salt marsh reaches its maximum functional value of 80%;
3) Created salt marsh will provide service flows for 50 years; and
4) Three percent discount rate.

Results of the HEA indicated approximately 22 acres of created salt marsh habitat would generate the credits to compensate for losses incurred from 1981 until full recovery of the areas; estimated to occur between 2017 and 2033 (Table 3.1).

TABLE 3.1. HEA SUMMARY FOR THE FORMER EXXONMOBIL SITES

Former VCC Site and Action	Size (acres)	Average % Loss of Benthic Services (MSQ)	DSAYs* Lost: HEA Debit	Compensatory Requirements: HEA Credit (acres)
Atlantic-Stono Marsh Non-Removal	35.90	6.72	121.78	7.38
Atlantic-Stono Marsh Excavation & Revegetation	3.00	65.12	110.21	6.68
Swift Agrichem Marsh Non-Removal	48.99	0.00	0.00	0.00
Swift Agrichem Marsh Excavation & Revegetation	2.04	60.38	71.0	4.30
Port of Baldwin Mines Non-Removal	8.40	0.00	0.00	0.00
Port of Baldwin Mines Marsh Excavation & Revegetation	2.00	46.86	58.60	3.55
TOTAL	100.33		361.59	21.91

* DSAYS= DISCOUNTED-SERVICE-ACRE-YEARS

3.1.6 Former Phosphate Fertilizer Sites Not Included in the HEA

The five former fertilizer sites that were not included in the HEA analysis completed for this NRDA are: the Wando Phosphate Site, the Lambs Fertilizer Site, the GCW Pon Pon Site, the VCC Blacksburg Site, and the VCC Greenville Site. Inclusion of those sites in the settlement with ExxonMobil did not result in an adjustment to the Trustees' HEA for the following reasons.

The Wando Phosphate Site is directly adjacent to and downstream of the Swift Agrichem Site and the footprint of the assessment conducted at the Swift Agrichem Site included the portion of the Wando Phosphate Site along the Ashley River. The Trustees determined that all of the (non-removal) marsh at the Swift Agrichem Site had a 0% injury. This included the salt marsh on the Wando Phosphate Site. Non-salt marsh habitat on the Wando Phosphate Site, including

removal areas, was limited in acreage. Therefore, the Trustees concluded that including the Wando Phosphate Site in the assessment did not warrant adjusting the HEA.

At the Lambs Fertilizer Site in North Charleston, the Trustees reviewed sampling results presented in EPA's Removal Action Completion Report (RACR) and found that contamination was limited to lead impacts in soil at a single location, prior to the removal action. Additionally, arsenic and lead were not detected above screening levels in sediment and surface water samples collected at the site. Due to the limited extent of the contamination documented at the site, the Trustees concluded that the site did not pose any known threats to trust resources and that including the Lambs Fertilizer Site in the assessment did not warrant adjusting the HEA.

With respect to the GCW Pon Pon, VCC Blacksburg, and VCC Greenville Sites, the Trustees reviewed the site locations and remedial site materials, and concluded that due to the sites' inland locations, as well as to the limited evidence of any known threats to trust resources at and/or from these sites, the inclusion of the sites in this NRDA did not warrant modifying the HEA.

4 CERCLA RESTORATION PLANNING – IDENTIFYING POTENTIAL RESTORATION ACTIONS AND EVALUATION CRITERIA

4.1 Restoration Goals and Objectives

The goal of the restoration planning process is to identify restoration alternatives that are appropriate to restore, rehabilitate, replace, or acquire natural resources and their services equivalent to natural resources and services injured or lost as a result of releases of hazardous substances. One restoration alternative may include multiple restoration actions, such as restoring multiple habitat types, or performing restoration across multiple sites.

4.2 Restoration Planning Process - Overview

In accordance with the CERCLA NRDAR regulations, the Trustees identified and evaluated a reasonable range of project alternatives that could be used to create or enhance benthic habitat in or near salt marshes in coastal South Carolina. The initial range of projects came from a broad survey of project ideas in Charleston and Beaufort counties conducted by the Trustees and consultants for ExxonMobil in 2005-2006. The Trustees reviewed available information on these projects to understand the potential benefits and feasibility of the specific projects identified. The Trustees evaluated the potential projects with the goal that preferred

restoration actions would be capable of providing multiple benefits or services. Additionally, the Trustees considered the potential restoration actions based on the criteria outlined below.

The results of that evaluation and the identification of the Trustees' preferred restoration alternative are provided in Section 5.0 of this Final RP/EA.

4.3 Identification of and Screening the Potential Restoration Actions

The Trustees developed a list of more than 50 potential restoration opportunities in the Charleston Harbor area (Ridolfi Inc. 2003) to consider for this NRDA. More recently, NOAA produced an inventory of additional hydrologic restoration projects in the Charleston area for consideration in this case. The Trustees then narrowed these lists based on the following screening factors identified by the Trustees:

- Preference for restoration projects with a strong nexus to the injured resources;
- Preference for restoration projects with a high degree of habitat enhancement;
- Preference for restoration projects that limit disruption to existing resources; and
- Preference for restoration projects that remain feasible post-settlement and could be implemented in the short-term.

Applying these screening factors, the Trustees identified three currently viable, potential restoration actions from the list that would provide compensation to the public for natural resource injuries resulting from the Sites:

- Edisto Island Salt Marsh Creation Project – Salt marsh creation on a publicly owned property on Edisto Island, South Carolina;
- Port Royal Oyster Reef Creation Project – Oyster reef creation in the Harbor River, near Port Royal, South Carolina; and
- Long Branch Creek Hydrologic Restoration Project– Salt marsh restoration through the restoration of tidal exchange and flow along a suburban creek system in the Charleston area.

In addition to these potential restoration actions, the Trustees considered a "No Action" alternative, as required by NEPA and the NRDA regulations. Under this alternative, the Trustees would take no action to compensate the public for interim losses associated with the natural resource injuries resulting from the Sites.

4.4 Restoration Actions for Consideration

4.4.1 Edisto Island Salt Marsh Creation Project

Edisto Island is located along the South Carolina coast, roughly equidistant between the Charleston area former phosphate fertilizer sites addressed in this NRDA and the Port of Baldwin Site in Port Royal. The Edisto Island Salt Marsh Creation Project would create up to 17 acres of salt marsh habitat at the property owned by CCPRC on Edisto Island abutting Russell Creek (Figure 4.1). Although CCPRC purchased this site to provide for potential future public recreation opportunities, the property has only been planned to a limited extent to inform the proposed salt marsh creation project, and no timeframes have been established for a potential full park design, development, or public access. Project costs were estimated as part of the 2019 settlement, and cost increases are expected should the project move into implementation.

Prior to its purchase by the CCPRC in 1994, the large land parcel on which the salt marsh project would occur was in agricultural use. By 2017, the forests on the site had regenerated in areas that were previously cultivated, particularly on the south and east sides of the property. The property also includes tidally influenced wetlands on the north end and multiple freshwater wetlands scattered throughout.

FIGURE 4.1. AERIAL OF THE PROPOSED EDISTO ISLAND SALT MARSH CREATION PROJECT SITE AND LARGER CCPRC PROPERTY. APPROXIMATE PROJECT BOUNDARY IN RED.

The CCPRC property includes an area where tidal wetlands (estuarine and marine wetlands) and freshwater wetlands are separated by an earthen berm. The freshwater wetland and upland areas to the south of the berm were historically used for agriculture and are now early to secondary successional forest. Salt marsh creation would be accomplished through berm removal and excavation of upland areas and creeks to re-establish tidal hydrology (Figure 4.2). More specifically, the restoration project would create salt marsh habitat by grubbing existing vegetation; excavating upland areas to tidal elevations in the marsh creation area; extending tidal channels from existing creeks; removing or reducing the impoundment; and revegetating the restoration areas with native species characteristic of tidal salt marsh and upland buffer habitats. The federally threatened eastern black rail may occur in the project area; attention will be given to ensuring black rail habitat identification and preservation in project design and implementation.

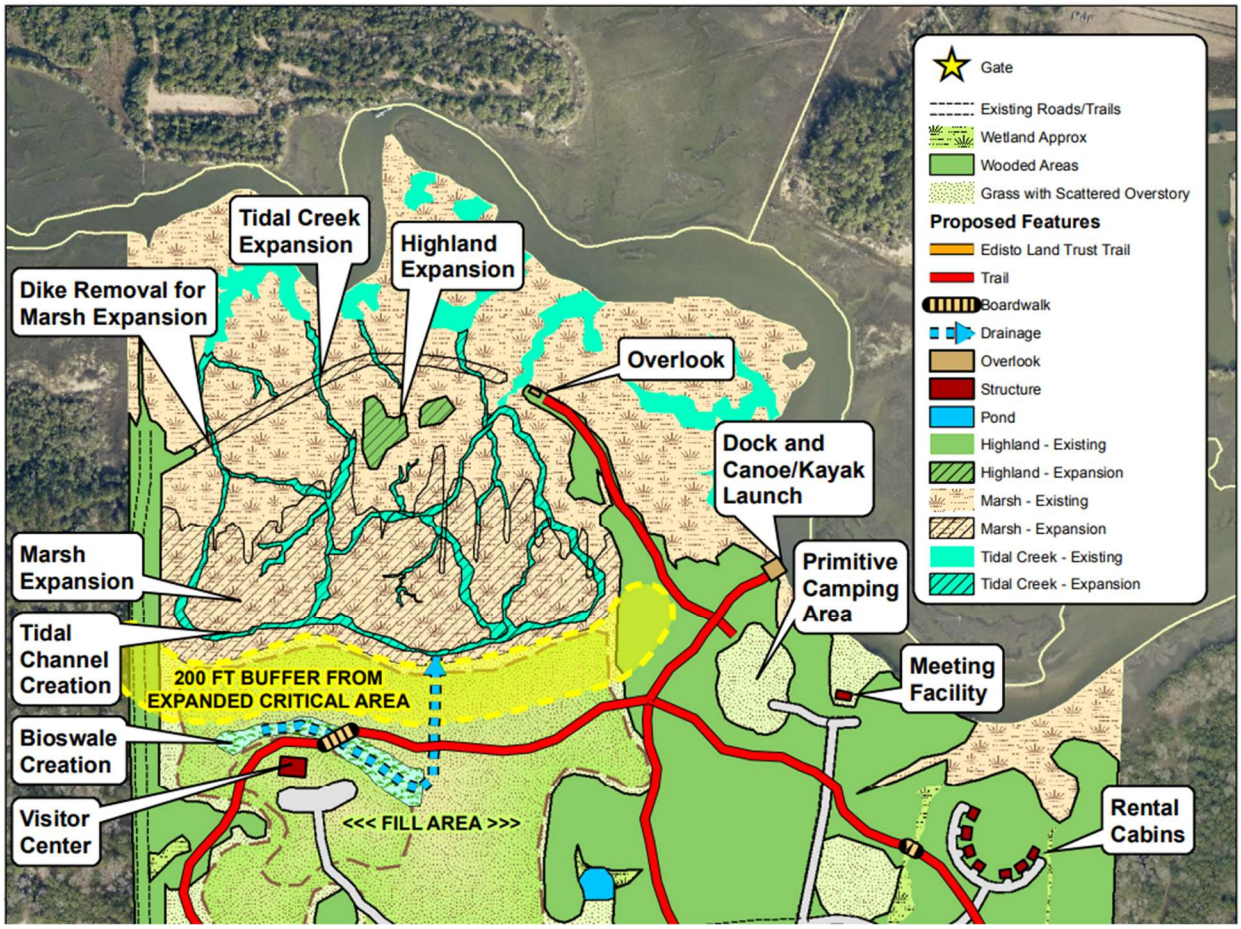

FIGURE 4.2. CONCEPTUAL DESIGN FOR SALT MARSH CREATION AREA ON NORTH END OF CCPRC PROPERTY. IMAGE EXCERPTED FROM FIGURE 4.3 CONCEPTUAL MASTER PLAN FOR CCPRC PROPERTY, EDISTO ISLAND, SOUTH CAROLINA (BELOW)

Because the restoration project would involve site clearing and excavation, the project would also require disposal of the excavated material. Spoil disposal is proposed to occur on-site, with the excavated material being used to diversify site topography and make soil available for future property features.

CCPRC may implement recreational park features at the site, such as trails and viewing platforms, in the future. If CCPRC were to implement such amenities at the site, those features would provide the public with recreational benefits, thus enhancing the reach of the ecological benefits created by the salt marsh creation associated with this NRDA (Figure 4.3).

