ENVIRONMENTAL ASSESSMENT

Federal Financial Assistance Grant Number: 43429
Creating a Resilient Delaware Bay Shoreline in Cape May and Cumberland Counties (NJ)

Prepared as Part of the
Hurricane Sandy Coastal Resiliency Competitive Grant Program

Prepared by:

U.S. Department of the Interior

In Partnership With

National Fish and Wildlife Foundation

and

The American Littoral Society

This Environmental Assessment becomes a Federal document when evaluated and signed by the responsible Federal Official.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF FIGURES

LIST OF TABLES

1.0 INTRODUCTION

The Hurricane Sandy Coastal Resiliency Competitive Grant Program (Program) supports projects that reduce communities' vulnerability to the growing risks from coastal storms, sea level rise, flooding, erosion, and associated threats through strengthening natural ecosystems that also benefit fish and wildlife. Funding for the Program is administered by the National Fish and Wildlife Foundation (NFWF) through the Department of the Interior (Department) Hurricane Sandy disaster relief appropriation (Disaster Relief Appropriations Act of 2013).

On June 16, 2014, the Department announced the award of 54 grants totaling $102.75 million. In addition, the grantees committed over $55 million in additional funding and in-kind contributions, for a total conservation investment of over $158 million. Grants were awarded to projects that assess, restore, enhance, or create wetlands, beaches, and other natural systems to help better protect communities and to mitigate the impacts of future storms and naturally occurring events on fish and wildlife species and habitats. Projects are located in the region affected by Hurricane Sandy: Connecticut, Delaware, the District of Columbia, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Virginia, and West Virginia. Each of these states officially declared a natural disaster as a result of the 2012 Hurricane Sandy storm event.

Upon completion of the projects, the Program will benefit more than 210 communities and engage over 4,800 youths, veterans, and volunteers. The Program will also result in more than 8,000 acres of wetlands and marshes restored or created, 220 acres of beach restored, and over 182 million gallons of stormwater runoff reduced to protect communities and infrastructure from future storms, as well as to benefit fish and wildlife.

The historical harvest and farming of salt hay (*Spartina patens*) in Delaware Bay has had a substantial impact on the ecology and morphology of the marsh. Salt hay farms were diked and the marsh transformed to lower elevations. The diking of the marsh also led to changes in the natural hydrology, and, as a consequence, changes in dominant plant and animal communities. Today, approximately 21.6 percent of formerly impounded marsh in Delaware Bay has not revegetated and has become open water or mudflat after impoundments were breached or dikes removed; in addition, adjacent marsh is rapidly eroding due to those changes in elevation (Appendix A). In comparison, only 0.5 percent of marsh that was never impounded has converted to open water since 1930.

Low-lying areas of Maurice River Township along the Maurice River and marshes of Delaware Bay are flooded during high-intensity rainfall events, coupled with high tides and high stormwater velocities. When Hurricane Sandy reached Maurice River Township in October of 2012, it created the sixth extreme high tide over the course of 2 years and resulted in widespread flooding, causing damage to homes, marinas, shipping channels, and fishing and oyster beds. In some areas, susceptible infrastructure was weakened, including roads, electric transmission lines, natural gas and telecommunications systems, and dikes, leading to increased vulnerability to future storm and tidal surge (Jacques Cousteau National Estuarine Research Reserve 2015). Maurice River Township's labor force spent approximately 400 hours to remedy issues resulting from the storm and dedicated approximately 300 hours to equipment operation. Approximately

670 cubic yards (cy) of fill was transported into the township to make permanent road repairs (New Jersey Department of Environmental Protection [NJDEP] 2015).

The DOI, as lead federal agency, and its Project partners,[1] the American Littoral Society (ALS) and the U.S. Fish and Wildlife Service (USFWS), are proposing the Creating a Resilient Delaware Bay Shoreline in Cape May and Cumberland Counties (NJ) Project (Project), Federal Financial Assistance Grant Number: 43429 (Figure 1-1). As the Project administrator, ALS is managing the Project activities.

The grant proposal (Appendix A) included potential restoration actions at the following six sites: Gandy's/Money Island Beach, Roadway Beach, East Point Lighthouse Beach, and Moores/Thompsons Beach (Cumberland County), and Reeds Beach/Pierces Point and South Reeds/Cooks/North Pierces Point Beaches (Cape May County). Also included in the original proposal was a plan to create shovel-ready designs for approximately 1,400 acres of marsh restoration at Egg Island and beach and marsh restoration at Cox Meadow.

After additional evaluation of areas along Delaware Bay, the sites and actions selected for restoration were changed to the following (Figure 1-2):

1. Dyers Cove Horseshoe Crab Habitat Restoration Project
2. Horseshoe Crab Habitat Restoration Project: Dyers Cove Reef
3. Horseshoe Crab Enhancement Project: Roadway Beach, Fortescue
4. Horseshoe Crab Habitat Restoration Project: Moores Beach Reef
5. Reeds Beach and Area Beach Restoration
6. Horseshoe Crab Habitat Restoration Project: Thompsons Beach Reef
7. Horseshoe Crab Habitat Restoration Project: Thompsons Beach
8. Thompsons Beach Marsh Restoration and Enhancement Project

In addition, a conceptual restoration plan for the mouth of the Maurice River would be developed as part of the grant Project, which would consist of an analysis of existing data to create a conceptual restoration plan that could eventually be implemented by ALS, Stockton University Coastal Research Center, and Niles & Associates in cooperation with county and local government and federal and state agencies. Development of the Cox Meadow and Egg Island conceptual restoration design plans was not selected to move forward as part of this grant project. Cumberland County and several townships in New Jersey began working with state and federal agencies several years ago on the concept of a dredge project for the Maurice River in-between the two previously proposed concept sites. The Maurice River conceptual plan would provide an opportunity for beneficial re-use and cost-effective restoration strategies with potential state and federal support. The plan would expand bay-wide marsh restoration planning to additional areas, to potentially include three other sites for a total of 3,500 acres, collectively. The goal of the conceptual plan is to create shovel-ready plans based on the marsh restoration experience developed through these projects for up to 3,500 acres.

[1] Other Project supporters include: Larry Niles & Associates, LLC; Conserve Wildlife Foundation; Partnership for the Delaware Estuary, Richard Stockton College; New Jersey Institute of Technology (NJIT); Rutgers University, Manomet Center for Conservation Sciences.

Environmental Assessments (EAs) for projects 1 through 7 were completed by USFWS, and restoration efforts in these areas have been completed.

This EA has been developed for proposed restoration and enhancement activities at the Thompsons Beach Marsh site (project 8 above) and the conceptual restoration plan for the Maurice River (Figure 1-3). This EA evaluates two alternatives to create more resilient marshes for inland protection against sea level rise and identify cost-effective and repeatable processes for future restoration projects in Delaware Bay: a No Action Alternative and one conceptual design Proposed Action Alternative (the Project). The EA analyzes the potential impacts these alternatives may have on the natural and human environment. Appendix A contains the Project grant proposal submitted to NFWF by ALS for the Program. This EA has been prepared in accordance with the requirements of the National Environmental Policy Act (NEPA) of 1969, the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 Code of Federal Regulations [CFR] 1500-1508), and DOI regulations (43 CFR Part 46), policy, and guidance.