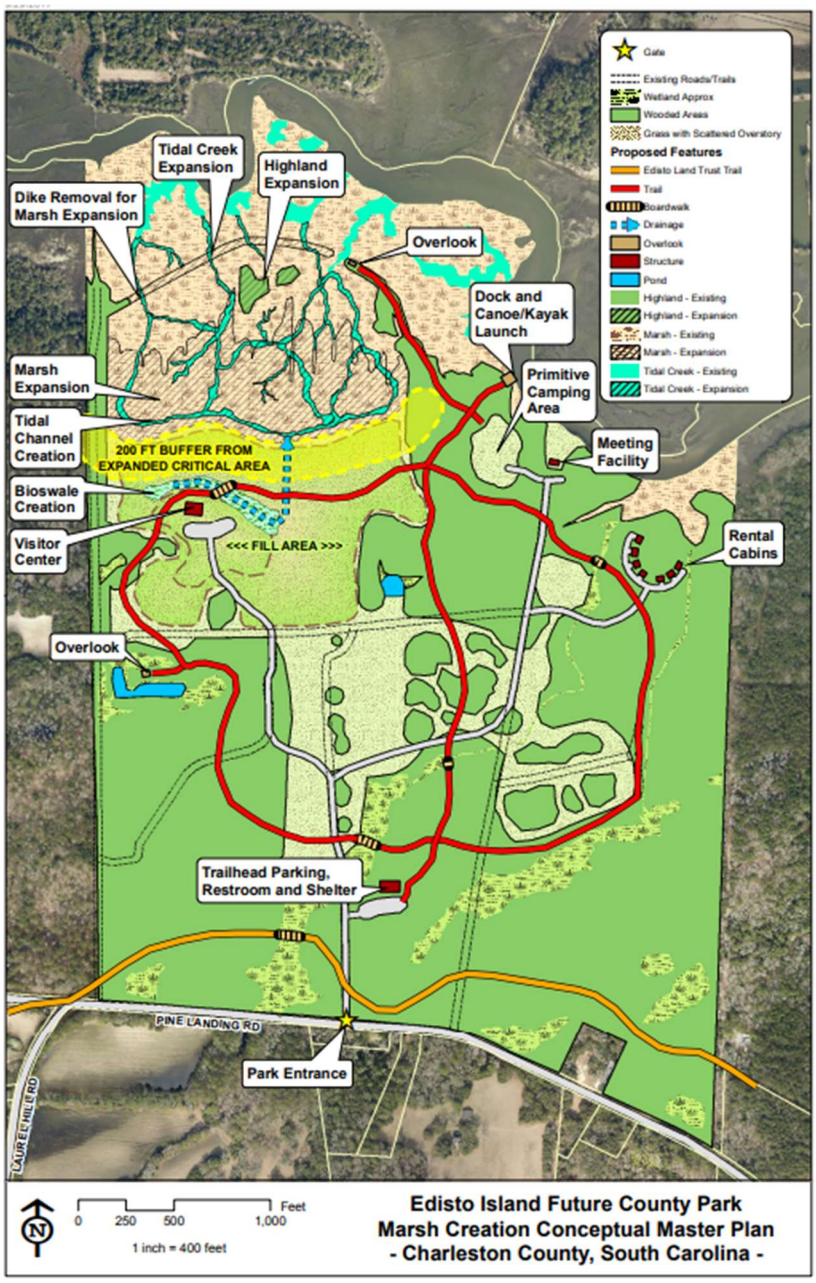

FIGURE 4.3 CONCEPTUAL MASTER PLAN FOR CCPRC PROPERTY, EDISTO ISLAND, SOUTH CAROLINA, INCLUDING PROPOSED ECOLOGICAL AND RECREATIONAL RESTORATION FEATURES.

The CCRPC property is currently protected through a conservation easement held by The Nature Conservancy (TNC). The Trustees would work with TNC and CCPRC to ensure that all NRDA funded activities on the site are consistent with the existing easement. Working with CCRPC, and as part of the restoration efforts associated with this NRDA, the Trustees would also establish a long-term stewardship and maintenance plan for the salt marsh creation area at the property.

4.4.2 Port Royal Oyster Creation Project

The Port Royal Oyster Reef Creation Project would create approximately 3.2 acres of oyster reef habitat in the area of Port Royal, South Carolina. The Port of Baldwin former phosphate fertilizer site is located in Port Royal. The SCDNR implements the State's oyster restoration programs. See https://www.dnr.sc.gov/marine/mrri/shellfish/oysrestore.html (last visited 1/19/2023). The preliminary oyster reef creation sites identified by the SCDNR as suitable locations for oyster reef creation in the Port Royal area include sites in the Harbor River, east of Parris Island (Figure 4.4).

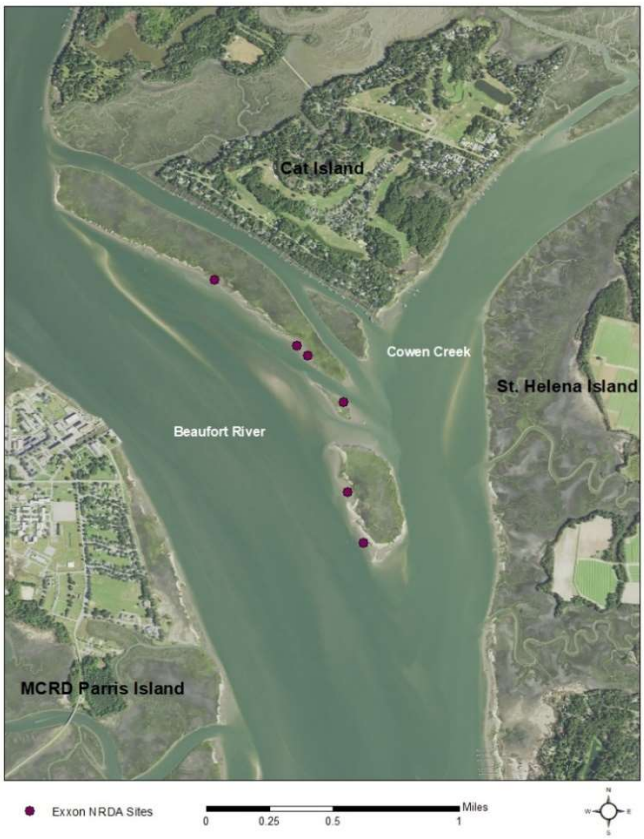

FIGURE 4.4 POTENTIAL SITES FOR THE PROPOSED PORT ROYAL OYSTER CREATION PROJECT IDENTIFIED BY SCDNR FOR THE EXXONMOBIL NRDA.

The oyster reef creation project would be implemented by the SCDNR. The SCDNR would create oyster habitat by construction of loose shell oyster reefs, i.e., by depositing loose oyster shell material on the river bottom. Prior to depositing or planting the loose oyster shell, the site(s) would be staked with 1" PVC poles, approximately 100' apart, which would facilitate shell placement when the site(s) are underwater during planting operations. During planting, bushels of loose oyster shell would be loaded onto a barge and transported to the site(s). Shell would be floated overboard, using a high-pressure water cannon, approximately ½ hour before and

after high tide, at a depth of 3”to 6”, based on the shoreline bottom type. After planting, the PVC stakes would be removed. The shell is then expected to serve as cultch for free-swimming oyster larvae to attach to and grow into three-dimensional oyster reefs.

The SCDNR routinely implements oyster reef creation projects similar to the proposed Port Royal Oyster Reef Creation Project through its oyster recycling and enhancement program. Shell loss is standard for these types of projects for a variety of reasons. Accordingly, due to anticipated shell loss, the original footprint for the proposed reef creation project would be 4.2 acres, which the Trustees expect would ultimately result in approximately 3.2 acres of new oyster reef.

The Trustees propose oyster reef creation in addition to the salt marsh creation project at Edisto Island in order to account for the difference in the amount of salt marsh available to be created at the CCPRC property and the approximately 22 acres of salt marsh assessed to be injured at the Sites. Oyster reef creation fills this gap, with the acreage necessary having been calculated using the relative habitat productivity ratios from Peterson, et al. (2007). The Port Royal area has a strong geographic nexus to injury as it is the location of the former Port of Baldwin Mines site.

4.4.3 Long Branch Creek Hydrologic Restoration Project

The Long Branch Creek Hydrologic Restoration Project would restore tidal hydrology and enhance salt marsh habitat along a portion of Long Branch Creek, a tidally influenced tributary to the Stono River in Charleston County, through the removal of existing tidal restrictions. Long Branch Creek is approximately 1.5 miles long and generally flows south from the Glenn McConnell Expressway at West Ashley Park to the Stono River (Figure 4.5.). The tidal salt marsh habitat associated with Long Branch Creek covers approximately 155 acres. Long Branch Creek has a history of extensive channelization and berm/dike construction, largely for agricultural purposes. In addition, the former Croghans Branch of the Atlantic Coast Line Railroad, which is now part of the West Ashley Greenway, crosses Long Branch Creek along a causeway near Highway 17 in West Ashley.

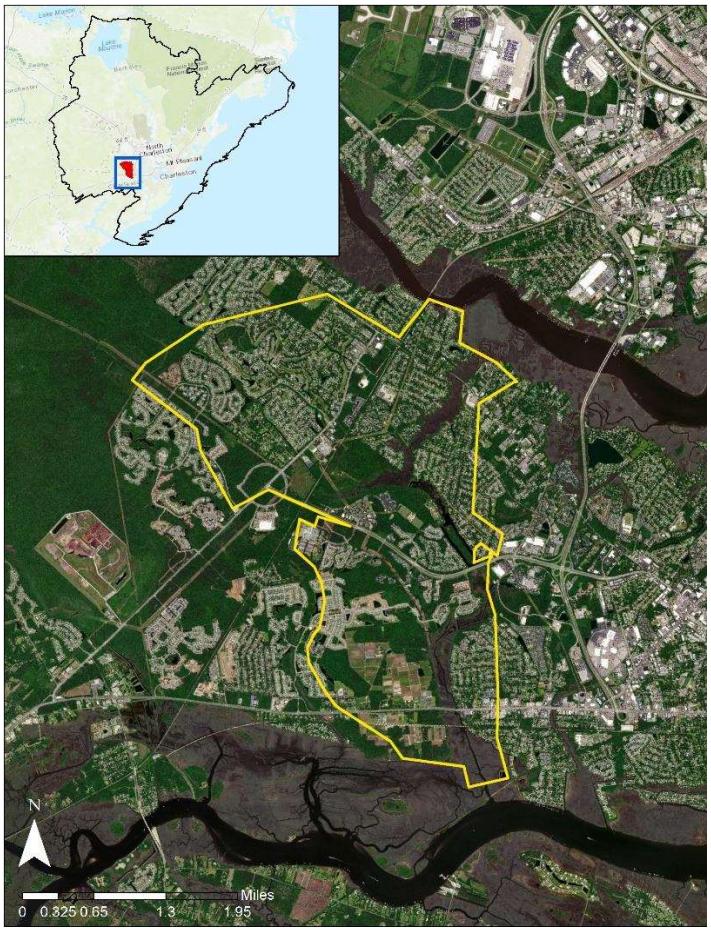

FIGURE 4.5. LONG BRANCH CREEK SYSTEM, CHARLESTON SOUTH CAROLINA. YELLOW BOUNDARY OUTLINES ACREAGE ASSOCIATED WITH THE ALTERNATIVE IN TERMS OF DRAINAGE, HYDROLOGY, IMPACTED LAND USES, AND DIRECT BENEFITS. CREDIT: CHARLESTON HARBOR WATERSHED COASTAL RESILIENCE ASSESSMENT.

The history of agricultural and transportation-related earthwork along Long Branch Creek has resulted in multiple points of hydrological restriction, such as undersized pipes and culverts, berms, and tide gates, where historic tidal flows are obstructed. These obstructions have altered the natural flow of water, leading to degraded salt marsh habitat, areas of increased sedimentation and erosion, and impaired water quality. Hydrologic restoration within the Long Branch Creek system could focus on these points of hydrologic restriction, returning natural tidal exchange to project areas, through practices including the installation of water conduit structures within existing berms and the replacement of existing undersized culverts with appropriately-sized water conduit structures (e.g., footbridge, box culvert).

The Trustees and their partners have considered habitat restoration within the Long Branch Creek system as a potential NRD restoration opportunity at multiple points in recent years. For example, Long Branch Creek was identified as a high priority area for restoration in NOAA's Habitat Blueprint Regional Initiative for Charleston Harbor (NOAA Fisheries, 2012). Additionally, studies funded by NOAA in collaboration with National Fish and Wildlife Foundation (NFWF)

and the U.S. Army Corps of Engineers previously identified a "Long Branch Creek Watershed Restoration Project" as a case study that would build nature-based resilience in the area, resulting in the maximum benefit for both human communities and fish and wildlife habitats (Crist, 2019). In 2008 the Restoration and Compensation Determination Plan (RCDP) and Environmental Assessment for the Macalloy Corporation NRD identified multiple restoration alternatives related to removing restrictions along Long Branch Creek; and in 2017 a restoration alternative focused specifically on alleviating the West Ashley Greenway restriction, which is caused by undersized pipes, was also identified and evaluated as a preferred NRD restoration project as part of the Damage Assessment and Restoration Plan and Environmental Assessment for the Koppers Site, Charleston, South Carolina.

For these reasons, the Trustees considered salt marsh habitat restoration through the removal of existing obstructions to historic tidal flows along Long Branch Creek as a potential restoration action for this NRDA.

4.4.4 No Action Alternative

Both the CERCLA NRDAR and NEPA regulations require the Trustees to evaluate a "Natural Recovery" or "No Action" restoration alternative. Under this alternative, the Trustees would take no action to restore injured resources and their services or interim losses associated with the evaluated natural resources.

4.5 Monitoring and Adaptive Management of Preferred Restoration Action(s)

Implementation of the preferred restoration alternative will include project monitoring and adaptive management protocols for the restoration projects. The workplan for the preferred alternative will commit adequate resources to support a long-term monitoring effort to meaningfully monitor and evaluate restoration outcomes. NOAA Restoration Center's guidance for Tier 1 Monitoring will support the Trustees' development of a monitoring and adaptive management plan (NOAA, 2022). Tier 1 metrics for hydrologic restoration (Edisto Island Marsh Creation project) include land elevations and water levels. Tier 1 metrics for oyster reef creation include reef area dimensions, reef height, oyster density, and oyster size-frequency distribution. Trustees may coordinate with partners such as NOAA science centers and local universities to design, develop, and implement monitoring protocols. While standard Tier 1 metrics for hydrologic and oyster reef restoration will be included, the Trustees are interested in pursuing expanded metrics intended to ensure that restoration is successful in the face of climate change and its impacts to coastal habitats.

4.6 The Trustees' Evaluation and Selection Criteria

In accordance with CERCLA NRDAR regulations, the following criteria were used to evaluate the potential restoration actions described above, including the No Action alternative:

- The extent to which the restoration action is expected to meet the Trustees' restoration goals and objectives: The primary goal of any restoration alternative is to provide a similar quantity and quality of resources and services as those lost. As part of this evaluation, the Trustees considered the likely relative productivity of restored habitat and whether the restored habitat is being created or enhanced. Future management of a restoration site is also a consideration because management decisions may influence the extent to which a restoration action meets its objective.
- The cost to carry out the restoration action: The likely benefits of a restoration action relative to its cost are a factor in evaluating potential restoration alternatives. Factors that can affect and increase the costs of implementing restoration may include project timing, access to the restoration site (for example with heavy equipment), acquisition of state or federal permits, acquisition of the land needed to complete a project, and the potential liability from project construction. Although a monitoring program does increase the cost of an alternative, the inclusion of an adequate monitoring component is necessary to ensure public benefits are realized.
- The likelihood of success of each restoration action: The Trustees consider technical factors that represent potential risks to successful project construction, successful project function, or long-term viability of the restored habitat. For example, potential for future degradation or habitat loss, such as high rates of subsidence at a project site, are considered a risk to long-term success. The Trustees also consider whether difficulties in project implementation are likely and whether long-term maintenance of project features is likely to be necessary and feasible.
- The extent to which each restoration action would avoid collateral injury to natural resources as a result of implementation: Restoration actions should not result in additional significant losses of natural resources and should minimize the potential to affect surrounding resources during implementation. Restoration actions with less potential to adversely impact surrounding resources are generally viewed more favorably.
- The extent to which the restoration action may benefit more than one natural resource or service: This criterion addresses the interrelationships among natural resources, and between natural resources and the services they provide. Projects that provide benefits to more than one resource and/or yield more beneficial services overall, are viewed more favorably.
- The effect of the restoration action on public health and safety: Restoration actions that may negatively affect public health or safety would not be appropriate for Trustee implementation.

Throughout the planning process, the Trustees also recognized the importance of public participation and the acceptance of a potential project by the community as critical components for restoration. Accordingly, a potential restoration action was considered more favorable if it was complementary to other community development plans/goals.

The results of the Trustees' evaluation and the identification of the Trustees' preferred restoration alternative are provided in Section 5.0 below.

5 EVALUATION OF POTENTIAL RESTORATION ALTERNATIVES

5.1 Evaluation of Alternative 1: Edisto Island Salt Marsh and Port Royal Oyster Reef Creation (*Preferred*)

Table 5.1 summarizes the evaluation of Alternative 1 based on the evaluation and selection criteria described in Section 4.6. Alternative 1 would provide for cost-effective estuarine habitat creation through the grading down of upland areas to intertidal elevations and planting of *Spartina alterniflora* or other appropriate native wetland plant species to create salt marsh habitat on Edisto Island, and the planting of cultch to support oyster reef development in the Port Royal area. Anticipated benefits from these actions include providing new benthic and pelagic fishery habitats provided by salt marsh. Salt marsh habitat supports a variety of flora and fauna species, including federally managed and protected migratory birds. The salt marsh habitat would provide nursery grounds and protection from predators for a wide range of aquatic organisms. Marshes also enhance water quality of adjacent open waterbodies and would create a natural buffer to the upland area. It is expected that the marsh would be largely self-sustaining once established and require minimal interventions following construction. Additionally, the conservation easement currently held by TNC would ensure protection for the salt marsh creation area, as well as preserving the buffering upland.

With respect to the Port Royal oyster reef creation component of the preferred alternative, the SCDNR has a demonstrated record of successfully implementing oyster reef restoration and creation projects in coastal South Carolina and has identified multiple suitable locations for oyster reef creation in the Port Royal area. This restoration action would be expected to improve water quality and increase habitat complexity and species diversity in the vicinity of the proposed project. The South Atlantic Fish Management Council (SAFMC) has designated oyster reefs as essential fish habitat (EFH). Federally managed species that utilize this type of habitat during various life stages include red drum and penaeid shrimp. Other species of commercial, recreational, and ecological importance include Atlantic croaker, spot, Atlantic menhaden, blue crab, killifish, and striped mullet. In turn, these fish provide prey for Spanish and king mackerel, cobia, and others managed by the SAFMC, for migratory species such as sharks and billfishes managed by NOAA, and for federally protected migratory birds. In South

Carolina, oyster reefs generate biodiversity and are identified as critical habitats of concern in both the State Conservation Plan and SCDNR's Comprehensive Wildlife Conservation Strategy. Additionally, it is anticipated that the constructed oyster reefs would be largely self-sustaining and require minimal intervention following construction to achieve functional success. Finally, the restoration actions would present no human health or safety issues beyond those met by standard procedures for safe construction.

TABLE 5.1. EVALUATION OF ALTERNATIVE 1 (PREFERRED)

Alternative 1: Edisto Island Salt marsh and Port Royal Oyster Reef Creation	
Restoration Criteria	Rationale
Meets Trustees' restoration goals and objectives effectively:	Yes; Creates and restores coastal salt marsh and oyster reef to offset injury.
Delivers benefits cost-effectively:	Yes; Cost effective relative to the resource and service losses and expected benefits.
High probability of success:	Yes; Proven approach and project team with prior demonstrated success.
Avoids collateral injury to natural resources:	Yes; Poses no long term direct or indirect impacts to injured or other natural resources.
Benefits more than one natural resource and/or service:	Yes; Provides benthic and pelagic fishery habitats; supports habitat complexity; species diversity (including migratory birds); nursery grounds; enhanced water quality; and buffer to upland area. Community services include wildlife viewing and environmental education opportunities.
Ensures protection of human health and safety:	Yes; Poses no significant risk to public health and safety.

5.2 Evaluation of Alternative 2: Long Branch Creek Hydrologic Restoration (*Non-Preferred*)

Table 5.2 summarizes the evaluation of Alternative 2 based on the evaluation and selection criteria described in Section 4.6. The project area would be within the general Charleston Harbor area. The project would provide for salt marsh restoration by reestablishing the tidal hydrology needed to support high-functioning marsh habitat, within the Long Branch Creek system. It is anticipated that the restored salt marsh creek complex would be self-sustaining, requiring limited or no active intervention following construction to achieve functional success. The nature of the project and the setting for construction would present no human health or safety issues beyond those met by standard procedures for safe construction.

This alternative would improve the quality of benthic and pelagic fish habitats currently provided by the salt marsh in the project area. Federally managed species that utilize this type of salt marsh habitat during various life stages include red drum and penaeid shrimp. Other species of commercial, recreational, and ecological importance include Atlantic croaker, spot, Atlantic menhaden, blue crab, killifish, and striped mullet. In turn, these fish provide prey for Spanish and king mackerel, cobia, and others managed by the SAFMC, and for migratory species such as sharks and billfishes managed by NOAA. The Atlantic Coastal Fish Habitat Partnership (ACFHP) identifies estuarine marsh as priority habitat in its Conservation Strategic Plan. Ultimately, the restoration of natural hydrology to the Long Branch Creek system would improve the overall health and function of benthic, salt marsh, and fishery habitats in the project area, while improving biodiversity, and thus it would provide compensatory restoration with a strong nexus to the natural resources and resource services injured by hazardous releases at the Sites.

Since 2017, the City of Charleston has been developing strategies and identifying projects for stormwater protection in the Long Branch Creek area. The city and its partners are planning and designing multiple stormwater projects in the Church Creek basin, Lake Dotterer, and the upper stretches of Long Branch Creek. Because the City of Charleston continues to work on city- and county-wide plans to address flooding issues in the region and develop strategies for stormwater protection for at-risk neighborhoods, it is not currently clear what specific salt marsh restoration opportunities may be compatible with city efforts, or when those specific opportunities may be available. While the Trustees do not consider the Long Branch Creek Hydrologic Restoration alternative a preferred restoration alternative at this time, the project could be reconsidered should additional funding become available.

TABLE 5.2. EVALUATION OF ALTERNATIVE 2 (NON-PREFERRED)

Alternative 2: Long Branch Creek Restoration	
Restoration Criteria	Rationale
Meets Trustees' restoration goals and objectives effectively:	Unclear; Restoration would be expected to restore and enhance coastal wetland, tidal creek, and benthic habitats to offset injury; however, any restoration would need to first fit within the City's objectives for stormwater management, flooding control, and resilience within the system.
Delivers benefits cost-effectively:	Yes; Marsh creation would be cost-effective relative to the resource and service losses and expected benefits.
High probability of success:	Unclear; Restoration technique is a proven approach. Technique modification to consider stormwater and community resilience objectives may impact habitat restoration success in some way.
Avoids collateral injury to natural resources:	Yes; Poses no long term direct or indirect impacts to injured or other natural resources.
Benefits more than one natural resource and/or service:	Yes; Improves creek and marsh hydrology; benefits benthic and pelagic fishery habitats; supports habitat complexity; species diversity (including migratory birds); nursery grounds; and enhanced water quality. Community services include stormwater/flood resilience and improved recreational experiences.
Ensures protection of human health and safety:	Yes; Poses no significant risk to public health and safety.

5.3 Restoration Alternative 3: No Action

Under this alternative, the Trustees would take no action to create, restore, or enhance estuarine marsh or other natural resources and resource services to compensate for the resource losses attributed to the Sites. The Trustees determined that natural resources and resource services were lost due to injuries caused by releases of hazardous substances from the Sites. While the remedial activities are expected to have included the actions needed to allow

injured resources at the Sites to recover to baseline, the remedial activities did not compensate the public for interim losses.

Under CERCLA, natural resource trustees seek to compensate the public for these interim losses through restoration. Under the No Action alternative, restoration actions needed to make the environment and the public whole would not occur. This is inconsistent with the goal of NRDA provisions under CERCLA and the purpose of this restoration plan.

Accordingly, while the No Action alternative has been considered in this Final RP/EA, the Trustees find that the No Action alternative does not meet the Trustees' restoration goals and objectives.

5.4 Conclusions for Preferred Alternative

Alternative 1 is the Trustees' preferred restoration alternative because we have determined it would most efficiently and effectively compensate the public for natural resource injuries resulting from hazardous releases at and from the Sites. The Edisto Island Salt Marsh and Port Royal Oyster Reef Creation projects would provide restoration benefits with a strong nexus to the injury. These projects are currently feasible to implement, with established implementation partners identified, who are prepared to work with the Trustees at this time. Additionally, the Edisto Island Salt Marsh Creation project would benefit from the long-term preservation provided by the conservation easement TNC holds on the CCPRC property. Though of interest to the Trustees, the Long Branch Creek Hydrologic Restoration alternative's immediate scope, timeline, and budget are not known due to other stormwater management efforts currently underway in the area by the City of Charleston.