Figure 1-1 General Vicinity Map

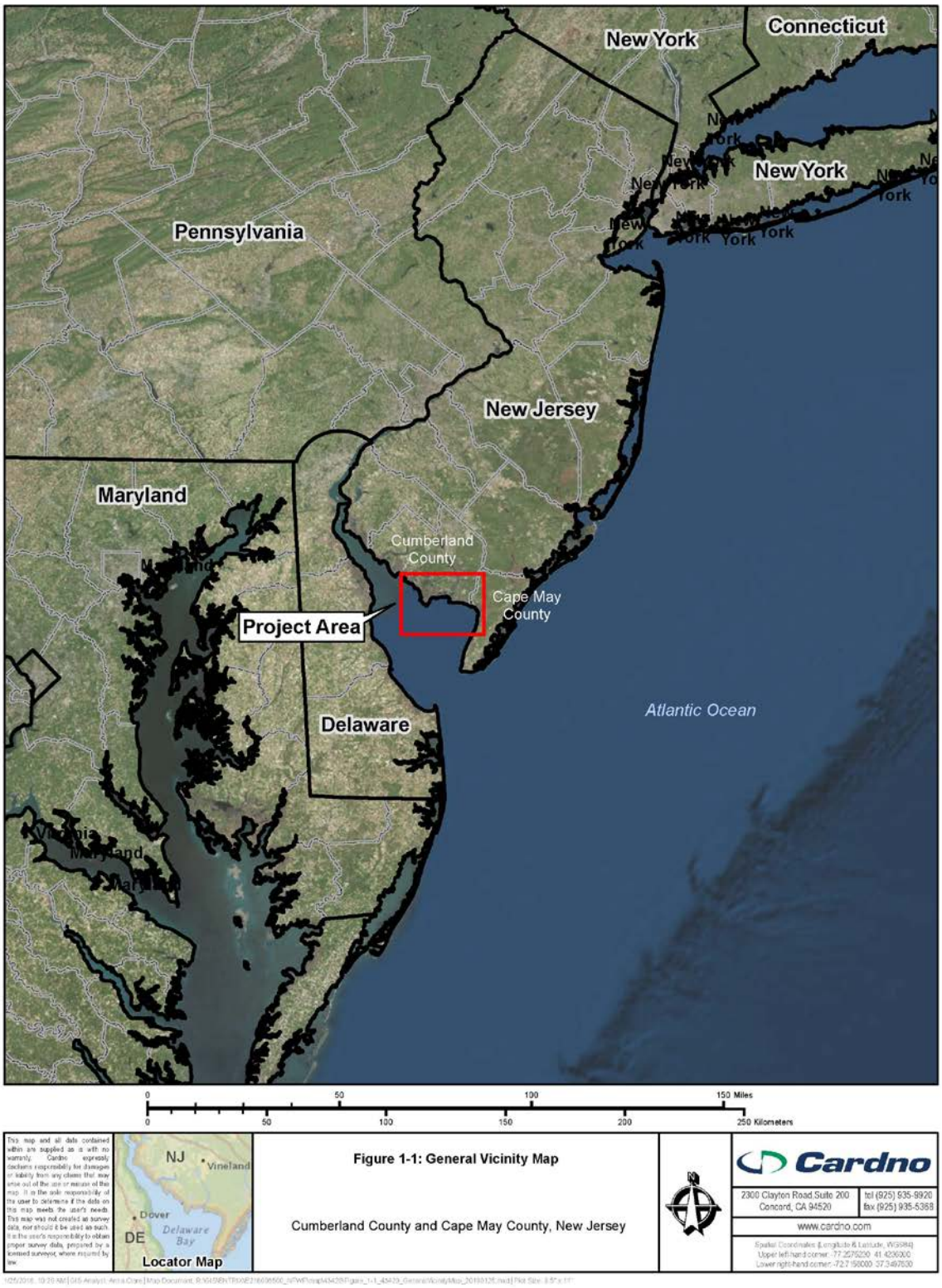
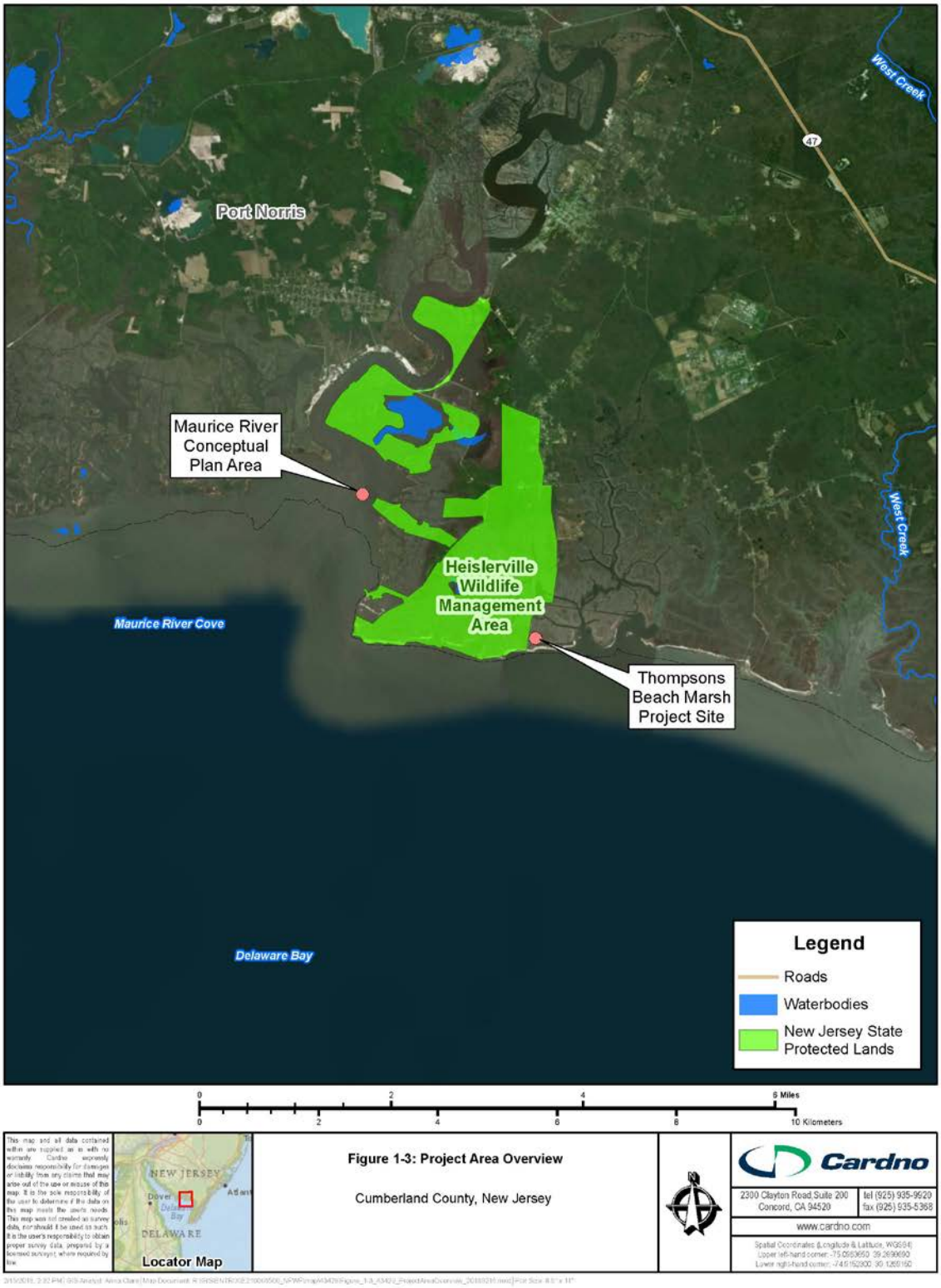


Figure 1-2 Sites Selected for Restoration Under Grant 43429

Figure 1-3 Project Area Overview



1.1 Purpose and Need

The purpose of the Program is to undertake a variety of actions to restore wetlands and other natural areas, better manage stormwater using green infrastructure, and assist states, tribes, and local communities in providing protection from major storms such as Hurricane Sandy. Overall, the Program goals relate to coastal resiliency and ecosystem enhancement. The Program provides funding for projects in five categories:

- **Project Planning and Design –** Projects that support the preparation of conceptual designs and engineering plans, and facilitate federal, state, and local permitting processes to position projects for successful implementation in the future.

- **Coastal Resiliency Assessments –** Projects that perform mapping, analysis, assessments, resiliency planning, and natural resource prioritizations that advance our knowledge of the effects of climate change, sea level rise, and storm events on coastal natural ecosystems and communities.

- **Restoration and Resiliency Projects –** Projects that restore, enhance, or create naturally functioning habitats or ecological systems for the benefit of communities and fish and wildlife species.

- **Green Infrastructure –** Projects that use green infrastructure techniques and approaches that provide multiple ecosystem benefits and help to provide community resiliency.

- **Community Coastal Resiliency Planning –** Projects that assist local governments and community organizations to integrate environmentally sound solutions into comprehensive planning and zoning and into capital programs for parks, schools, transportation, and community redevelopment.

The Program provides technical and financial assistance to identify, protect, conserve, manage, enhance, or restore habitat and infrastructure on both public and private lands that have been negatively impacted by Hurricane Sandy.

Over 10,000 acres of marsh located along Delaware Bay has been lost due to marsh diking and historical use for salt hay farming. The Project area (Figure 1-3) was previously diked and used for salt hay farming, which resulted in degraded habitat and marsh elevations, and sediment deficits. Marsh diking causes changes to natural hydrology and to dominant plant and animal communities. Approximately 22 percent of formerly impounded marshes in Delaware Bay have become open water or mudflats following impoundment breaches or dike removal. Degradation and loss of marshes in Delaware Bay have exacerbated the impacts of severe weather events, including Hurricane Sandy, which resulted in widespread flooding, causing damage to homes, marinas, shipping channels, fishing and oyster beds, and further loss of marsh areas.

Marshes are systems in the transition zone between terrestrial and marine communities. Salt marshes perform many key services for humans and wildlife—they absorb energy of ocean storms and protect shorelines; improve water quality in bays and estuaries; provide nutrients to marine food webs; supply important habitat for the reproduction of many ocean species; and

provide critical habitat for non-breeding use by migratory birds. Delaware Bay is an important area for migrating shorebirds, including the endangered red knot (*Calidris canutus rufa*), and for other bird species for staging, nesting, or breeding. Furthermore, the shoreline of eastern North America possesses the highest level of vertebrate biodiversity and endemism of any salt marsh region worldwide (Saltmarsh Habitat and Avian Research Program 2014).

The purpose of the Project is to create more resilient marshes for inland community and ecosystem protection from storm surges and sea level rise and identify cost-effective and repeatable processes for future restoration projects in Delaware Bay. It is important to identify cost-effective and repeatable processes for future restoration projects so other areas in Delaware Bay that have also been impacted by severe weather events such as Hurricane Sandy can be restored, resulting in more robust and resilient coastal areas to withstand future storm events. The Project is needed to restore fish and wildlife habitat in New Jersey to regain important natural resources lost as a result of environmental degradation.

2.0 ALTERNATIVES

An alternatives analysis was performed to determine the most feasible and prudent means of achieving the defined Project's purpose and need. The ability to create more resilient marshes for inland community and ecosystem protection against storm surges and sea level rise and identify cost-effective and repeatable processes for future restoration projects in Delaware Bay was evaluated under each alternative. Two alternatives were analyzed: a No Action Alternative and the Proposed Action, as described below.

2.1 No Action Alternative

Under the No Action Alternative, in addition to the salt marsh restoration not being undertaken, the associated benefits would not be realized; e.g., post-restoration monitoring, collection of information to support future restoration projects in Delaware Bay (e.g., successes, failures, and lessons learned), and planning for the mouth of the Maurice River. Under this alternative, there would be no elevation increase or improvement of salt marsh habitat, and no increased resiliency of coastal communities to sea level rise. For these reasons, the No Action Alternative would not meet the Program and Project's purpose and need to create more resilient marshes for inland community and ecosystem protection from storm surges and sea level rise and identify cost-effective and repeatable processes for future restoration projects in Delaware Bay.

2.2 Proposed Action Alternative

2.2.1 Overview

The Project area is located adjacent to Thompsons Beach within a 1,112-acre salt marsh at the northeast end of Delaware Bay, just over a mile east of the Maurice River (Figure 1-3). The area is located on lands owned by the Public Service Enterprise Group (PSEG) as well as lands within the Heislerville Wildlife Management Area owned by NJDEP's Division of Fish and Wildlife. This site has historically been diked and farmed for salt hay. Over time, as the salt hay operations ceased, the dikes fell into disrepair and the area became inundated from tidal flow. In the late 1990s, PSEG initiated a restoration project in the area, called the Estuary Enhancement Program, in which a functioning salt marsh was achieved where there had previously been low elevations and no remaining natural marsh hydrology. The project also dredged more than 7 miles of new tidal channels across the area to simulate natural marsh hydrology. These new channels allowed for increased sediment transport into the area, and now much of the former salt hay farm is a vegetated, functioning salt marsh. However, some areas remain inundated from tidal flow and lack vegetation.