6 NEPA ENVIRONMENTAL CONSEQUENCES

This section describes the Trustees' analysis of the environmental consequences anticipated to result from the restoration actions evaluated in this Final RP/EA. For the restoration alternatives evaluated in this document, the geographic context for considering potential significance of the actions is local or regional, as opposed to national or worldwide.

6.1 Affected Environment

This section describes the general environmental resources that could be affected by the implementation of restoration actions evaluated in this Final RP/EA. It includes information on

the physical, biological, social, economic, cultural, and historic resources. Further detail is provided on specific resources that could be affected—either beneficially or adversely—by the implemented restoration alternatives. Analysis of these potentially impacted resources is scaled to the HUC-10 watersheds, counties, Lowcountry regional, and South Carolina state geographies where these restoration alternatives are proposed and as data are available.

6.1.1 The Physical Environment

The restoration actions evaluated in this Final RP/EA are situated along the South Atlantic coast between 32.8 and 32.3 degrees north latitude in the South Carolina Lowcountry. The Lowcountry climate is classified as humid subtropical with mean monthly temperatures ranging from 91°F in July to 38°F in January and around 50 inches of average annual precipitation (U.S. Climate Data, n.d.). The Lowcountry is prone to tropical cyclones, particularly between June 1st and November 30th when ocean temperatures are warmest. Between 1851 and 2021, 44 tropical cyclones made landfall in South Carolina (SCDNR, 2022). Associated hazards include storm surge, inland flooding, extreme precipitation, wind, and tornadoes.

Geologically, the restoration actions are situated within watersheds of the Lower Coastal Plain of South Carolina. The Port Royal oyster reef creation component of Alternative 1 would be implemented in the Broad River-Port Royal Sound Watershed (watershed 03050208-05); the Edisto Island salt marsh creation component of Alternative 1 would be implemented in the North Edisto River Watershed (watershed 03050206-04). Alternative 2: Long Branch Creek hydrologic restoration would be implemented in the Stono River Watershed (watershed 03050202-02). These watersheds are characterized by extensive estuary and tidal creeks. The geologic makeup of the South Carolina Coastal Plain consists of sedimentary deposits of sand, gravel, clay, marl, and limestone resting on metamorphic and igneous rocks. Overlying these deposits are marine and riverine sediments and a thin veneer of sand, clay, and shell comprising Pleistocene and recent formations.

Collectively, these watersheds are generally composed of approximately 37.5% uplands, 29% open water, 16.8% palustrine wetland, and 16.7% estuarine wetland. Land use patterns within the watersheds are on average 9.7% developed, 7.2% agricultural and grasslands, 28.3% forested, 6.3% shrub/scrub, 17.9% forested wetland, 29.7% non-forested wetland, and 0.9% bare land (NOAA OCM, 2016). Figure 6.1 provides a detailed breakdown of percentage land cover by watershed. Federal, state, county, and municipal governments own 42,917 acres of fee simple parcels set aside for protection (USGS PAD-US, 2022).

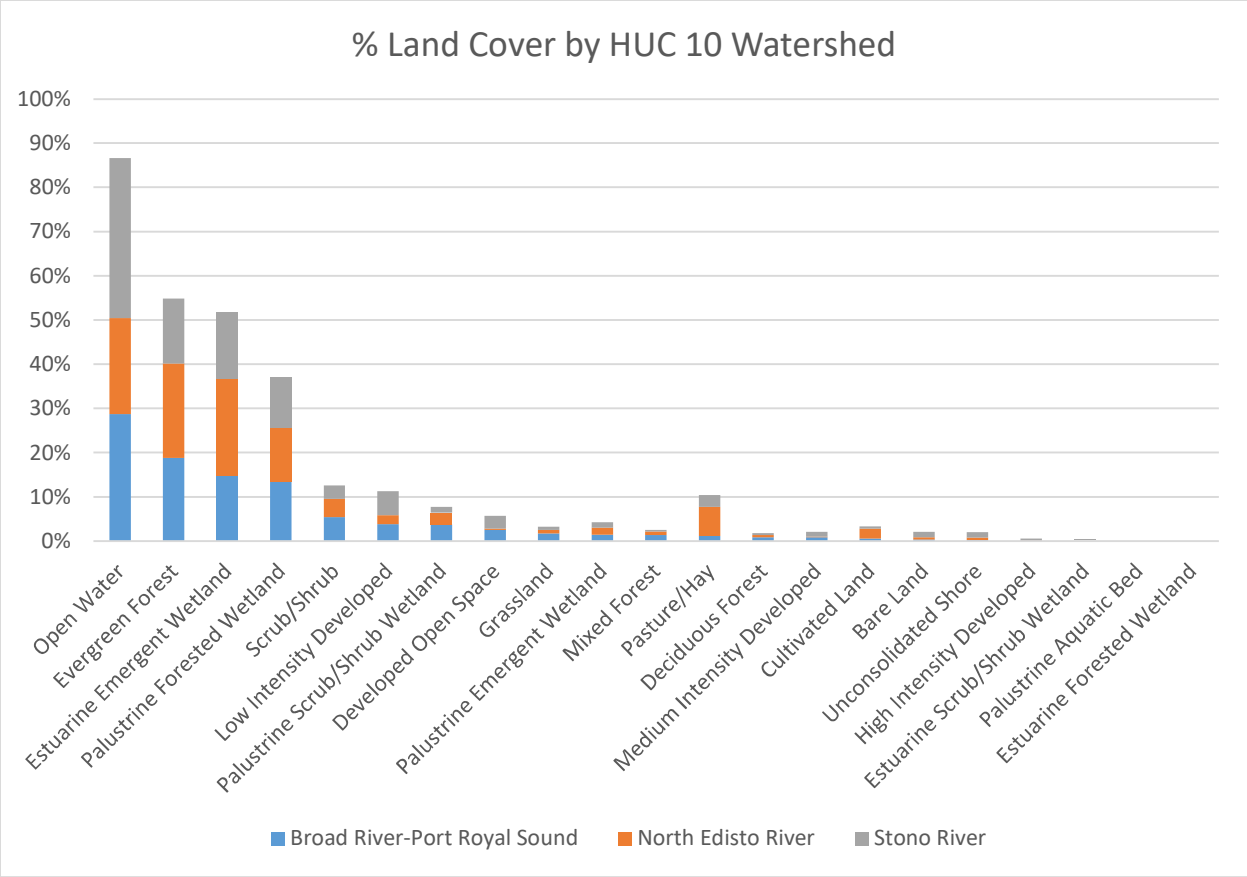

FIGURE 6.1: THE PERCENTAGE LAND COVER COMPOSITION OF EACH WATERSHED WHERE RESTORATION ALTERNATIVES ARE PROPOSED (NOAA C-CAP, 2016)

The Broad River-Port Royal Sound Watershed and the Stono River Watershed have both been identified as areas of high potential for growth and development due to the urban and suburban expansion of the Beaufort and Charleston areas. The North Edisto River Watershed is considered to have a low potential for growth, characterized as a rural agricultural-based landscape primarily outside of the Charleston County Urban Growth Boundary. In both high- and low-growth landscapes, the development and agricultural land use of upland areas threatens the efficacy of watershed services and stands to increase point and non-point source pollutions that may impact estuary water quality (SCDHEC, n.d.a).

Within these watersheds, the confluence of their associated rivers and the Atlantic Ocean create estuary conditions. An estuary is a mixing zone where freshwater from the land and saltwater from the sea meet, providing habitat for saltwater and freshwater organisms and those that live in between. Highly dynamic, estuaries are influenced by the salinity gradient that extends from pure seawater to freshwater upriver, and the tide that provides the energy that mixes the fresh and saltwater. Mean tidal range is 5.5 feet (1.7 meters) with spring tides averaging 7 feet (2.1 meters) in range. Along the coast of South Carolina, estuary water temperature on average ranges from around 50°F to 87°F (10°C to 30.7°C). Salinities range from

0 to 35.6 parts per thousand within the State's coastal estuaries (USGS Coastal Salinity Index, 2022). Similarly, dissolved oxygen levels range from 0 to 17.1 milligrams per liter (mg/L) averaging 7.3 mg/L over the estuaries on the South Carolina coast (NOAA CO-OPS, 2022; USGS, 2022a; USGS, 2022b).

Air quality is generally good in the South Carolina Lowcountry. The EPA establishes an Air Quality Index (AQI) for five major pollutants that are regulated by the Clean Air Act: ozone, particle pollution, carbon monoxide, nitrogen dioxide, and sulfur dioxide. The AQI for each pollutant is generally based on their respective national ambient air quality standard. In Charleston and Beaufort counties, where the restoration alternatives are proposed, historical AQIs for ozone and particle pollution are generally good --- the remaining pollutants are not reported (EPA AirNow, n.d.). It should be noted that as there are no federal or state air quality monitors in Beaufort County, these indices are interpolated. These findings are supported by the 2021 Charleston County EPA Air Quality Statistics Report (EPA Outdoor Air Quality Data, 2021). The American Lung Association State of the Air Report Card for Charleston County rated Charleston a "B" for ozone pollution, an "A" for Particle Pollution 24-hour, and a "Pass" for Particle Pollution Annual (American Lung Association, 2022).

The South Carolina Lowcountry experiences various stressors from global climate change. Primary climate change stressors include sea level rise (SLR), severe weather, flooding, warming temperatures, drought, and ocean acidification. These stressors impact the physical environment with cascading impacts on the habitats, natural resources, and communities connected to the restoration alternatives evaluated in this Final RP/EA. Research suggests that the Lowcountry sea level has risen approximately 1 foot since the beginning of the 20th century (Watson *et al.*, 2021; S.C. Sea Grant Consortium, 2015). Projections suggest that between 2020 and 2050, Lowcountry sea level will rise between 0.64 and 1.24 feet (NASA EarthData 2022; Sweet et al., 2022). By 2100, projections suggest 1.37 to 6.51 feet in sea level rise since 2020. SLR is largely attributed to vertical land movement and sterodynamic sea level changes.

Historic trends in severe weather (e.g., tropical cyclones, 3-inch extreme precipitation events) are uneven (Runkle *et al.*, 2022), but extreme storms are projected to increase in frequency and severity. Between 2015 and 2020, South Carolina experienced above average total annual precipitation and multiple 3-inch extreme precipitation events. Globally, tropical cyclones are expected to increase in intensity by 1 to 10% (Knutson, 2022). SLR and severe weather stressors contribute to increased flooding in the Lowcountry. Annual high tide flooding (HTF) events associated with SLR increased 190% between 2000 and 2019 along the southeast Atlantic coast (Waggonner & Ball and The Water Institute of the Gulf, 2019). By 2030, Charleston may experience HTF once a month and once every 10 days or more by 2050. Tidal flooding events are further exacerbated by the increasing extreme precipitation events.

Temperatures in South Carolina have risen more than 1°F since the beginning of the 20th century (Runkle *et al.*, 2022) with the trend being uneven but generally upward (US Climate

Resilience Toolkit, n.d.). Across the Southeast, temperatures are projected to rise 4°F to 9°F by 2100 (SCDNR, 2013). Coastal water temperatures mirror these trends (2013). South Carolina statewide has observed increasing numbers of extremely hot days (maximum temperature of 100°F or higher) and decreasing numbers of freezing days (Runkle *et al.*, 2022) — these trends are projected to continue increasing and decreasing, respectively. With rising temperatures and extremely hot days, the frequency, duration, and intensity of droughts are likely to continue to increase in South Carolina (SCDNR, 2013).

Globally, oceans are experiencing acidification due to increasing levels of atmospheric carbon dioxide – oceans absorb approximately one third of carbon dioxide emitted leading to the creation of carbonic acid (Hall *et al.*, 2020). Since 1860, global surface ocean acidity has increased by approximately 26%. In coastal areas, ocean acidification is exacerbated by regional processing tied to climate change and development (e.g., freshwater and nutrient runoff). There is no ongoing ocean acidification monitoring in South Carolina, although evidence suggests that carbon dioxide is increasing in areas off the shelf of the South Carolina coast. Ocean acidification impacts ecologically, economically, and culturally important reefs, mollusks, crustaceans, and some plankton that incorporate calcium carbonate into skeletons (SCDNR, 2013). Although estuaries do tend to have extreme fluctuations in their physical properties, including pH, there is no evidence to suggest that these habitats and organisms are less vulnerable to general increasing acidity trends (Hall *et al.*, 2020).

These climate change stressors impact the communities and natural environments of the South Carolina Lowcountry creating increasingly challenging conditions. Acknowledging the potential consequences of these impacts, the communities linked to restoration actions evaluated in this Final RP/EA have developed strategies for climate change resilience. Community climate change resilience publications include the following: *City of Charleston All Hazards Vulnerability and Risk Assessment* (2020), *Charleston City Plan* (2021), *Dutch Dialogues Charleston* (2019), *Charleston Climate Action Plan: An Equitable Strategy for a Healthier Future* (2021), *Charleston Flooding and Sea Level Rise Strategy* (2019), *Sea Level Rise Adaptation Report: Beaufort County, South Carolina* (2015), and *Town of Edisto Beach Flooding and Sea Level Rise Vulnerability Assessment* (2021). These documents consistently provide recommendations for nature-based adaptation strategies consistent with the restoration actions evaluated in this Final RP/EA.

6.1.2 The Biological Environment

The South Carolina Lowcountry estuaries and their tidal currents provide a highly diverse and dynamic habitat for the plants and animals common to the coastal zone. Marsh vegetation is extensive in this region due to the gently sloping coastal plain and the wide tidal range. Estuarine wetlands acreages in the Broad River-Port Royal Sound, the North Edisto River, and the Stono River Watersheds are approximately 37,227, 28,315, and 23,284 acres, respectively.

A diverse assemblage of plant species typically found throughout the Southeast is found within the estuaries with the distribution determined by salinity and the duration of inundation. The tidal marshes of the Broad River-Port Royal Sound, the North Edisto River, and the Stono River watersheds reflect a strong marine influence, with salt and brackish water marshes bordering their entire river lengths. These watersheds exhibit a wide range of vegetation, changing markedly from salt to brackish to freshwater species.

The shallow marsh habitats of the Lowcountry provide seasonal year-round essential fish habitats (EFH) for a diverse assemblage of adult and juvenile finfish and crustaceans. EFH includes those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity – marine fish could not survive without these vital habitats. The highly productive marshes provide abundant food resources for early life history stages. The shallow-water marsh also serves as a refuge by providing a diversity of habitats and by excluding predators from the upper reaches of the estuary. These advantages result in reduced competition, lower mortality, and faster growth rates. Many of these species are either commercially or recreationally valuable. Notably, the estuaries contribute to the state's shrimp and crab landings – the largest commercial fisheries of South Carolina. Spot, Atlantic croaker, red drum, spotted seatrout, flounder, and catfish inhabit the estuary and are recreationally important. The estuary also supports numerous ecologically important species such as bay anchovy and grass shrimps, which serve as food for economically and recreationally important species. Several species of finfish that are spawned in the lower estuary or ocean enter the shallows of the estuary as juveniles and stay until they reach larger sizes or until lowering winter temperatures drive them seaward.

The spatial distribution of benthic organisms living in coastal South Carolina estuaries is similar to that of other estuaries along the mid-Atlantic, southeast and gulf coasts of the United States. Numerically dominant species include mollusks, polychaetes, oligochaetes, nematodes, and amphipods.

Federal and South Carolina state listed threatened and endangered species (T&E) and their critical habitats could occur in the evaluated restoration action project areas. As of May 13, 2022, the federally published list of T&E species for the State of South Carolina includes 27 animals and 22 plant species. Table 6.1 provides a list of federal and South Carolina recognized T&E animal and plant species that are potentially found in Beaufort and Charleston Counties.

TABLE 6.1: FEDERAL AND STATE LISTED THREATENED AND ENDANGERED SPECIES AND THEIR CRITICAL HABITATS. BEAUFORT AND CHARLESTON COUNTIES, SOUTH CAROLINA.

Species	Critical Habitat	Federal Status	State Status
Amphibians			
Carolina Gopher Frog *Lithobates capito*	n/a	n/a	Endangered
Frosted Flatwoods Salamander *Ambystoma cingulatum*	Yes	Threatened	Endangered
Northern Dwarf Siren *Pseudobranchus striatus*	n/a	n/a	Threatened
Birds			
Bachman's Warbler *Vermivora bachmanii*	n/a	Endangered	Endangered
Bald Eagle *Haliaeetus leucocephalus*	n/a	n/a	Threatened
Eastern Black Rail *Laterallus jamaicensis* ssp. *jamaicensis*	n/a	Threatened	n/a
Eskimo Curlew *Numenius borealis*	n/a	n/a	Endangered
Least Tern *Sternula antillarum*	n/a	n/a	Threatened
Piping Plover *Charadrius melodus*	Yes	Threatened	n/a
Red Knot *Calidris canutus rufa*	Yes	Threatened	n/a
Red-cockaded Woodpecker	n/a	Endangered	Endangered

Picoides borealis			
Swallow-tailed Kite *Elanoides forficatus*	n/a	n/a	Endangered
Wilson's Plover *Charadrius wilsonia*	n/a	n/a	Threatened
Wood Stork *Mycteria americana*	n/a	Threatened	Endangered
Plants			
American Chaffseed *Schwalbea americana*	n/a	Endangered	n/a
Canby's Dropwort *Oxypolis canbyi*	n/a	Endangered	n/a
Golden Sedge *Carex lutea*	Yes	Endangered	n/a
Pondberry *Lindera melissifolia*	n/a	Endangered	n/a
Seabeach Amaranth *Amaranthus pumilus*	n/a	Threatened	n/a
Insects			
Monarch Butterfly *Danaus plexippus*	n/a	Candidate	n/a
Species	**Critical Habitat**	**Federal Status**	**State Status**
Mammals			
Northern Long-eared Bat *Myotis septentrionalis*	n/a	Threatened	n/a

Rafinesque's Big-eared Bat *Corynorhinus rafinesquii*	n/a	n/a	Endangered
West Indian Manatee *Trichechus manatus*	Yes	Threatened	Endangered
Fish			
Atlantic sturgeon *Acipenser oxyrinchus*	n/a	Threatened/ Endangered	n/a
Shortnose sturgeon *Acipenser brevirostrum*	n/a	Endangered	Endangered
Reptiles			
Green Sea Turtle *Chelonia mydas*	Yes	Threatened	n/a
Kemp's Ridley Sea Turtle *Lepidochelys kempii*	Yes	Endangered	Endangered
Leatherback Sea Turtle *Dermochelys coriacea*	Yes	Endangered	n/a
Loggerhead Sea Turtle *Caretta*	Yes	Threatened	Threatened
Southern Hog-nosed Snake *Heterodon simus*	n/a	n/a	Threatened
Spotted Turtle *Clemmys guttata*	n/a	n/a	Threatened

There are numerous public and private entities permitted to discharge wastewater to Charleston and Beaufort waterways under the National Pollutant Discharge Elimination System (NPDES). These permits regulate the discharge of industrial and domestic wastewater, stormwater, and cooling water. As of 2021, there were 82 permitted discharges in these

counties — 46 and 36 in Charleston and Beaufort Counties, respectively (SCDHEC, n.d.b). Other sources of pollution affecting the harbor include nonpoint source runoff from urban, suburban, and industrial areas, marina and port facilities, and from forested and agricultural lands. Several diked, dredged material disposal areas are located in the harbor area, with the largest being Drum Island. The water quality of the harbor's tidal saltwater is rated as suitable for fishing and boating, but not for swimming, and the harvesting of oysters, mussels, and clams is prohibited.

6.1.3 The Social and Economic Environment

The restoration activities evaluated in this Final RP/EA are situated within Charleston County and Beaufort County, South Carolina. The populations of Charleston and Beaufort County are 401,165 and 186,095, respectively (U.S. Census Bureau, 2019). These figures represent 29.4% and 53.9% increases in these populations since 2000 (U.S. Census Bureau, 2000)—the eighth- and seventh-fastest growing counties in South Carolina between 2010 and 2019. There are 187,953 and 99,204 housing units in these counties, respectively. The demographic profile of Charleston County is 68.3% white, 26.7% Black, 1.5% Asian, 2.1% two or more races, 1.5% some other race alone, and 5.1% Hispanic or Latine. The demographic profile of Beaufort County is 74% white, 17.7% Black, 1.3% Asian, 2.3% two or more races, 4% some other race alone, and 11.1% Hispanic or Latine. The median ages are 37.8 in Charleston County and 45.5 in Beaufort County. Incorporated municipalities make up 31% of land area in Charleston County (17 municipalities total) and 23.5% in Beaufort County (5 municipalities total). There are 13,321 employer establishments in Charleston County and 5,154 in Beaufort County. Their respective employment rates are 62% and 49% with median household incomes of $64,022 and $68,377. Poverty rates are 13.7% and 10.2% respectively.

Tourism, the Port of Charleston, health care, and several large industrial employers heavily influence the economy of the state as a whole and these coastal counties in particular. The 2019 American Community Service 5-year estimates report the following employment figures in Charleston County by sector: 7.4% construction; 6.3% manufacturing; 2.3% wholesale trade; 10.2% retail trade; 4.3% transportation and warehousing, and utilities; 2.1% information; 6.6% finance and insurance, and real estate and rental and leasing; 15.4% professional, scientific, and management, and administrative and waste management services; 22.6% educational services, and health care and social assistance; 13.1% arts, entertainment, and recreation, and accommodation and food services; 4% public administration. And in Beaufort County: 8.8% construction; 5.5% manufacturing; 1.2% wholesale trade; 14.2% retail trade; 3.7% transportation and warehousing, and utilities; 6.4% finance and insurance, and real estate and rental and leasing; 12.8% professional, scientific, and management, and administrative and waste management services; 20.6% educational services, and health care and social assistance; 15.1% arts, entertainment, and recreation, and accommodation and food services; 4.1% public administration.

Charleston Harbor's port facilities, composed of an extensive network of modern shore side facilities, represent the largest economic resource associated with the Charleston Harbor estuary. During 2019, the ports of South Carolina handled 2.44 million TEUs (Twenty-foot Equivalent Units) of containerized cargo, up 5.2% from the previous year (South Carolina Ports Authority, n.d.). Charleston's breakbulk cargo totaled 727,295 tons in FY2021. Top commodities passing through the Port of Charleston include forest products, chemicals, machinery parts, consumer products, apparel, hardware, vehicles, and agricultural products. The Charleston Customs district ranks as the nation's eighth largest in dollar value of international shipments, with cargo valued at more than $75 billion in 2019.

Within Charleston and Beaufort counties, there are six military facilities. These facilities include two Naval hospitals, two Marine Corps bases, an Air Force base, and Navy base. Charleston International Airport provides commercial and military air service for the region and served over 4.9 million passengers in 2019. Interstates I-26, I-95, and I-526 provide access to residential, private, government, and commercial concerns. Eight public and private non-profit colleges and universities are located within the region.

6.1.4 Cultural and Historic Resources

The South Carolina Lowcountry contains some of the most significant historic and archeological features in the United States. Cultural resources include historic buildings, structures and sites, unique commercial and residential areas, unique natural and scenic resources, archeological sites, and educational, religious, and entertainment areas or institutions. In some areas, preservation programs are effective in maintaining these resources. In other areas these resources are being lost or neglected primarily because of our limited knowledge. There is a continuing need for surveys to identify the cultural resources, their locations, and significance. This knowledge must be made available to local officials and interest groups to gain greater support of preservation programs and other cultural activities.

The earliest inhabitants of what is now the South Carolina Lowcountry included various Indigenous American groups. Recognizing the diverse and dynamic history of territorial geographies in the Lowcountry, the areas of interest for this Final RP/EA include, but are not limited to, the historic territories of the Yamassee Nation, the Seewee Tribe, and the Natchez-Kusso Tribe (also known as the Edistos). These indigenous cultures drew strong connections to the natural resources of the Lowcountry, including their active use of fisheries resources. With European colonization of the Lowcountry, disease, conflict, and expanding European settlement led to the near erasure of indigenous populations in South Carolina by the time of the American Revolution. Today, Yamassee Nation and Natchez-Kusso Tribe members are still active in South Carolina — the Natchez-Kusso are recognized by the state of South Carolina and are seeking federal recognition as of November 2021.

In the colonial and post-colonization history of coastal South Carolina, of note is the legacy of Lowcountry agricultural practices and the reshaping of the coastal estuarine habitats. Portions of the coast are dominated by dikes, drains, berms, and flood control structures that are remnants of historic rice agriculture. In South Carolina alone, there are over 200,000 acres of either intact or broken rice field structures scattered throughout the coastal landscape (Hanks *et al.*, 2021). These structures are artifacts of agriculture technologies introduced by enslaved African peoples in the late 17th and early 18th century to create impounded areas for Euro-colonial rice plantations in the region.