The Proposed Action Alternative is to raise the existing salt marsh elevation on a 1.0-acre site within Thompsons Beach Marsh to a level that can support resilient salt marsh vegetation, and protect the surrounding community from future storm surge (Appendix B1[2]). The Proposed

[2] The acreage described for the Eastern marsh restoration area in the Project Description (Appendix B1) was reduced to 1 acre, though permits are for activities up to 3.75 acres. Also note that Appendix B1 includes activities described in the Project Description for a Southern marsh restoration area, which are no longer moving forward.

Action would build on the prior salt marsh restoration efforts aimed to help recover elevation and improve area resiliency to storms and sea level rise. The sediment and elevation deficits that were the legacy of salt hay farming until the 1920s have not been fully recovered across some of the area, which is now considered open space. The site is unlikely to fully recover its elevation and keep pace with sea level rise without the addition of sediment, further degrading species habitat and increasing potential risks to the area from future storm surges.

The site targeted for restoration at Thompsons Beach Marsh is the Eastern marsh restoration area, which is identified as a managed tidal wetland (Figure 2-1). The Proposed Action involves using dredge material from adjacent waterways for deposition in the restoration site. These tidal creeks (East Creek and West Creek) are located east and west of a public boat ramp on Thompsons Beach Road East, and were constructed as part of the Estuary Enhancement Program.

The Project would utilize a containment method to recover elevation deficits and prevent sediment loss during severe weather events. Containment is the placement of dredged sediment through hydraulic means (as a liquid mixture of sediment and water placed through a pipe) into an area bounded by coir logs. The coir logs would hold dredged sediment at the desired elevation, acting as a containment berm to prevent sediment loss and allowing the marsh platform to be built up where elevations are too low in the tidal range to support robust vegetation. This would result in the mudflats being converted into functioning *Spartina* low marsh. The target is to recover a fully vegetated low marsh platform comprising 80 percent *Spartina alterniflora*.

Figure 2-1 Thompsons Beach Marsh

2.2.2 Dredge and Placement Operations

Under the Proposed Action Alternative, the human-made East and West creek channels located immediately adjacent to the marsh restoration area would be dredged for the purpose of beneficial reuse for marsh restoration at Thompsons Beach Marsh. The Project would involve the use of low-impact machinery to place coir logs initially above mean higher high water for adequate containment and erosion resistance/control at the marsh restoration area. Upon completion of the containment berms, East and West creeks would then be hydraulically dredged and the sediment pumped through a dredge pipe to the containment area at the restoration site. Material would be aerially sprayed or pumped in as a slurry, stopping and adjusting as needed within each day's operation.

West Creek and East Creek each are 10-foot-wide channels that would be dredged to a maximum depth of −5.5 feet below mean low water. The U.S. Army Corps of Engineers (USACE) permit (Appendix C10) allows approximately 13,635 cy to be dredged from West Creek, and 6,657 cy from East Creek. However, it is estimated that only 2,930 cy of material would be needed for the Eastern marsh restoration area to reach the desired elevation from 0.7 feet to a maximum of 2.5 feet. Although the amount of material proposed to be dredged is greater than the amount needed for placement, dredging would stop once the desired amount of material is obtained for the Project.

Although the moisture content of the dredge sediment is relatively high (60 to 70 percent), the sediment would still need to be mixed with water for hydraulic transport. As a result of mixing with water and the mechanical disturbance associated with the operations, the volume of sediments required for placement is greater than the amount that is left on the restoration site after the process is complete. This increased volume is called a "bulking factor." Historically, the bulking factor was multiplied by the dredge volume to assist in determining the necessary amount of material to dredge and fill. However, because of the uncertainty introduced by bulking, dredging quantities for the Proposed Action would be determined by the difference between pre- and post-dredge surveys rather than relying on bulking estimates. Since the goal would not be to fully compact or dewater the sediment, but rather to mimic existing adjacent marsh conditions, only the volume of sediment needed to achieve the target elevation range would be placed within the containment. This would involve placement and daily dewatering of small volumes of approximately 500 cy of sediment per day, during daytime only. Dewatering is expected to occur each day for the small daily volumes of material being placed.

Following the completion of dredging and placement activities, the area would be evaluated for sediment consolidation and the containment berms would be adjusted as needed to an elevation near or below mean higher high water to ensure tidal exchange to the area. Over three growing seasons, the area is expected to revegetate to its previous condition prior to the salt hay farming operations.

Vehicles would be used on adjacent roads and creek/mudflats, avoiding vegetated salt marsh areas. One piece of heavy equipment would be used on the salt marsh surface, a low-pressure amphibious floating excavator with 4-foot-wide tracks. The excavator would primarily operate within the footprint of the dredged material placement area.

2.2.3 Eastern Marsh Restoration Area Project Activities

The Eastern marsh restoration area consists of 1 acre of vegetative cover and mudflat with an average elevation of 0.7 feet, which is flooded at high tides. Its low elevation and frequent flooding have resulted in ice scour during the winter, which removes aboveground vegetation. Restoration at this site would improve the existing mudflat and raise it to an elevation that could support low marsh habitat. Coir mats would be used at the site as a foundation with 24-inch cribbed coir logs to contain sediments and runoff during dewatering and to maximize elevation. Secondary/backup containment would be achieved through the use of a parallel 12-inch-diameter log. A pre-implementation survey of the Project area would be conducted to determine the best placement around the perimeter of the area for coir logs. Coir logs would be left in place to biodegrade after Project activities are complete. Improvement of marsh elevation is expected to result in natural recovery of the vegetation at this location.

The source of material for the Eastern marsh restoration area would be East Creek. Upper West Creek may be used in the Eastern marsh restoration area if necessary. Approximately 2,930 cy of dredged material would be placed at the Eastern marsh restoration area raising the marsh plain to a target elevation range of 1.75 to 2.5 feet. Dredging would be initiated at the south end of the creek where water is present in the creek even at low tide, cutting north into the creek and allowing tidal flow to follow. Dredging would be performed using 6-inch-diameter polyethylene pipe that would convey the dredged material to the Eastern marsh restoration area along the creek, up the boat ramp, and down the side of the closed access road. Use of the closed access road would be the preferred route for dredged material as it would minimize impacts to the marsh; however, a secondary route across the marsh is included on the Project plans to allow for contingencies.

A low-pressure amphibious floating excavator would be used to move coir logs and floating dredge pipe as needed. Work would be conducted during daylight hours, and dredging and material placement within the containment area would not be conducted 1 hour before, during, or 1 hour after high tide (dependent on tide level). Any potential damage that occurs within the placement zone by installation of coir logs would be restored after placement.

Following the natural dewatering of the area and sediment consolidation, the coir logs may need to be lowered to an elevation near or below mean higher high water to ensure tidal exchange to the area to promote the revegetation by desirable species. This would ensure that the containment area does not retain water or create mosquito breeding habitat.

It is expected that natural revegetation would reestablish at the Eastern marsh restoration area after three growing seasons. However, seeding and planting of native vegetation may be necessary in the event that monitoring reveals that natural revegetation is not progressing.

2.2.4 Monitoring

A draft Monitoring Framework and a draft Adaptive Management Plan have been developed for the Thompsons Beach Marsh site (Appendices B2 and B3, respectively). The NJDEP Division of Fish and Wildlife reviewed the plan and requested additional information on January 12, 2017, which ALS provided on January 23, 2017, and is incorporated herein (ALS 2017).

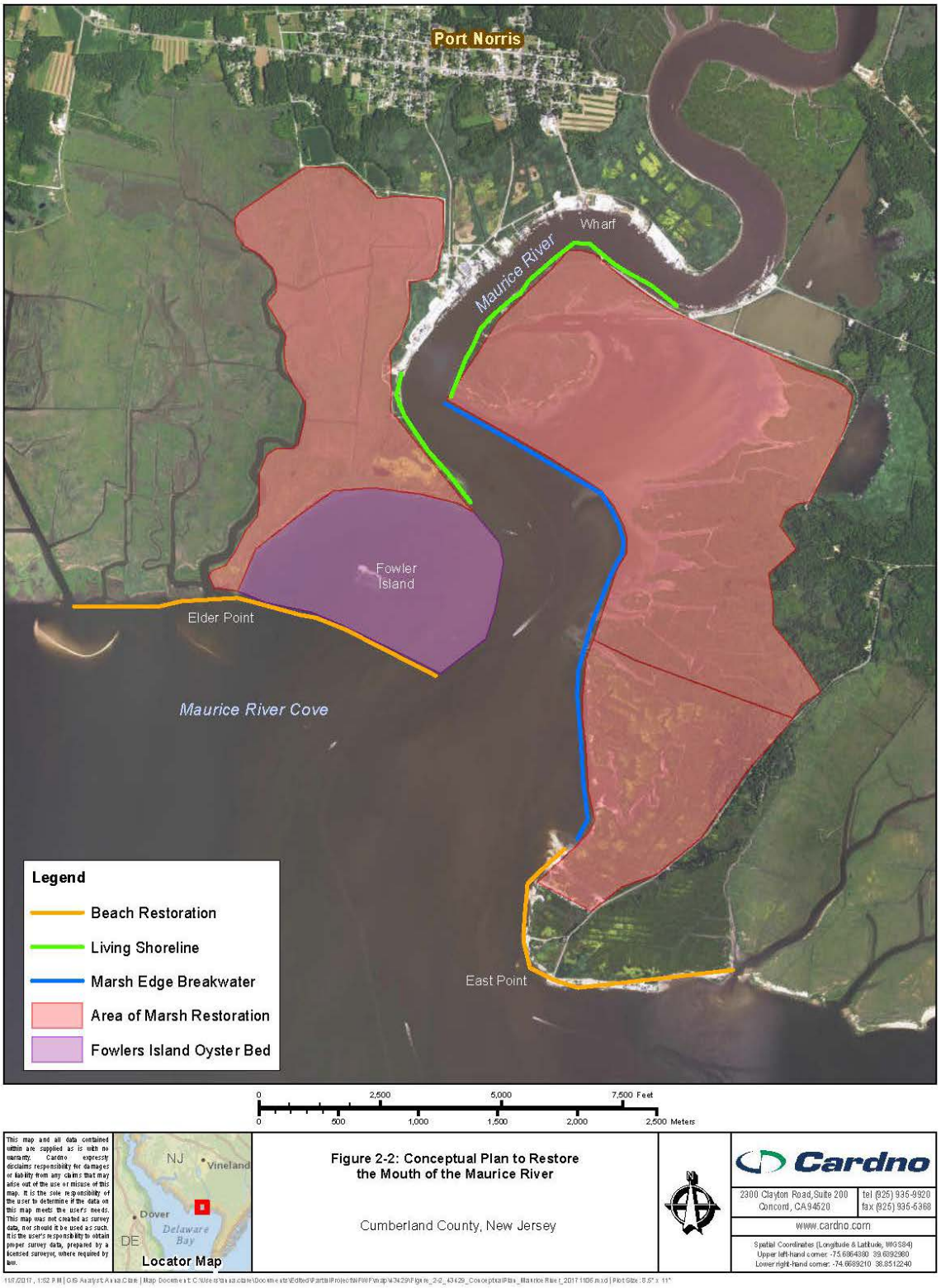
The draft Monitoring Framework (Appendix B2) and draft Adaptive Management Plan (Appendix B3) describe the proposed methodology and schedule for measuring elevation, bathymetry, vegetation, hydrology, and other factors that would be used to evaluate Project success and inform adaptive management decision-making in order to improve Project success. Post-restoration sediment surveys would be performed to determine if the method of containment succeeded in recovered elevations and restored marsh. This monitoring would provide information about the scalability of the containment method and assist in the formulation of modified management practices during future Project iterations in order to restore some portion of the 10,000 acres of marsh along Delaware Bay in New Jersey lost as a result of past impoundment. Key metrics at the Eastern marsh restoration area are elevation and vegetation cover. The Proposed Action includes a target of 80 percent successful plant cover. If this target is not met within three growing seasons, reseeding and/or replanting would be performed. The USACE permit stipulates that within 60 days of the date of the permit, the permittee shall hold a meeting with NOAA NMFS, EPA and the USACE to discuss further development of the long term Monitoring and Adaptive Management Plan and outlines items that must be included at minimum. The final long term Monitoring and Adaptive Management Plan would be submitted to USACE for coordination with the National Marine Services and EPA for final review and written approval (Appendix C10).

2.2.5 Maurice River Conceptual Plan

In addition to the proposed restoration work at Thompsons Beach Marsh, a concept plan for the mouth of the Maurice River would be prepared. Low-lying areas of the Maurice River are typically flooded during severe weather events, as occurred during Hurricane Sandy, resulting in degraded shorelines and salt marshes at the mouth of the river. The goal would be to eventually restore the degraded shoreline and salt marsh at the mouth of the Maurice River, thereby increasing protection of nearby infrastructure and fishing ports. The conceptual design would propose restoration of approximately 1,830 acres of salt marsh and 2.1 miles of beach, as well as creation of 1.8 miles of living shoreline and 3.3 miles of marsh-edge breakwaters (Figure 2-2). Dredged silt would be used to return degraded salt marsh elevation to historical levels—between 1 to 3 feet higher than existing elevations—and dredged sand would be used to restore eroded beaches to historical elevations. Prior to completion of conceptual engineering design, a desktop assessment determining dredge material availability, fill requirements, and cost would be completed. Living shoreline and marsh-edge breakwaters would be created to enclose the restored salt marshes, provide protection against storm-force waves, and reduce shoreline erosion. The locations for rebuilding historical oyster reefs and creating ribbed mussel beds along the living shoreline would be determined based on tidal data and wave attenuation. The conceptual plan would include a wave attenuation and existing coastal geomorphological study to support engineering design.

It is important to note that this EA addresses development of the conceptual plan to restore the Maurice River. It does not include analyses of specific impacts of actions included in the plan, which would be assessed under a separate environmental review if the plan activities move forward into project implementation.

Figure 2-2 Conceptual Plan to Restore the Mouth of the Maurice River



2.2.6 Proposed Action Summary

The containment method would be employed for the proposed Project to recover elevation deficits by converting mudflats to vegetated salt marsh. Additionally, the Project area would be monitored for revegetation success. Information compiled from revegetation monitoring would be used to:

- Develop and test cost-effective restoration methods for offsetting marsh elevation deficits resulting from prior marsh impoundments in Delaware Bay;
- Compare results of containment method and revegetation with other restoration sites implementing similar restoration strategies in New Jersey;
- Use information to better apply adaptive management strategies (if needed);
- Apply lessons learned on a regional basis; and
- Set the stage for large-scale restoration in the region by developing, testing, and evaluating methodology and establishing a baseline for future project cost estimates.

In addition, the Maurice River conceptual plan would be reviewed and considered for potential future restoration in the area.

The Proposed Action meets the Project's purpose and need as it would create more resilient marshes for inland protection from storm surge and sea level rise and would identify cost-effective and repeatable processes for future restoration projects in Delaware Bay. The Proposed Action is the preferred alternative for this EA.

3.0 AFFECTED ENVIRONMENT

3.1 Introduction – Scope of Resources Evaluated

The environmental resources identified and analyzed in this document are listed below along with reasons for their inclusion in this EA. The evaluation of environmental effects resulting from implementation of the Proposed Action to these resources for each alternative is described in Section 4. Impacts from implementation of the Maurice River conceptual plan would be assessed under a separate environmental review if the plan activities move forward. Descriptions of existing resource conditions are provided below.

3.2 Soils, Sediment, and Topography

The Project area is located adjacent to Thompsons Beach within a 1,112-acre salt marsh at the northeast end of Delaware Bay, just over a mile east of the Maurice River. This area has historically been diked and farmed for salt hay. As the salt hay operations ceased, the dikes fell into disrepair and the area became inundated from tidal flow. In the late 1990s, the Estuary Enhancement Program restored the salt marsh where there had previously been low elevations and no remaining natural marsh hydrology. The project also dredged more than 7 miles of new tidal channels (including East and West creeks) across the area to increase sediment transport into the area. Now, much of the former salt hay farm is a vegetated, functioning salt marsh. However, elevations at the Eastern marsh restoration area are far below normal and some areas remain inundated from tidal flow and lack vegetation.

The area at the mouth of the Maurice River has suffered the effects of extensive erosion in recent decades and has lost meanders and acres of salt marsh. Hurricane Sandy exacerbated shoreline erosion and deterioration at the mouth of the Maurice River and Delaware Bay. The Maurice River and its tributaries have high turbidity levels with suspended sediment and detritus present. On September 20, 21, and 22, 2016, the Stockton University Coastal Research Center collected sediment samples from the proposed dredging and restoration locations at the Thompsons Beach Marsh site to analyze the grain size, percent moisture, and total organic content. All samples taken in the East and West creeks and the Eastern marsh restoration area contain gray to black organic silt, which is consistent with low-energy creeks, marshes, and mudflats (Appendix E). The East and West creek sediments were determined to be heterogeneous, with variable texture along the length of the creek channels. Upper reaches had finer sediments (less than 10 percent sand) and were mostly silt, while fine sand percentage increased to 30 to 60 percent toward the lower reaches.

All samples from the Eastern marsh restoration area were less than 2 percent sand and had the highest level of degradation, as evidenced by soft and unconsolidated substrates compared to the surrounding marsh. Composite samples located closer to the road contained higher percentages of sand than those taken nearer the creeks. The results of sampling indicated similar chemical and physical properties of the creek sediment to existing sediments in the adjacent Eastern marsh placement site. Polycyclic aromatic hydrocarbons (PAHs) and pesticides were not detected in any of the creek or marsh sediment samples.

3.3 Water Resources and Wetlands

3.3.1 Flood Zones

The Federal Emergency Management Agency (FEMA) defines floodplains as any land area susceptible to being inundated by floodwaters from any source. Flood zones, a commonly used term in floodplain management, are geographic areas defined by FEMA, reflecting the severity or type of flooding in the area. Special Flood Hazard Areas (SFHAs) refer to flood zones with a 1 percent or greater chance of flooding in any given year and are further differentiated by zones (FEMA 2016a). The Project area is designated as SFHA Zone AE with base flood elevations of 9 and 10 feet (FEMA 2016b).

Executive Order (EO) 11988, *Floodplain Management* (1977), states that when considering the potential impacts of federal actions on flooding, the geographic extent of a floodplain should be established based on the type of action and whether or not the action is critical (i.e., an activity for which even a slight chance of flooding would be too great).

The Project area is located within an SFHA but the proposed Project is not considered a critical action; therefore, any increases to the extent of the floodplain would not affect the Project's flood zone designation.

3.3.2 Surface Water and Hydrology

As a result of the legacy salt hay operations, the natural creek hydrology of the Project area was highly modified and replaced by a grid of farm ditches. When salt hay operations ceased, the dikes fell into disrepair and the area became inundated with tidal flow due to its lowered elevation. No natural salt marsh creek hydrology remained in the area to help sediment move and accrete back into the marsh with the tides to rebuild elevation and revegetate.

The Estuary Enhancement Program initiated in the area in the late 1990s aimed to restore the hydrology of the bayfront salt hay farm, which had experienced dike breaching. The project dredged more than 7 miles of new tidal channels across the area, including the Project area, to simulate natural marsh hydrology, including the 10-foot-wide East and West creeks. The project resulted in a functioning salt marsh where there had previously been low elevations and no remaining natural marsh hydrology. However, some portions of the Eastern marsh restoration area remain inundated from tidal flow and lack vegetation or vegetation diversity.

The Proposed Action is subject to review by USACE under the Rivers and Harbors Act (33 U.S. Code [USC] 403) Section 10 and the Clean Water Act (CWA) (33 USC 1344) Section 404, which govern work or structures in navigable waters of the United States and/or the discharge of dredged or fill material into waters of the United States, including their adjacent wetlands. Additionally, CWA Section 401 requires states to certify that activities authorized by the federal government pursuant to Section 404 will not violate State Water Quality Standards. ALS applied for a permit for the Proposed Action from the USACE on July 25, 2017, and was issued a final permit on February 2, 2018. The USACE permit is included in Appendix C10.