The remote conditions of the Lowcountry plantation landscape allowed these enslaved peoples, predominantly from West Africa, to preserve and recreate the cultural practices of their various ethnic affiliations. From this, the unique Gullah/Geechee ethnic identity and language emerged. Gullah/Geechee communities persist today along the South Atlantic coast from north Florida to North Carolina. In recognition of the Gullah/Geechee, the U.S. Congress established the Gullah Geechee Cultural Heritage Corridor as a National Heritage Area. Beyond their connection to Lowcountry agriculture, the Gullah/Geechee culture is linked to the natural resources of the Lowcountry estuarine environment (American Fisheries Society, 2015; Ellis *et al.*, 2014; Fuller, 2021).

6.1.5 Environmental Justice

Executive Order (E.O.) 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, direct federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental impacts of federal projects on minority and low-income populations and Tribal Nations. The USEPA defines environmental justice (EJ) as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies. EJ efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities. Impacts on minority and low-income populations are considered disproportionately high and adverse under E.O. 12898 if they would “significantly … and adversely” affect a low-income or minority population and would “appreciably exceed or [be] likely to appreciably exceed” impacts on the general population or another appropriate comparison group (CEQ 1997). These impacts are described in Section 4, Environmental Consequences below.

Consistent with E.O. 12898, this section examines environmental and demographic data indicative of communities with EJ concerns within the Census Block Groups proximal to the restoration actions evaluated in this Final RP/EA. The USEPA’s EJSCREEN: Environmental Justice

Screening and Mapping Tool (https://www.epa.gov/ejscreen) was used to access and analyze the most recent data from USEPA environmental monitoring programs and the U.S. Census Bureau's American Community Survey (ACS) 5-year estimates from 2015 to 2019. Table 6.2 provides environmental and demographic data by Census Block Group.

TABLE 6.2: DEMOGRAPHIC AND ENVIRONMENTAL DATA FOR THE CENSUS BLOCK GROUPS PROXIMAL TO RESTORATION ACTIONS (EJSCREEN 2022). INCLUDES BLOCKS PROXIMAL TO ACTIONS EVALUATED IN THIS FINAL RP/EA. VALUES BETWEEN THE 70TH AND 80TH PERCENTILES FOR SOUTH CAROLINA ARE SHADED GRAY; BETWEEN THE 80TH AND 90TH ARE SHADED YELLOW; BETWEEN THE 90TH AND 95TH ARE SHADED ORANGE; BETWEEN THE 95TH AND 100TH ARE SHADED RED. THIS CLASSIFICATION IS CONSISTENT WITH THAT USED BY THE USEPA IN THE EJSCREEN MAPPER TOOL.

		U.S. Census Block Groups									
		Long Branch Creek				Edisto Marsh	Port Royal Oysters				
	DATA	450190056002	450190026142	450190028011	450190026141	450190023001	450130010001	450130009031	450130011023	450130010002	450130011022
Demographic	Population	8622	1047	1964	2472	1670	2985	2352	1201	1098	1972
	People of Color (% Pop)	39%	44%	34%	47%	37%	37%	39%	39%	34%	84%
	Low Income (% Pop)	20%	27%	16%	38%	32%	19%	40%	52%	60%	36%
	Unemployment Rate (% Pop)	4%	2%	1%	2%	4%	0%	10%	1%	12%	2%
	Linguistically Isolated (% Pop)	3%	0%	0%	2%	1%	0%	2%	3%	0%	0%
	Less Than High School Education (% Pop)	3%	6%	1%	8%	12%	0%	9%	28%	2%	7%
	Under Age 5 (% Pop)	8%	4%	9%	5%	1%	1%	4%	0%	26%	6%
	Over Age 64 (% Pop)	12%	22%	17%	11%	32%	0%	23%	30%	0%	18%
Environmental	Particulate Matter 2.5 (ug/m3)	7.29	7.29	7.22	7.29	6.9	7.29	7.25	7.09	7.29	7.09
	Ozone (ppb)	32.3	32.4	32.4	32.4	32.8	33.9	33.5	33.8	33.9	33.8
	2017 Diesel Particulate Matter (ug/m3)	0.231	0.303	0.264	0.303	0.0873	0.123	0.12	0.103	0.123	0.103
	2017 Air Toxics Cancer Risk (risk per MM)	30	30	30	30	20	20	30	20	20	20
	2017 Air Toxics Respiratory HI	0.4	0.4	0.4	0.4	0.3	0.3	0.4	0.3	0.3	0.3
	Traffic Proximity (daily traffic count/distance to road)	65	320	160	65	N/A	N/A	6.1	N/A	N/A	N/A
	Lead Paint (% pre-1960s housing)	0.0053	0.036	0.1	0.053	0.073	0.2	0.032	0.081	0	0.14
	Superfund Proximity (site count/km distance)	0.089	0.11	0.11	0.12	0.025	0.64	0.16	0.11	0.58	0.12
	RMP Facility Proximity (facility count/km distance)	0.15	0.14	0.13	0.16	0.039	0.064	0.055	0.067	0.073	0.053
	Hazardous Waste Proximity (facility count/km distance)	0.58	1.5	1.8	1.6	0.064	0.93	0.56	0.11	0.58	0.13
	Underground Storage Tanks	0.29	2.8	1.7	4.9	0.06	0	0.64	0	0	0.56
	Wastewater Discharge (toxicity-weighted concentration/m distance)	N/A	N/A	N/A	5.9E-07	0.00028	2.9E-06	5.4E-06	1.4E-06	1.1E-06	4.1E-07

6.2 Environmental Consequence Analysis for Restoration Alternatives

This section describes the Trustees' analysis of the environmental consequences that would be likely to arise from implementation of the three restoration projects that comprise the Trustees' preferred and non-preferred alternatives, as well as the No Action alternative (Tables 6.3 - 6.5).

The following definitions were generally used to characterize the nature of the various impacts (effects) evaluated with this RP/EA:

- *Effects or Impacts. Means changes to the human environment that are caused by a proposed action and that are reasonably foreseeable.*

- *Short-term or long-term impacts. These characteristics are determined on a case-by-case basis and do not refer to any rigid time period. In general, short-term impacts are those that would occur only with respect to a particular activity or for a finite period. Long-term impacts are those that are more likely to be persistent and chronic.*

- *Direct or indirect impacts. A direct impact is caused by a proposed action and occurs at the same time and place as the action. An indirect impact is caused by a proposed action and might occur later in time or be farther removed in distance but still be a reasonably foreseeable outcome of the action.*

- *Minor, moderate, or major impacts. These relative terms are used to characterize the magnitude of an impact. Minor impacts are generally those that might be perceptible but, in their context, are not amenable to measurement because of their relatively minor character. Moderate impacts are those that are more perceptible and, typically, more amenable to quantification or measurement. Major impacts are those that, when considering the potentially affected environment and the degree of the effects, have the potential to be significant, and thus, warrant heightened attention and examination for potential means for mitigation to fulfill the requirements of NEPA.*

- *Adverse or beneficial impacts. An adverse impact is one having adverse, unfavorable, or undesirable outcomes on the man-made or natural environment. A beneficial impact is one having positive outcomes on the man-made or natural environment. A single act might result in adverse impacts on one environmental resource and beneficial impacts on another resource.*

- *Cumulative impacts. These are effects on the environment that result from the incremental effects of the proposed action when added to the effects of other past, present, and reasonably foreseeable actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time.*

TABLE 6.3. ENVIRONMENTAL CONSEQUENCES FOR ALTERNATIVE 1 (PREFERRED)

Environmental Consequences	Alternative 1: Edisto Island Salt Marsh and Port Royal Oyster Reef Creation
Physical Resources	
Hydrology and Water Quality	<u>Edisto Island Salt Marsh Creation</u>: Short-term, direct, minor, adverse impacts to hydrology and water quality would occur during construction due to turbidity. Impacts from earth moving activities would be minimized using best management practices. Long-term, direct and indirect, beneficial impacts to water quality and hydrology would occur through improved hydrological flow from wetland restoration. <u>Port Royal Oyster Reef Creation</u>: Short-term, direct, minor, adverse impacts to hydrology and water quality would occur during construction due to turbidity. Impacts from reef structure installation activities would be minimized using best management practices. Long-term, direct and indirect, beneficial impacts to water quality and hydrology would occur through improved oyster filtering capacity from new oyster habitat.
Air Resources	<u>Edisto Island Salt Marsh Creation</u>: Short-term, direct, minor, adverse impacts to air resources would occur from exhaust emissions during construction. No anticipated long-term beneficial or adverse impacts to air resources. <u>Port Royal Oyster Reef Creation</u>: Short-term, direct, minor, adverse impacts to air resources would occur from exhaust emissions during construction.

	No anticipated long-term beneficial or adverse impacts to air resources.
Sediment/Geology	Edisto Island Salt Marsh Creation: Short-term, direct, minor adverse impacts to sediments and geology would occur during construction due to moving sediments and substrate. Impacts from earth moving activities would be minimized using best management practices. Long-term, direct, beneficial impacts to sediments and geology would occur from hydrologic connection to the tidal creeks. Port Royal Oyster Reef Creation: Short-term, direct, minor adverse impacts to sediments and geology would occur during construction due to reef installation on sediments and substrate. Impacts from construction activities would be minimized using best management practices. Long-term, direct, beneficial impacts to sediments and geology would occur due to the sediment stabilization provided by new oyster reef substrates.
Climate Change	Edisto Island Salt Marsh Creation: Short-term, direct, minor, adverse impacts to climate change would occur during construction due to the release of exhaust emission into the atmosphere during construction and the dislodging of sequestered carbon by vegetation removal and sediment excavation. Impacts from construction activities would be minimized using best management practices. Long-term, direct, beneficial impacts to climate change would occur from the creation of new marsh habitat – an effective carbon sink – and the promotion of marsh habitat resilience to sea level rise through the conservation of upland marsh migration corridors. Port Royal Oyster Reef Creation: Short-term, direct, minor, adverse impacts to climate change would occur during construction due to the release of exhaust

	emission into the atmosphere during construction. Impacts from construction activities would be minimized using best management practices. Long-term, direct, beneficial impacts to climate change would occur from the enhanced resilience to extreme storm and sea level rise provided by the oyster habitat.
Biological Resources	
Fish and Habitats	<u>Edisto Island Salt Marsh Creation</u>: Short-term, direct, minor, adverse impacts to fish and associated habitats, including EFH, would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to fish and estuarine habitats are anticipated. Salt marsh creation would provide long-term, direct and indirect, beneficial impacts to fisheries species by creating new habitats for feeding and shelter for fish and benthic species, including species of recreational and commercial importance including finfish and shrimp species. The Trustees will complete Endangered Species Act (ESA) and EFH consultations prior to project implementation. <u>Port Royal Oyster Reef Creation</u>: Short-term, direct, minor, adverse impacts to fish and associated habitats, including EFH, would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to fish and estuarine habitats are anticipated. Oyster reef creation would provide long-term, direct and indirect, beneficial impacts to fisheries species by creating new habitats for feeding and shelter for fish and benthic species, including species of recreational and commercial importance including summer flounder, blue fish, and snapper grouper. The Trustees will complete ESA and EFH consultations prior to project implementation.