3.3.3 Wetlands

The USFWS National Wetlands Inventory Mapper (USFWS 2017a) identifies two types of wetlands occurring in the Project area. The salt marsh restoration area is classified entirely as estuarine/marine wetlands, and the dredging areas in East and West creeks are classified as estuarine/marine deepwater wetlands.

Estuarine/marine wetlands consist of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land, have access to the open ocean (open, partly obstructed, or sporadic access), and receive freshwater runoff from land. The salinity in estuarine/marine wetlands can periodically increase above that of the ocean, due to evaporation. The substrate in these wetland habitats is irregularly flooded, meaning the tides flood the substrate less often than once a day. It is characterized by herbaceous hydrophytic vegetation (i.e., plants that are tolerant of periodic inundation or grow in water) usually dominated by perennial plants. This wetland type represents a partially drained/ditched wetland that has been altered hydrologically but has sufficient soil moisture to support hydrophytic vegetation (USFWS 2017b).

Estuarine/marine deepwater wetlands consist of deepwater tidal habitats and adjacent tidal wetlands that are usually semi-enclosed by land, have access to the open ocean (open, partly obstructed, or sporadic access), and receive freshwater runoff from land. The salinity in estuarine/marine deepwater wetlands can periodically increase above that of the ocean, due to evaporation. Substrate in these wetland habitats is continuously covered with tidal water; at least 25 percent of the bottom is covered by particles smaller than stones, with less than 30 percent vegetative cover (USFWS 2017b).

The salt marsh habitat at the restoration area is important for absorbing coastal storms and protecting shorelines, and for providing important habitat for wildlife. This area has been degraded over time by historical salt hay farming and subsequent sedimentation of waterways and flooding of landward areas. As a result, these current wetland marsh conditions are less resilient to sea level rise and storm surge.

3.4 Biological Resources and Vegetation

3.4.1 Common Flora

The 1,112-acre Thompsons Beach Marsh is covered predominantly by saltmarsh cordgrass (*Spartina alterniflora*) and 5 percent high marsh. Forty-three percent of the Eastern marsh restoration area is composed of *Spartina alterniflora* vegetative cover while the remaining area is considered a mudflat with no vegetation. Due to the historical use of the Project area for salt hay production, the marsh elevation is much lower than it should be under natural conditions.

3.4.2 Common Fauna

The extensive wetlands in the Delaware Bay, including Thompsons Beach Marsh, provide resting habitat and nesting sites for many species of migratory waterfowl, raptors, and wading birds. Delaware Bay is a Western Hemisphere Shorebird Reserve Network (WHSRN) Site of Hemispheric Importance for migrating shorebirds, including the endangered red knot. Sites of Hemispheric Importance are areas that act as staging, nesting, or breeding grounds for at least 30

percent of a given avian biogeographic population. The Project area is a major stopover for 80 percent of the Atlantic Flyway population of snow geese (*Chen caerulescens*). The northbound migration of shorebirds coincides with horseshoe crab (*Limulus polyphemus*) spawning in the bay (WHSRN 2017). Thompsons Beach Marsh is located behind Thompsons Beach where horseshoe crabs spawn, and their eggs provide a rich food source for shorebirds such as sanderlings (*Calidris alba*) and ruddy turnstones (*Arenaria interpres*). Shorebirds move between the beach and marsh for feeding, resting, and roosting.

Thompsons Beach Marsh supports many species of birds. Some species, such as seaside sparrow (*Ammodramus maritimus*) and clapper rail (*Rallus crepitans*), prefer areas of lower elevation with taller vegetation while others such as saltmarsh sparrow (*Ammodramus caudacutus*), black rail (*Laterallus jamaicensis*), and northern harrier (*Circus cyaneus*) prefer areas of higher elevation with shorter grasses. Currently, the salt marsh provides mostly areas of low elevation and tall grass (McNamara 2015). No colonial nesting bird rookeries (e.g., herons, egrets, ibis, terns, gulls, or skimmers) occur within the Project area (Appendix C2).

Opportunistic wildlife surveys were conducted by ALS in the Project area between 2014 and 2016, and the species observed were typical of salt marshes in the region (Appendix B1). Mammals observed in the Project area included mink (*Neovison vison*), muskrat (*Ondatra zibethicus*), marsh rice rat (*Oryzomys palustris*), meadow vole (*Microtus pennsylvanicus*), and northern river otter (*Lontra canadensis*). Diamondback terrapin (*Malaclemys terrapin*) were also abundant throughout the Project area. Invertebrates observed at the site included purple marsh crab (*Sesarma reticulatum*), fiddler crab (*Uca pugnax* and *Uca pugilator*), ribbed mussel (*Geukensia demissa*), salt marsh tiger beetle (*Ellipsoptera marginata*), Aaron's skipper (*Poanes aaroni*), salt marsh skipper (*Panoquina panoquin*), and seaside dragonlet (*Erythrodiplax berenice*).

In addition to the opportunistic wildlife surveys, investigators from the Saltmarsh Habitat and Avian Research Program (SHARP) conducted bird surveys in 2015 and 2016 (Appendix B1). The following bird species were observed using the salt marsh habitat within the Project area: American bittern (*Botaurus lentiginosus*), great blue heron (*Ardea herodias*), great egret (*Ardea alba*), snowy egret (*Egretta thula*), little blue heron (*E. caerulea*), tricolored heron (*E. tricolor*), black-crowned night heron (*Nycticorax nyticorax*), glossy ibis (*Plegadis falcinellus*), snow goose, American black duck (*Anas rubripes*), green-winged teal (*Anas carolinensis*), hooded merganser (*Lophodytes cucullatus*), osprey (*Pandion haliaetus*), bald eagle (*Haliaeetus leucocephalus*), northern harrier, clapper rail, Virginia rail (*Rallus limicola*), greater yellowlegs (*Tringa melanoleuca*), lesser yellowlegs (*Tringa flavipes*), eastern willet (*Tringa semipalmata*), semipalmated sandpiper (*Calidris pusilla*), least sandpiper (*Calidris minutilla*), short-billed dowitcher (*Limnodromus griseus*), common tern (*Sterna hirundo*), Forster's tern (*Sterna forsteri*), least tern (*Sternula antillarum*), black skimmer (*Rhychops niger*), short-eared owl (*Asio flammeus*), marsh wren (*Cistothorus palustris*), Nelson's sparrow (*Ammodramus nelsoni*), saltmarsh sparrow, seaside sparrow, eastern meadowlark (*Sturnella magna*), red-winged blackbird (*Agelaius phoeniceus*), and boat-tailed grackle (*Quiscalus major*) (Appendix B1).

The Delaware River is a main migratory pathway for anadromous fish in New Jersey. Anadromous species are those that migrate from the ocean up rivers to spawn. Anadromous fish

species known to occur within the Delaware River system near the Project area include blueback herring (*Alosa aestivalis*), alewife (*Alosa pseudoharengus*), striped bass (*Morone saxatalis*), Atlantic sturgeon (*Acipenser oxyrhynchus*), shortnose sturgeon (*Acipenser brevirostrum*), American eel (*Anguilla rostrate*), and American shad (*Alosa sapidissima*) (Appendix B1). Blueback herring and alewives are collectively referred to as river herring (Maine Department of Marine Resources 2017). Anadromous species are present seasonally in Delaware Bay and are temperature-dependent, with primary herring runs from March through late May. The tributaries near the Project area are not designated by NJDEP to support herring runs, and spawning habitat is not present within them. Both East and West creeks lack upstream connectivity to potential spawning habitat. However, juveniles, young-of-year, and adults may use the Delaware Bay shoreline open water to forage during spring migration and fall emigration (Appendix C3).

Many species of infaunal benthic invertebrates are common in the soft sediments of the Project area. Clams, oysters, snails, conchs, shrimps (*Palaemonetes pugio*, *Squilla empusa*), amphipods, polychaetes, flatworms, mussels such as Atlantic slipper shell (*Crepidula fornicate*) and Atlantic ribbed mussel, and crustaceans such as fiddler crabs, hermit crabs (*Pagurus* spp.), black-fingered mud crab (*Panopeus herbstii*), and marsh crabs are abundant and crucial to healthy ecosystems (Chesapeake Bay Program 2017).

Because the Project area is within the Heislerville Wildlife Management Area, an application was submitted to the NJDEP Division of Fish and Wildlife, Bureau of Land Management for a Special Use Permit to access to the Project site (Appendix C5). The permit will be issued in the spring of 2018.

3.4.3 Special-Status Species

3.4.3.1 Federally Listed Species

Endangered Species Act

Special-status species include those federally listed as threatened or endangered, or considered candidate species, by the USFWS or the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS) under the Endangered Species Act (ESA). Special-status species also include species protected under the Migratory Bird Treaty Act (MBTA), Bald and Golden Eagle Protection Act, and those species listed as threatened or endangered by the NJDEP.

A species list was generated on October 9, 2017, using the USFWS online Information for Planning and Consultation (IPaC) system (Appendix D). Six federally listed threatened or endangered species may occur within the Project area: red knot, northern long-eared bat (*Myotis septentrionalis*), American chaffseed (*Schwalbea americana*), Knieskern's beaked-rush (*Rhynchospora knieskernii*), sensitive joint-vetch (*Aeschynomene virginica*), and swamp pink (*Helonias bullata*). No critical habitat for any federally listed species was identified in the Project area (Appendix D).

- **Northern Long-eared Bat (Threatened).** Northern long-eared bat is a medium-size bat with a wingspan of 10 inches, distinguished from other species by its long ears. This

species occurs across much of the eastern and north-central United States and all Canadian provinces from the Atlantic coast west to the southern Northwest Territories and eastern British Columbia. The northern long-eared bat range includes 37 states and over 20 New Jersey counties, including Cumberland County. A serious threat to the species is white-nose syndrome, which is a fungal disease known to affect hibernation sites throughout the Northeast (where species declines are 99 percent at many sites) (USFWS 2016a). Northern long-eared bat occurs throughout the state. However, there is no suitable habitat for northern long-eared bat within the Project area (Appendix C4).

- **Red Knot (Threatened).** Red knot habitat includes tidal flats, shores, and tundra in summer. They migrate long distances between nesting areas in arctic latitudes and southern nonbreeding habitats located from the coastal United States (low numbers) to southern South America. Red knots forage along the beaches of Delaware Bay during the spring and have strong fidelity to migration stopover sites (Cornell University 2015; NatureServe 2015; USFWS 2016b). Large flocks of red knot depend on the Delaware Bay and New Jersey's Atlantic coast as a stopover during spring migration, which occurs in the area from May 1 to June 15. Spring migration coincides with the spawning season of horseshoe crab, which provide an important food source for migrating red knots. Red knots occur along the entire length of Delaware Bay in Cumberland County and could be present within the Project area during migration (Appendix C4).

- **American Chaffseed (Endangered).** American chaffseed is found in open pine flatwoods, savannas, and other open areas in moist to dry acidic sandy loams or sandy peat loams (USFWS 1995a). The Project area does not provide appropriate habitat for American chaffseed.

- **Knieskern's Beaked-rush (Threatened).** Knieskern's beaked-rush is found on wet bogs-iron substrates (USFWS 1993). The Project area does not provide appropriate habitat for Knieskern's beaked-rush.

- **Sensitive Joint-vetch (Threatened).** Sensitive joint-vetch typically occurs in fresh or slightly brackish tidal river systems (USFWS 1995b). It is known to occur in the Manumuskin River, a tributary of the Maurice River. The Project area does not provide habitat of the appropriate salinity to support sensitive joint-vetch.

- **Swamp Pink (Threatened).** Swamp pink is an obligate wetland species occurring along streams and seepage areas in freshwater swamps and other wetland habitats (USFWS 1991). The Project area does not provide habitat of the appropriate salinity to support swamp pink.

Consultation with USFWS regarding species listed under the ESA occurred during the USACE permit process (Appendices C4 and C10), as discussed Section 4 of the EA.

Threatened or endangered marine species managed by NMFS that could inhabit Delaware Bay (e.g., shortnose or Atlantic sturgeon, marine sea turtles) would not occur in the salt marsh environment where the Proposed Action would take place (Appendix C6).

Essential Fish Habitat

NMFS designates "essential fish habitat" (EFH) to protect and conserve the habitats of marine, estuarine, and anadromous finfish, mollusks, and crustaceans. EFH is broadly defined to include "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." NMFS lists EFH and fisheries resources in the Project area for the following species: bluefin tuna (*Thunnus thynnus*), smooth dogfish (*Mustelus canis*), sandbar shark (*Carcharhinus plumbeus*), clearnose skate (*Raja eglanteria*), winter skate (*Leucoraja ocellata*), little skate (*Leucoraja erinacea*), windowpane flounder (*Scophthalmus aquosus*), winter flounder (*Pseudopleuronectes americanus*), red hake (*Urophycis chuss*), black sea bass (*Centropristis striata*), longfin inshore squid (*Doryteuthis pealeii*), bluefish (*Pomotomus saltatrix*), Atlantic butterfish (*Peprilus triacanthus*), Atlantic herring (*Clupea harengus*), scup (*Stenotomus chrysops*), and summer flounder (*Paralichthys dentatus*) (Appendix C6).

Additional EFH species were identified using the NOAA *Guide to Essential Fish Habitat Designations in the Northeastern United States* (NOAA 2012). These include king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), sand tiger shark (*Carcharias taurus*), and dusky shark (*Carcharhinus obscurus*) (Appendix C3). Species with EFH designated within the Project area have the potential to transit or forage within or near the proposed dredge sites, although many species are unlikely to use the human-made channels within the salt marsh habitat due to depth and temperature restrictions.

There are no recent fish data for the Project area within the marsh or within East or West creeks; however, many of these species have been confirmed in the inshore waters of Delaware Bay near the Project area during finfish trawl surveys conducted by NJDEP Division of Fish and Wildlife from 1991 to 2008 (Appendix C3). The available habitat within the dredge sites is predominantly silt, and depths range from 0 to 4 feet, depending on tidal conditions. Based on the life histories and descriptions of the EFH species listed above, the dredging sites and marsh could provide habitat for a subset of these species as described in Appendix C3.

Habitat Areas of Particular Concern (HAPC) are a subset of EFH and represent habitat types or geographic areas identified as priorities for habitat conservation, management, and research. These areas play important roles in the life history of managed species and/or are especially vulnerable to degradation from human activities. The HAPC designation does not confer specific habitat protections, but can focus habitat conservation efforts (Mid-Atlantic Fishery Management Council 2016). A HAPC is designated for sandbar shark immediately offshore of the Project area, but does not extend into the channels proposed for dredging (Appendix C6).

Consultation with NMFS regarding EFH occurred during the USACE permit process (Appendices C10 and C11), as discussed in Section 4 of the EA.

Migratory Bird Treaty Act

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) (40 Stat 755 as amended; 16 USC 703-712). The MBTA is a federal law making it unlawful to pursue, hunt, take, capture, kill, or sell birds listed therein. The MBTA does not discriminate between live or dead birds and offers full protection to any bird parts, including feathers, eggs, and nests. The

MBTA provides protections for all species native to the United States or its territories, which are those that occur as a result of natural biological or ecological processes. Nonnative species are not protected under the MBTA (USFWS 2015c). Migratory birds may use the Project area for breeding or overwintering, during migration, or may be present year-round.

Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act (16 USC 668-668c) prohibits take of bald and golden eagles, including their parts, nests, or eggs. The act provides criminal penalties for persons who "take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald or golden eagle, alive or dead, or any part, nest, or egg thereof." The act defines "take" as "pursue, shoot, shoot at, poison, wound, fill, capture, trap, collect, molest or disturb." Projects can be considered to disturb eagles if they agitate the birds to the extent that the eagle is injured, exhibits a decrease in normal productivity, or abandons its nest due to the project interfering with normal breeding, feeding, or sheltering behaviors. The definition also covers impacts that result from human-induced alterations initiated around a previously used nest site while eagles are not present (USFWS 2016c). Bald eagles were observed in the Project area by investigators from SHARP during bird surveys conducted in 2015 and 2016; however, no bald eagle nests are present at or near the Project area.

Fish and Wildlife Conservation Act

The 1988 amendment to the Fish and Wildlife Conservation Act mandates that the USFWS "identify species, subspecies, and populations of all migratory nongame birds that, without additional conservation actions, are likely to become candidates for listing under the ESA of 1973." These species are designated as Birds of Conservation Concern and include nongame birds; gamebirds without hunting seasons; and ESA candidate, proposed, or recently delisted species (USFWS 2017c).

USFWS Birds of Conservation Concern that may be present in the Project area include American oystercatcher (*Haematopus palliates*), Audubon's shearwater (*Puffinus iherminieri*), black-billed cuckoo (*Coccyzus erythropthalmus*), buff-breasted sandpipe (*Tryngites subruficollis*), black rail, black skimmer, bobolink (*Dolichonyx orysivorus*), Canada warbler (*Wilsonia canadensis*), cerulean warbler (*Dendroica cerulean*), clapper rail, dunlin (*Calidris alpine arcticola*), evening grosbeak (*Coccothraustes vespertinus*), eastern whip-poor-will (*Caprimulgus vociferous*), gull-billed tern (*Gelochelidon nilotica*), golden-winged warbler (*Vermivora chrysoperta*), Hudsonian godwit (*Limosa haemastica*), Kentucky warbler (*Oporornis formosus*), king rail (*Rallus elegans*), long-eared owl (*Asio otus*), least tern, lesser yellowlegs, Nelson's sparrow, prairie warbler (*Dendroica discolor*), prothonotary warbler (*Protonotaria citrea*), purple sandpiper (*Calidris maritima*), red-headed woodpecker (*Melanerpes erythrocephalus*), red-throated loon (*Gavia stellate*), rusty blackbird (*Euphagus carolinus*), saltmarsh sparrow, seaside sparrow, whimbrel (*Numenius phaeopus*), and wood thrush (*Hylocichla mustelina*) (Appendix D).

3.4.3.2 State-Listed Species

State-listed endangered species are defined as those species whose prospects for survival in New Jersey are in immediate danger due to loss or change of habitat, overexploitation, predation,

competition, disease, disturbance, or contamination. State-listed threatened species are defined as those that may become endangered if adverse conditions begin or continue to deteriorate.

The NJDEP Natural Heritage Program's Landscape Project 3.1 Species Based Patches provides data on rare wildlife species or habitat that may be located in the Project area. The following state-listed species could occur within the Project area: black-crowned night heron (threatened), red knot (endangered), sanderling (special concern), semipalmated sandpiper (special concern), least tern (endangered), bald eagle (endangered), black rail (endangered), northern harrier (endangered), and osprey (threatened). The previously described wildlife surveys have confirmed the presence of all of these species with the exception of black rail. Black rail were known to nest at the Project area when it was a salt hay farm, but have not been confirmed there recently. Two osprey nests have been observed within 1,000 feet of the proposed dredging locations.

Consultation with NJDEP regarding special-status species in the state of New Jersey occurred during application for the Coastal General Permit 24 (approved September 13, 2017) (Appendices C1 and C7). Special conditions imposed on the proposed Project are described in Section 4 of the EA.

3.5 Human Health and Safety

Salt marshes serve as a buffer for coastal communities during storm surges and floods. Ecosystem functions of salt marshes include increased buffering capacity against storm and flood damage and improved water quality. The existing salt marsh within the Project area has experienced elevation and sediment deficits due to previous decades of use as a salt hay farm, and the area is currently vulnerable to sea level rise and flooding. Sediment samples collected from the two proposed dredging locations and the area proposed for restoration were analyzed for the presence of contaminants. Results indicated the areas had no detected concentrations of any potential contaminant of concern (Appendix E). Consequently, NJDEP determined that the dredged material was suitable for the work proposed at the restoration area.

High-intensity rainfall events, coupled with high tides and high stormwater velocities, result in flooding in low-lying areas of Maurice River Township along the Maurice River and marshes of Delaware Bay. Frequent flooding restricts access to homes in the area, causes economic losses to businesses, and results in extensive property and roadway damage. When Hurricane Sandy reached Maurice River Township, it was the sixth extreme high tide over the course of 2 years. The flooding was widespread, causing damage to homes, marinas, shipping channels, and fishing and oyster beds. In some areas, Sandy weakened susceptible infrastructure, such as roads, electric transmission lines, natural gas and telecommunications systems, and dikes, leading to increased vulnerability to future storm and tidal surge (Jacques Cousteau National Estuarine Research Reserve 2015). Low-lying areas remain vulnerable and can severely restrict roadway travel within the township and the region (Maurice River Township 2015).