Threatened and Endangered Species	<u>Edisto Island Salt Marsh Creation</u>: Short-term, direct, minor, adverse impacts to T&E species and associated critical habitats may occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to T&E species and their critical habitats are anticipated. Salt marsh creation could provide long-term, direct and indirect, beneficial impacts to some T&E species by creating new habitats for feeding and shelter. The Trustees will complete ESA consultations prior to project implementation. <u>Port Royal Oyster Reef Creation</u>: Short-term, direct, minor, adverse impacts to T&E species and associated critical habitats may occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to T&E species and their critical habitats are anticipated. Oyster reef creation could provide long-term, direct and indirect, beneficial impacts to T&E species by creating new habitats for feeding and shelter. The Trustees will complete ESA consultations prior to project implementation.
Wildlife & Habitats	<u>Edisto Island Salt Marsh Creation</u>: Short-term, direct, minor, adverse impacts to wildlife would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect adverse impacts would occur due to construction. Habitat restoration would provide long-term, direct and indirect, beneficial impacts by creating new wetland and subtidal habitats for birds and other estuarine wildlife. <u>Port Royal Oyster Reef Creation</u>:

	Short-term, direct, minor, adverse impacts to wildlife would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect adverse impacts would occur due to construction. Habitat restoration would provide long-term, direct and indirect, beneficial impacts by creating new oyster reef and subtidal habitats for birds and other estuarine wildlife.
Socioeconomics	
Cultural and Historical Resources	<u>Edisto Island Salt Marsh Creation</u>: There are no known cultural or historical resources that would be negatively impacted during activities in or around the proposed salt marsh creation areas. A letter of concurrence as part of National Historic Preservation Act (NHPA) Section 106 consultation with the State Historic Preservation Office (SHPO) will be requested prior to the project implementation. <u>Port Royal Oyster Reef Creation</u>: There are no known cultural or historical resources that would be negatively impacted during activities in or around the proposed oyster reef creation areas. A letter of concurrence as part of NHPA Section 106 consultation with the SHPO will be requested prior to the project implementation.
Recreation	<u>Edisto Island Salt Marsh Creation</u>: No anticipated short- or long-term, direct or indirect, adverse impacts to recreation and tourism because these activities do not currently exist at and around the project sites. Long-term, direct and indirect beneficial impacts are anticipated for tourism and recreational use within the project area because proposed actions are expected to improve habitat quality. <u>Port Royal Oyster Reef Creation</u>: Short-term, direct, minor, adverse impacts to recreation would occur in the immediate vicinity of the project site during

	construction, due to potential limited access by recreational boaters and fishers. No long-term, direct or indirect adverse impacts would occur due to construction. Oyster reef creation would provide long-term, direct and indirect, beneficial impacts by creating new fish habitat for recreational fishing.
Transportation	Edisto Island Salt Marsh Creation: No anticipated short- or long-term, direct or indirect, adverse or beneficial impacts to transportation. Port Royal Oyster Reef Creation: No anticipated short- or long-term, direct or indirect, adverse or beneficial impacts to transportation.
Public Health and Safety	Edisto Island Salt Marsh Creation: No anticipated short- or long-term, direct or indirect, adverse impacts to public health and safety. Port Royal Oyster Reef Creation: No anticipated short- or long-term, direct or indirect, adverse impacts to public health and safety.
Environmental Justice	Edisto Island Salt Marsh Creation: Data accessed through the USEPA EJSCREEN tool suggests that there are notable populations of linguistically isolated and/or over the age of 64 individuals in the Census Block Group associated with this restoration action. This project does not have the potential to negatively or disproportionately affect these populations with EJ concerns in the area, including economically, socially, recreationally, or in terms of conditions affecting their health. Habitat restoration would provide long-term, direct and indirect, beneficial impacts by enhancing natural resources. Enhanced resilience to climate change noted above would extend to the

	broader community including populations with environmental justice concerns. Port Royal Oyster Reef Creation: Data accessed through the USEPA EJSCREEN tool suggests that there are notable populations of people of color, low income, unemployed, linguistically isolated, less than high school educated, under the age of 5, and/or over the age of 64 individuals in the Census Block Groups associated with this restoration action. Further, various environmental data for these Block Groups are indicative of EJ issues (Table 6.1). This project does not have the potential to negatively or disproportionately affect populations with EJ concerns in the area, including economically, socially, recreationally, or in terms of conditions affecting their health. Oyster reef creation would provide long-term, direct and indirect, beneficial impacts by enhancing recreational and subsistence fisheries resources and improving water quality. Enhanced resilience to climate change noted above would extend to the broader community including populations with environmental justice concerns.

TABLE 6.4. ENVIRONMENTAL CONSEQUENCES FOR ALTERNATIVE 2 (NON-PREFERRED)

Environmental Consequences	**Alternative 2: Long Branch Creek Hydrologic Restoration**
Physical Resources	
Hydrology and Water Quality	Short-term, direct, minor, adverse impacts to hydrology and water quality would occur during construction due to turbidity. Impacts from earth moving activities would be minimized using best management practices. Long-term, direct and indirect, beneficial impacts to water quality and hydrology would occur through improved hydrological flow and enhanced wetland habitat.

Air Resources	Short-term, direct, minor, adverse impacts to air resources would occur from exhaust emissions during construction. No anticipated long-term beneficial or adverse impacts to air resources.
Sediment/Geology	Short-term, direct, minor adverse impacts to sediments and geology would occur during construction due to moving sediments and substrate. Impacts from earth moving activities would be minimized using best management practices. Long-term, direct, beneficial impacts to sediments and geology would occur from enhanced hydrologic connection to the tidal creeks.
Climate Change	Short-term, direct, minor, adverse impacts to climate change would occur during construction due to the release of exhaust emission into the atmosphere and the dislodging of sequestered carbon by vegetation removal and sediment excavation. Impacts from construction activities would be minimized using best management practices. Long-term, direct, beneficial impacts to climate change would occur from the enhancement of marsh habitat – an effective carbon sink – and the promotion of resilience to flooding and sea level rise through the improved hydrologic processes.
Biological Resources	
Fish and Habitats	Short-term, direct, minor, adverse impacts to fish and associated habitats, including EFH, would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to fish and estuarine habitats are anticipated. Hydrologic connection and salt marsh enhancement would provide long-term, direct and indirect, beneficial impacts to fisheries species by creating new habitats for feeding and shelter for fish and benthic species, including species of recreational and commercial importance including finfish and shrimp species. The

	Trustees will complete ESA and EFH consultations prior to project implementation.
Threatened and Endangered Species	Short-term, direct, minor, adverse impacts to T&E species and associated critical habitats may occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect, adverse impacts to T&E species and their critical habitats are anticipated. Hydrologic connection and salt marsh enhancement could provide long-term, direct and indirect, beneficial impacts to some T&E species by creating new habitats for feeding and shelter. The Trustees will complete ESA consultations prior to project implementation.
Wildlife and Habitats	Short-term, direct, minor, adverse impacts to wildlife would occur in the immediate vicinity of the project site during construction, due to potential for construction noise and disturbances. No long-term, direct or indirect adverse impacts would occur due to construction. Habitat enhancement would provide long-term, direct and indirect, beneficial impacts by enhancing wetland and subtidal habitats for birds and other estuarine wildlife.
Socioeconomics	
Cultural and Historical Resources	There are no known cultural or historical resources that would be negatively impacted during activities in or around the proposed alternative areas. A letter of concurrence as part of NHPA Section 106 consultation with the SHPO will be requested prior to the project implementation.
Recreation	No anticipated short- or long-term, direct or indirect, adverse impacts to recreation and tourism because these activities do not currently exist at and around the project sites. Long-term, direct and indirect beneficial impacts are anticipated for tourism and recreational use within the project area because

	proposed actions are expected to improve habitat quality and recreational experience.
Transportation	No anticipated short- or long-term, direct or indirect, adverse or beneficial impacts to transportation.
Public Health and Safety	No anticipated short- or long-term, direct or indirect, adverse impacts to public health and safety.
Environmental Justice	Data accessed through the USEPA EJSCREEN tool suggest that there are notable populations of linguistically isolated, under the age of 5, and/or over the age of 64 individuals in the Census Block Groups associated with this restoration action. Further, various environmental data for these Block Groups are indicative of EJ issues (Table 6.1). This project does not have the potential to negatively or disproportionately affect populations with EJ concerns in the area, including economically, socially, recreationally, or in terms of conditions affecting their health. Hydrologic restoration would provide long-term, direct and indirect, beneficial impacts by enhancing recreational and subsistence fisheries resources and improving water quality. Enhanced resilience to climate change and flooding impacts noted above would extend to the broader community including populations with environmental justice concerns.

TABLE 6.5. ENVIRONMENTAL CONSEQUENCES FOR NO ACTION

Environmental Consequences	**Alternative 3: No Action**
Physical Resources	
Hydrology and Water Quality	Project area water, air, and geological/sediment conditions would not be affected since no restoration would occur. Any ecological benefits that may result from proposed alternatives would not occur, and the trajectory of any ecologically degraded areas would remain unchanged.
Air Resources	
Sediment/Geology	
Climate Change	

Biological Resources	
Fish and Habitats	Project area fish, wildlife, vegetation, habitats, and threatened and endangered species would not be affected since no restoration would occur.
Threatened and Endangered Species	
Wildlife and Habitats	
Socioeconomics	
Cultural and Historical Resources	Project area socio-economic variables would not be affected since no restoration would occur. Potential economic benefits as a result of the enhanced recreational opportunities would not be realized.
Recreation	
Transportation	
Public Health and Safety	
Environmental Justice	This alternative does not have the potential to negatively or disproportionately affect populations with EJ concerns in the area, including economically, socially, recreationally, or in terms of conditions affecting their health.

6.3 Cumulative Impacts of Preferred Alternative

The preferred alternative is expected to result in cumulative, long-term, beneficial impacts by increasing the area and ecological function of salt marsh habitat, including increased habitat stability. Up to 17 acres of marsh and 3.2 acres of oyster reef will be directly impacted by restoration, and the overall ecological function of the larger estuarine habitat at the restoration sites will be benefitted by the restored hydrologic function and creation of oyster reef.

The project actions would not result in any change to the economic activity in the area, and the restoration would contribute to the overall ecological health of the restoration areas. At the Edisto Island restoration site, there is the direct potential to improve water quality through upland watershed conservation/restoration and improved creek hydrology. Additionally, both the salt marsh and oyster reef creation components of the preferred alternative would result in the creation and enhancement of fish and wildlife habitat supplementing existing habitat in the restoration areas. Thus, overall, a net beneficial cumulative impact may result from the implementation of the preferred alternative in synergy with future restoration activities. Cumulative impacts would not occur at a regional scale and are not expected to be significant.

6.4 Cumulative Impacts of Non-Preferred Alternative

The non-preferred alternatives would have no major adverse impacts on area habitats, lands, or waterways. The alternative may result in minor, adverse impacts during hydrologic restoration construction, but those impacts would be localized and short-term. When considered with other past, present, and reasonably foreseeable future actions, the alternative is not anticipated to have adverse cumulative impacts, but may result in localized, long-term, beneficial impacts to physical and biological resources. Cumulative impacts would not occur at a regional scale and are not expected to be significant.

6.5 Cumulative Impacts of No-Action Alternative

With No Action, natural resources and their services would not return to baseline, and interim service losses would not be compensated. However, because No Action would be taken there would be no cumulative impacts, beneficial or adverse.

7 COMPLIANCE WITH OTHER KEY STATUES, REGULATIONS, AND POLICIES

7.1 Federal Laws

Consultations have been initiated for Essential Fish Habitat, Coastal Zone Management Act, Section 7 (ESA), and Section 103 (NHPA) to ensure that implementation of the preferred alternative will comply with these laws. All federal state and local laws will be complied with prior to project implementation. Federal laws, regulations and executive orders that may be applicable include, but are not limited to:

- Endangered Species Act (16 U.S.C. §§ 1531 *et seq*.)
- Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. §§ 1801 *et seq*.)
- Marine Mammal Protection Act (16 U.S.C. §§ 1361 *et seq*.)
- Coastal Zone Management Act (16 U.S.C. §§ 1451 *et seq*.)
- National Historic Preservation Act (16 U.S.C. §§ 470 *et seq*.)
- Migratory Bird Treaty Act (16 U.S.C. §§ 703 *et seq*.)

- Bald and Gold Eagle Protection Act (16 U.S.C. §§ 668 *et seq*.)
- Clean Air Act (42 U.S.C. §§ 7401 *et seq*.)
- Federal Water Pollution Control Act (Clean Water Act) (33 U.S.C. §§ 1251 *et seq*.) and/or Rivers and Harbors Act (33 U.S.C. §§ 401 *et seq*.)
- Marine Protection, Research and Sanctuaries Act (16 U.S.C. §§ 1431 *et seq.* and 33 U.S.C. §§ 1401 *et seq*.)
- Estuary Protection Act (16 U.S.C. §§ 1221–1226)
- Archaeological Resource Protection Act (16 U.S.C. §§ 470aa–470mm)
- National Marine Sanctuaries Act (16 U.S.C. §§ 1431 *et seq*.)
- Farmland Protection Policy Act (7 U.S.C. §§ 4201–4209)
- EO11988: Floodplain Management augmented by EO13690, January 30, 2015)
- EO11990: Protection of Wetlands
- EO12898: Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations
- EO12962: Recreational Fisheries
- EO13007: Indian Sacred Sites
- EO13112: Safeguarding the Nation from the Impacts of Invasive Species
- EO13175: Consultation and Coordination with Indian Tribal Governments
- EO13186: Responsibilities of Federal Agencies to Protect Migratory Birds
- EO13693: Planning for Federal Sustainability in the Next Decade

8 LIST OF PREPARERS

Agency	Name	Position
State of South Carolina		
Department of Health and Environmental Control	Heather Cathcart	Natural Resource Trustee, Federal Remediation Section
Department of Health and Environmental Control	Susan Fulmer	Natural Resource Trustee, Federal Remediation Section Manager
Department of Health and Environmental Control	Karen Ratigan	Assistant General Counsel
Department of Natural Resources	Stacie Crowe	Natural Resource Trustee, Coastal Environmental Project Manager
Department of Natural Resources	Susan Porter	General Counsel
Department of Natural Resources	Van Whitehead	Deputy General Counsel
Department of the Interior		
Office of the Solicitor	Genette Gaffney	Attorney-Advisor
United States Fish and Wildlife Service	Eric Bauer	Trustee Council Representative
National Oceanic and Atmospheric Administration		

Restoration Center/Earth Resources Technology, Inc.	Krista McCraken	Natural Resource Trustee, Marine Habitat Resource Specialist
Restoration Center/Earth Resources Technology, Inc.	Ian Rossiter	Natural Resource Trustee, Marine Habitat Resource Specialist
Restoration Center	Howard Schnabolk	Natural Resource Trustee, Marine Habitat Resource Specialist
Office of General Counsel	Corinna McMackin	Attorney-Advisor

9 LITERATURE CITED

American Fisheries Society. 2015. News, Spotlight on Members: The Gullah/Geechee Fishing Association. Accessed at https://fisheries.org/2015/07/the-gullahgeechee-fishing-association/.