After initial damages to property, a 2015 study funded by the New Jersey Department of Health found that residents continued to be affected by Hurricane Sandy in the form of unfinished repairs, disputed claims, and recurrent mold, which are associated with mental health distress, post-traumatic stress disorder (PTSD), and depression (New Jersey Environmental Justice

Alliance 2017). Mold was associated with both asthma and with mental health distress. For New Jersey residents whose homes were damaged by Hurricane Sandy, 27 percent experienced moderate or severe mental health distress and 14 percent report the signs and symptoms of PTSD even 2.5 years after the storm, and children in hurricane-damaged homes are at higher risk for mental health problems than children whose homes suffered no damage (New Jersey Environmental Justice Alliance 2017).

3.6 Cultural Resources

Projects receiving federal funding and permitting are required to undergo a review for compliance with Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (36 CFR 800). Section 106 of the NHPA outlines the process in which federal agencies are required to determine the effects of their undertakings on historic properties. The term "historic property" refers to cultural resources that have been determined eligible for listing, or are listed, in the National Register of Historic Places (NRHP). Historic properties may include archaeological sites, historic resources, or properties of traditional cultural or religious importance to tribes. Effects to historic properties could occur if there is an alteration to the characteristics of a property that qualify it for inclusion in the NRHP.

The grantee has consulted with the NJDEP Historic Preservation Office (HPO) on the Proposed Action. The HPO noted that there are no buildings, structures, sites, objects, or historic districts in the Project area that are listed in, or that have been identified as eligible for listing in, the New Jersey or National Registers of Historic Places (Appendix C9).

Although there are no federally recognized tribes in New Jersey, federally recognized tribes in neighboring states may have an interest in the Proposed Action. Consequently, tribal consultation under Section 106 of NHPA occurred during the USACE permit process (Appendix C10). The USACE issued a public notice on September 7, 2017, and no public comments in response to the notice regarding cultural resources have been received. The USACE emailed the Saint Regis Mohawk Tribe, Stockbridge-Munsee Community Band of Mohican Indians, Eastern Shawnee Tribe of Oklahoma, Seneca Nation of Indians, Oneida Indian Nation, Delaware Nation, and Delaware Tribe of Indians on January 24, 2018, requesting review and concurrence with the USACE determination of no historic properties affected by the Proposed Action (Appendix C12). To date, two tribes have responded. The Stockbridge-Munsee Community Band of Mohican Indians indicated no interest in the Project area on January 24, 2018, and the Seneca Nation of Indians indicated they have no issues with the proposed Project on January 24, 2018 (Appendices C13 and C14).

3.7 Socioeconomics, Environmental Justice, and Protection of Children

The communities along the Delaware Bayshore are economically dependent upon Delaware Bay for commercial fishing and shellfish operations. The local economy in Maurice River Township includes water-based activities including boating, fishing, and crabbing, and ecotourism. Ecotourism is promoted in the area with birding and wildlife viewing opportunities in Heislerville Wildlife Management Area (Maurice River Township 2017).

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, requires federal agencies to examine proposed actions to determine whether they would have disproportionately high and adverse human health or environmental effects on minority or low-income populations. EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, seeks to protect children from disproportionately incurring environmental health risks or safety risks that might arise as a result of federal policies, programs, activities, and standards. Environmental health risks and safety risks include risks to health and safety attributable to products or substances that a child is likely to come in contact with or ingest. For a project to affect environmental justice (EJ) populations or children, significant adverse environmental impacts must fall disproportionately upon EJ populations or children within the affected area.

The population of Maurice River Township was recorded at 7,649 in the 2010 census and 2010 American Community Survey (New Jersey Department of Labor and Workforce Development 2012; U.S. Census Bureau 2017). These data show that 9.7 percent of the population lives below the poverty level, the median household income is $69,419, and the median family income is $78,713 (compared to Cumberland County as a whole, with 12.8 percent living below the poverty level, a median household income of $50,651, and a median family income of $60,642). With regard to race, 58 percent of the township's population identifies as White; 36 percent as Black or African American; and 12 percent as Hispanic or Latino, which results in a minority population of approximately 48 percent (compared to Cumberland County with 37 percent). EJ communities are defined as areas where the percentage of minorities is above or the median family income is below that of a comparable geographic area. Based on data from the 2010 census and survey, Maurice River Township had a minority population above that of Cumberland County, which means that Maurice River Township is identified as an EJ community based on race. Approximately 10 percent of the township's population is under the age of 18 and the nearest residential community is over 1.5 miles from the Project area (New Jersey Department of Labor and Workforce Development 2012).

3.8 Land Use, Recreation, and Coastal Zone Management

3.8.1 Land Use and Recreation

The Project area is located within Cumberland County, New Jersey. Cumberland County has the lowest density of urban development in New Jersey. Only 12 percent of county land is urban/developed, with 22 percent used for agriculture and 38 percent preserved or protected. The largest industry in the county is agriculture. Approximately 38 percent of Cumberland County, or 123,181 acres, is preserved, including farmland and tidal wetlands (Cumberland County Planning Board 2011). These areas are generally not suitable for most recreation activities. However, where accessible, these areas are appropriate for passive recreation such as hiking, fishing, and bird watching. There are no preserved farmland areas or target farms located in the vicinity of the Project area. The Project area is located within parks and open space, identified as tidal wetlands by the Cumberland County Open Space and Recreation Master Plan (Cumberland County Planning Board 2011).

The Project area is located on lands owned by PSEG as well as lands within the Heislerville Wildlife Management Area, which is owned by NJDEP's Division of Fish and Wildlife. A Deed

of Conservation Restriction conveyed to the State of New Jersey ensures that these lands will be preserved in perpetuity. The Heislerville Wildlife Management Area currently protects 7,231 acres of Delaware Bay shoreline, wetlands and uplands—including some of the most important beaches used by migrating shorebirds such as red knots, which fuel up on horseshoe crab eggs as they fly to breeding grounds as far north as the Canadian Arctic (NJDEP 2017a). Recreational opportunities available in Heislerville Wildlife Management Area include bird and wildlife watching, biking, boating, and fishing (New Jersey Audubon 2010).

The closest town to the Project area is Heislerville, an unincorporated community in Maurice River Township, which is located 1.5 miles north of the Project area. A small community was previously located at Thompsons Beach, which is adjacent to the project area, along Delaware Bay. There were once hundreds of buildings along the beach, primarily vacation homes, but also businesses and primary residences. A hurricane devastated much of the community in 1950 and erosion steadily wore away at what buildings were left until only 14 structures remained. In the mid-1990s, PSEG provided Maurice River Township with funds to repair the only access road to the community as it was continuously being overtopped and blocked by high tides and water from storm surge. Ultimately PSEG used these funds to buy out the remaining property owners as the township eventually ceased maintenance on the access road. In 1997, the remaining structures were condemned, demolished, and the land was converted to open space (Press of Atlantic City 2013).

As stated previously, the Project area was diked and used for salt hay farming, which has resulted in degraded habitat and marsh elevations, and sediment deficits. Once salt hay operations ceased in the 1920s (Sebold and Leach 1991), the dikes failed and the area was inundated with tidal flow. In the late 1990s, the Estuary Enhancement Program was able to achieve a functioning salt marsh where there had previously been low elevations and no remaining natural marsh hydrology. To improve and enhance environmental education, public access, and long-term use of the site, additional project components included the construction of a boat ramp, two parking areas, and observation platform. In addition, more than 7 miles of new tidal channels were dredged across the area to simulate natural marsh hydrology and allow for increased sediment transport into the area. Since that time, the East and West creeks have accumulated sediment such that use of the existing boat ramp has become increasingly prohibitive.

3.8.2 Coastal Zone Management

The Coastal Zone Management Act (CZMA) of 1972 (16 USC Section 1451 et seq., as amended) provides assistance to states, in cooperation with federal agencies, for developing land and water use programs in coastal zones. Section 307 of the CZMA and 15 CFR 930 subpart C stipulate that where a federal project initiates reasonably foreseeable effects on any coastal use or resource, the action must be consistent to the maximum extent practicable with enforceable policies of the affected state's federally approved coastal management plan.

In response to the CZMA, New Jersey developed the New Jersey Coastal Management Program (NJCMP), which was approved by NOAA in 1980 and ensures coastal resources and ecosystems are conserved to enhance sustainable coastal communities. Subchapter 9 of the Coastal Zone

Management Rules outlines “special areas” (New Jersey Administrative Code [N.J.A.C.] 7:7) found in the coastal zone that are regulated by NJDEP. These special areas are either naturally valuable, important to human use, hazardous, or sensitive to impacts. Any development within sites with special areas must demonstrate compliance with the special area rule (NJDEP 2017b). All wetlands and flood hazard areas, including those within the Project area, are considered special areas (NJDEP Division of Land Use Regulation 2016).

New Jersey’s coastal zone encompasses approximately 1,800 miles of tidal and non-tidal waters, waterfronts, and inland areas. The Project area is considered within this coastal area. Consequently, the Coastal Zone Management Rules have been reviewed to identify those applicable to the Project, including (information is summarized, see Appendix C2):

- 7:7-9.15 Intertidal and Subtidal Shallows: Development, filling, new dredging, or other disturbance is discouraged but may be permitted in accordance with this rule.

- 7:7-9.27 Wetlands: Development in wetlands is prohibited unless the proposed development requires water access or is water oriented as a central purpose of the basic function of the activity; has no prudent or feasible alternative on a non-wetland site; will result in minimum feasible alteration or impairment of natural tidal circulation (or natural circulation in the case of non-tidal wetlands); and will result in minimum feasible alteration or impairment of natural contour or the natural vegetation of the wetlands.

- 7:7-9.36 Endangered or Threatened Wildlife or Plant Species Habitats: Development of endangered or threatened wildlife or plant species habitat is prohibited unless it can be demonstrated that endangered or threatened wildlife or plant species habitat would not directly or through secondary impacts on the relevant site or in the surrounding area be adversely affected.