American Lung Association. 2022. State of the Air Report Card: Charleston County. Accessed at https://www.lung.org/research/sota/city-rankings/states/south-carolina/charleston.

BBL. 2004a. Engineering Evaluation/Cost Analysis Report, Former Atlantic Phosphate Works Site, Charleston, South Carolina, prepared by Blasland, Bouck & Lee, Inc., Cary, NC for Exxon Mobil Corporation, Houston, TX, June 2004.

BBL. 2004b. Engineering Evaluation/Cost Analysis Report. Former Stono Phosphate Works Site, Charleston, South Carolina, prepared by Blasland, Bouck & Lee, Inc., Cary, NC for Exxon Mobil Corporation, Houston, TX, June 2004.

BBL. 2004c. Engineering Evaluation/Cost Analysis Report. Former Swift Agri-Chem Site, Charleston, South Carolina, prepared by Blasland, Bouck & Lee, Inc., Cary, NC for Exxon Mobil Corporation, Houston, TX, June 2004.

Burton, G. Allen. 1992. Sediment Toxicity Assessment. Lewis Publishers, Inc., Chelsea, MI.

CEQ, T., 1997. Environmental justice guidance under the national environmental policy act. Washington (DC), 7.

Chapman, P.M., M. Cano, A.T. Fritz, C. Gaudet, C.A. Menzie, M. Sprenger, W.A. Stubblefield. 1997. Workgroup summary report on contaminated site cleanup decisions. In: Ecological Risk Assessments of Contaminated Sediments. Ed., C.G., Ingersoll, T. Dillon, G.R. Biddinger. SETAC Press, Pensacola, FL.

Crist, P.J., R. White, M. Chesnutt, C. Scott, R. Sutter, P. Cutter, and G. Dobson. Coastal Resilience Assessment of the Charleston Harbor Watershed. 2019. National Fish and Wildlife Foundation.

Ellis, J.H., Friedman, D.B., Puett, R. *et al*. 2014. A Qualitative Exploration of Fishing and Fish Consumption in the Gullah/Geechee Culture. J Community Health 39, 1161–1170. https://doi.org/10.1007/s10900-014-9871-5

Exxon Mobil Corporation. 2004. Engineering Evaluation/Cost Analysis Report, Former Atlantic Phosphate Works Site, Charleston, South Carolina.

Fuller, S.Y. 2021. Indigenous Ontologies: Gullah Geechee Traditions and Cultural Practices of Abundance. Hum Ecol 49, 121–129. Accessed at https://doi.org/10.1007/s10745-021-00215-2.

Hall, E.R., Wickes, L., Burnett, L.E., Scott, G.I., Hernandez, D., Yates, K.K., Barbero, L., Reimer, J.J., Baalousha, M., Mintz, J. and Cai, W.J., 2020. Acidification in the US Southeast: causes, potential consequences and the role of the Southeast Ocean and coastal acidification network. Frontiers in Marine Science, 7, p.548.

Hanks, R. Daniel, Robert F. Baldwin, Travis H. Folk, Ernie P. Wiggers, Richard H. Coen, Michael L. Gouin, Andrew Agha, Daniel D. Richter, and Edda L. Fields-Black. 2021. Mapping Antebellum Rice Fields as a Basis for Understanding Human and Ecological Consequences of the Era of Slavery. Land 10, no. 8: 831. Accessed at https://doi.org/10.3390/land10080831.

Ingersoll, C.G., T. Dillon, G.R. Biddinger. 1997. Ecological Risk Assessments of Contaminated Sediments. SETAC Press, Pensacola, FL.

Knutson, T. 2022. NOAA Global Warming and Hurricanes: An Overview of Current Research Results. Accessed at https://www.gfdl.noaa.gov/global-warming-and-hurricanes/.

MacDonald, D.D. 1994. Approach to the assessment of sediment quality in Florida Coastal Waters. Report to FL Department of Environmental Protection, November, 1994.

NASA EarthData. 2022. Interagency Sea level Rise Scenario Tool. Access at https://sealevel.nasa.gov/task-force-scenario-tool/.

NOAA. 2022. NOAA Restoration Center Implementation Monitoring: Guidance for Proposing and Conducting Tier 1 Monitoring.

NOAA. 2012. NOAA Habitat Blueprint. Fishery Management Councils. chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://static1.squarespace.com/static/56c65ea3f2b77e3a78d3441e/t/56ce1ea94c2f85d43b23138a/1456348854228/CCC_2012-01_013_Habitat+Blueprint+Presentation.pdf.

NOAA. 2006. Habitat Equivalency Analysis: An Overview, Damage Assessment and Restoration Program, National Oceanic and Atmospheric Administration, Department of Commerce, 23 pp. http://www.darp.noaa.gov/pdf/heaoverv.pdf.

NOAA. 1999. Discounting and the treatment of uncertainty in natural resource damage assessment. Technical Paper 99-1. National Oceanic and Atmospheric Administration, Damage Assessment and Restoration Program. Website www.darp.noaa.gov/publicat.htm.

National Oceanic and Atmospheric Administration, Center for Operational Oceanographic Products and Services (NOAA CO-OPS). 2022. Tides & Currents (various stations). Accessed May 2022, at https://tidesandcurrents.noaa.gov/

National Oceanic and Atmospheric Administration, Office for Coastal Management (NOAA OCM). 2016. "2016 C-CAP Regional Land Cover." Coastal Change Analysis Program (C-CAP) Regional Land Cover. Charleston, SC: NOAA Office for Coastal Management. Accessed May 2022 at www.coast.noaa.gov/htdata/raster1/landcover/bulkdownload/30m_lc/.

Peterson, C.H., M. Wong, M.F. Piehler, J.H. Grabowski, R.R. Twilley, and M.S. Fonseca. 2007. Estuarine habitat productivity ratios at multiple trophic levels. Final Report to NOAA Office of Response and Restoration, Assessment and Restoration Division, Silver Spring, MD. 62 pp.

Ridolifi Inc. 2003. Habitat Restoration Opportunities in The Charleston Harbor, SC, Area. Prepared by Ridolifi Inc. for NOAA, November 2003.

Runkle, J., K.E. Kunkel, L.E. Stevens, R. Frankson, B.C. Stewart, W. Sweet, and S. Rayne. 2022. South Carolina State Climate Summary 2022. NOAA Technical Report NESDIS 150-SC. NOAA/NESDIS, Silver Spring, MD, 5 pp.

South Carolina Department of Health and Environmental Control/Office Coastal Resource Management (SCDHEC/ OCRM). 2000. Charleston Area Special Area Management Plan. NOAA Award # NA86OZ0203. http://www.scdhec.net/environment/ocrm/pubs/docs/SAMP/CHP/CHP.pdf

South Carolina Department of Health and Environmental Control (SCDHEC). n.d.a. SC Watershed Atlas. Retrieved May, 2022, from https://gis.dhec.sc.gov/watersheds/.

South Carolina Department of Health and Environmental Control (SCDHEC). n.d.b. National Pollutant Discharge Elimination System (NPDES) Overview. Accessed May, 2022, at https://scdhec.gov/national-pollutant-discharge-elimination-system-npdes-overview

South Carolina Department of Natural Resources (SCDNR). 2022. SC Hurricanes Comprehensive Summary.

South Carolina Department of Natural Resources (SCDNR). 2013. Climate Change Impacts to Natural Resources. Accessed at https://www.dnr.sc.gov/pubs/CCINatResReport.pdf.

South Carolina Ports Authority. n.d. South Carolina Ports: About the Port. Accessed at https://scspa.com/

South Carolina Sea Grant Consortium. 2015. Sea Level Rise Adaptation Report: Beaufort County, South Carolina. S.C. Sea Grant Consortium, Charleston, S.C.

Sweet, W.V., B.D. Hamlington, R.E. Kopp, C.P. Weaver, P.L. Barnard, D. Bekaert, W. Brooks, M. Craghan, G. Dusek, T. Frederikse, G. Garner, A.S. Genz, J.P. Krasting, E. Larour, D. Marcy, J.J. Marra, J. Obeysekera, M. Osler, M. Pendleton, D. Roman, L. Schmied, W. Veatch, K.D. White, and C. Zuzak. 2022. Global and Regional Sea Level Rise Scenarios for the United States: Updated Mean Projections and Extreme Water Level Probabilities Along U.S. Coastlines. NOAA Technical Report NOS 01. National Oceanic and Atmospheric Administration, National Ocean Service, Silver Spring, MD, 111 pp. https://oceanservice.noaa.gov/hazards/sealevelrise/noaa-nostechrpt01-global-regional-SLR-scenarios-US.pdf

U.S. Census Bureau. (2019). 2015-2019 American Community Survey 5-year. Accessed at https://data.census.gov/cedsci/.

U.S. Census Bureau. (2000). 2000 Decennial Census. Accessed at https://data.census.gov/cedsci/.

United States Department of the Interior (DOI). 2004. Department of the Interior Departmental Manual. Available at http://elips.doi.gov/app_dm/act_getfiles.cfm?relnum=3618 Last accessed: July 2006.

United States Fish & Wildlife Service. 2005. Threatened and Endangered Species Homepage [http://ecos.fws.gov/tess_public/TESSSpeciesReport]

U.S. Environmental Protection Agency (EPA). 2021. Outdoor Air Quality Data: 2021 Charleston County EPA Air Quality Statistics Report. Accessed May 2022, at https://www.epa.gov/outdoor-air-quality-data.

U.S. Environmental Protection Agency (EPA). n.d.. AirNow. Accessed May 2022, at https://www.airnow.gov/.

U.S. Geological Survey (USGS). 2022a. National Water Information System (Water Data for the Nation). Accessed May 2022, at https://waterdata.usgs.gov/nwis.

U.S. Geological Survey. 2022. National Water Information System (National water Dashboard). Accessed May 2022, at https://www.usgs.gov/tools/national-water-dashboard-nwd.

U.S. Geological Survey (USGS) Gap Analysis Project (GAP), 2022, Protected Areas Database of the United States (PAD-US) 3.0: U.S. Geological Survey data release, https://doi.org/10.5066/P9Q9LQ4B.

Waggonner & Ball and The Water Institute of the Gulf. 2019. Dutch Dialogues Charleston. Accessed at https://www.historiccharleston.org/dutch-dialogues/.

Watson, S., Knapp, L., and Gorstein, M. 2021. Town of Edisto Beach Flooding and Sea Level Rise Vulnerability Assessment. S.C. Sea Grant Consortium, Charleston, S.C.

Weather Service: U.S. Climate Data. n.d.. Climate – South Carolina. Retrieved May 2022, from https://www.usclimatedata.com/climate/

Additional Website Resources

https://statesummaries.ncics.org/chapter/sc/

https://sealevel.nasa.gov/task-force-scenario-tool

https://www.lung.org/research/sota/city-rankings/states/south-carolina/charleston

https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/

https://toolkit.climate.gov/tool/ocean-acidification-curriculum-connection

https://oceanacidification.noaa.gov/WorkingTogether.aspx#14914

https://www.socan.secoora.org/acidification

https://www.usclimatedata.com/climate/charleston-afb/south-carolina/united-states/ussc0052

https://sealevel.nasa.gov/flooding-days-projection/

https://sealevel.nasa.gov/

https://www.gfdl.noaa.gov/global-warming-and-hurricanes/

https://earthobservatory.nasa.gov/images/147761/rising-seas-in-charleston#:~:text=On%20average%2C%20Charleston%20saw%2010,amplified%20by%20sea%20level%20rise

https://travelnoire.com/developers-displacing-edisto-island

https://www.exploreedisto.com/blog/edisto-island-the-african-american-journey

https://fisheries.org/2015/07/the-gullahgeechee-fishing-association/

https://link.springer.com/article/10.1007/s10900-014-9871-5

https://link.springer.com/article/10.1007/s10745-021-00215-2