- 7:7-9.38 Public Open Space: New or expanded public or private open space development is encouraged at locations compatible or supportive of adjacent and surrounding land uses. Development that adversely affects existing public open space is discouraged.

- 7:7-9.48 Lands and Waters Subject to Public Trust Rights: Development that adversely affects lands and waters subject to public trust rights is discouraged. Public access to lands and waters subject to public trust rights shall be provided in accordance with the public trust rights rule.

- 7:7-12.6 Maintenance Dredging: Maintenance dredging is conditionally acceptable to the authorized depth, length, and width within all General Water Areas to ensure that adequate water depth is available for safe navigation.

- 7.7-12.7 New Dredging: New dredging is conditionally acceptable in all General Water Areas for boat moorings, navigation channels, or anchorages.

- 7.7-12.9 Dredging Material Disposal: Dredged material disposal is prohibited in tidal guts, human-made harbors, medium rivers, creeks and streams, and lakes, ponds, and

reservoirs. Dredged material disposal in water areas shall conform to applicable State Surface Water Quality Standards.

- 7.7-12.11 Filling: Filling is discouraged; in cases where there is no alternative to filling, filling is conditionally acceptable provided the detailed requirements of this rule are met.

- 7:7-12.17 Dams and Impoundments: These structures are conditionally acceptable provided they are essential for water supply purposes or for the creation of special wildlife habitats; adverse impacts are minimized; and the structures will not adversely affect navigation routes.

- 7.7-15.12 Dredged Material Placement on Land: Dredged material placement on land is conditionally acceptable provided that the use is protective of human health, groundwater quality, and surface water quality, and manages ecological risks.

New Jersey enacted the Coastal Area Facilities Review Act (CAFRA) in 1973 to regulate land use and development within coastal wetlands in the state. The Project area is located within coastal wetlands regulated by CAFRA, as it is within 150 feet from the mean high water line (Cumberland County Planning Board 2011).

3.9 Air Quality and Noise

3.9.1 Air Quality

Air quality is defined by ambient air concentrations of specific pollutants determined by the U.S. Environmental Protection Agency (USEPA) to be of concern to the health and welfare of the general public and the environment and widespread across the United States. The primary pollutants of concern, called "criteria pollutants," include carbon monoxide (CO), sulfur dioxide (SO_2), nitrogen dioxide (NO_2), ozone, suspended particulate matter less than or equal to 10 microns in diameter (PM-10), fine particulate matter less than or equal to 2.5 microns in diameter (PM-2.5), and lead. These pollutants are subject to both primary and secondary National Ambient Air Quality Standards (NAAQS). Primary standards provide public health protection, including protecting the health of "sensitive" populations such as asthmatics, children, and the elderly. Secondary standards provide public welfare protection, including protection against decreased visibility and damage to animals, crops, vegetation, and buildings. State air quality standards cannot be less stringent than the NAAQS.

The USEPA determines air quality attainment status based on whether the air quality in an area meets (attains) the NAAQS. Areas that violate NAAQS are designated as nonattainment areas for the relevant pollutants. Areas with insufficient data are designated as attainment/unclassified areas and are treated as attainment areas under the Clean Air Act. Areas that were previously designated nonattainment and have demonstrated compliance with a NAAQS are designated "maintenance" for 20 years after the effective date of attainment, assuming they remain in compliance with the standard.

The Project area is within Cumberland County, New Jersey, which is located in the Philadelphia-Wilmington-Atlantic City nonattainment area for the 2008 8-hour ozone standard (USEPA

2017a). On October 1, 2015, the USEPA lowered the 8-hour ozone standard from 0.075 parts per million (ppm) to 0.070 ppm. The NJDEP urged the USEPA to adopt a single nonattainment area for the 2015 standard compassing New Jersey, Connecticut, southeastern New York, eastern Pennsylvania, Delaware, Maryland, District of Columbia, and northeastern Virginia for the 2015 8-hour ozone standard (NJDEP 2016). On December 20, 2017, the USEPA issued its preliminary intent to designate Cumberland County as part of the Philadelphia-Wilmington-Atlantic City nonattainment area for the 2015 ozone standard (USEPA 2017b).

Furthermore, the entire state of New Jersey is in the Ozone Transport Region (OTR). States located in the OTR are required to implement additional requirements to control pollutants that form ozone, which include oxides of nitrogen (NOx) and volatile organic compounds (VOCs).

3.9.2 Noise

Sound is mechanical energy transmitted by pressure waves in media such as air or water. When the sound level becomes excessive, annoying, or unwanted, it is referred to as "noise." Noise may be continuous (constant noise at a steady level), steady (constant noise with a fluctuating level), impulsive (having a high peak of short duration), stationary (occurring from a fixed source), intermittent (at intervals of high and low levels), or transient (occurring at different levels).

Noise levels are quantified using decibels (dB), which are units of sound pressure. The A-weighted sound level, expressed as dBA, is an expression of the relative loudness of sounds in air as perceived by the human ear and is usually used to quantify audible sound and its effect on people. The State of New Jersey Noise Control Act of 1971 authorized the NJDEP to develop regulations related to noise control and abatement. NJDEP developed a Model Noise Ordinance (2014) that can be adopted by local municipalities. Local noise ordinances cannot be less stringent than the Model Noise Ordinance, but local municipalities can make changes to the state ordinance and submit them for approval by NJDEP. NJDEP established outdoor sound level standards of 50 dBA during nighttime (10:00 p.m. to 7:00 a.m.) and 65 dBA during daytime (7:00 a.m. to 10:00 p.m.) for receiving residential properties. For commercial, public service, non-residential, and community service facilities, the receiving outdoor sound level standard is 65 dBA 24 hours a day (NJDEP 2014; NJDEP Compliance & Enforcement 2016).

Existing ambient noise levels (background noise levels) are the sounds from natural and artificial sources present at the time a sound measurement is taken. The magnitude and frequency of background noise at any given location may vary considerably over the course of a day or night and throughout the year. The variations are caused in part by weather conditions, seasonal vegetative cover, and human activity. The Project area is located within parks and open space designated land, and is over 1.5 miles from the nearest community. The USEPA estimates that the day-night average outdoor noise for wilderness and agricultural crop land ranges from 35 to 44 dBA (USEPA 1978).

3.10 Weather Intensity

The Project area is located along the Delaware Bay shoreline in New Jersey within the 100-year flood zone, and is vulnerable to future severe weather events, sea level rise, and other

environmental risk factors resulting from climate change. Although the Delaware Bayshore communities did not sustain significant economic damage to residential and commercial businesses from Hurricane Sandy as compared to Atlantic coast communities, impacts to wetland edges (land-water interface) appeared to be more significant than those on the Atlantic coast. Larger, contiguous areas of shoreline were compromised by erosion, undercuts, and sloughing. Furthermore, the storm surge extended farther inland to the tree line, dikes were blown out, wetlands were inundated, and a significant loss of wetland area was observed at the confluence of the bay and rivers (i.e., Maurice and Cumberland rivers; NJDEP 2015). Maurice River Township's labor force spent approximately 400 hours to remedy issues resulting from the storm and dedicated approximately 300 hours to equipment operation. Approximately 670 cy of fill was transported into the township to make permanent road repairs (NJDEP 2015).

The average temperature in New Jersey has warmed by about 3 degrees Fahrenheit in the last century, heavy rainstorms are more frequent, and the sea is rising about 1 inch every 6 years. The sea level is rising more rapidly along the New Jersey shore than in most coastal areas because the land is sinking. If the oceans and atmosphere continue to warm, the sea is likely to rise 18 inches to 4 feet along the New Jersey shore in the next century. Higher water levels are eroding beaches, submerging low lands, exacerbating coastal flooding, and increasing the salinity of estuaries and aquifers. In the coming decades, coastal and inland flooding, harm to coastal and inland ecosystems, disruption of fishing and farming, and risks to human health are likely to increase (USEPA 2016).

Average annual precipitation in New Jersey has increased 5 to 10 percent in the last century, and precipitation from extremely heavy storms has increased 70 percent in the northeastern United States since 1958. In the 1980s there was only one major disaster event in New Jersey as compared to six events between 2000 and 2009 (Newark Water Group 2014). Climatologists predict that strong storms (such as Hurricane Sandy) will become more prevalent (New York State Office of Parks, Recreation and Historic Preservation 2015).

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 Introduction – Scope of Impacts Evaluated

Section 4 summarizes the environmental effects to each resource and alternative described in Section 3 with regard to the restoration of the Thompsons Beach Marsh site. This EA does not include analyses of specific impacts for implementation of the Maurice River conceptual plan. This would be assessed under a separate environmental review if the plan activities move forward into project implementation.

4.2 Soils, Sediment, and Topography

4.2.1 No Action Alternative

Under the No Action Alternative, there would be no immediate change to the topography of the restoration site, which would remain at low elevation, causing the area to continuously be inundated from tidal flow. As a result, the marsh would not revegetate and would remain as open water or mudflat. Over time, the salt marsh would continue to degrade and become even more susceptible to sediment erosion and coastal flooding from intense storm events and sea level rise, resulting in a long-term moderate to major impacts to soil resources.

4.2.2 Proposed Action

Dredging and sediment placement would result in temporary minor adverse impacts to soil resources. The use of a floating dredge pipe and movement of equipment (a single low-pressure amphibious floating excavator) across the marsh could cause soil disturbance and compaction. To reduce these effects, the pipe placement and equipment routes would use existing access roads and other hard surfaces (e.g., the boat ramp) to the maximum extent possible (the exception is the footprint of the dredge sites). A secondary route across the marsh is included on the Project plans to allow for contingencies. Areas of temporary disturbance would be restored to pre-existing condition and grade to reduce these soil impacts. Furthermore, to reduce any potential erosion that may result from the placement of dredged materials at the restoration area, coir logs would be used as part of Project activities. The coir logs would work with natural topography to contain sediment/runoff and provide erosion resistance/control while the material dewaters, naturally consolidates, and becomes revegetated. The area is expected to revegetate over the course of three growing seasons to its previous condition prior to the salt hay farming operations.

Over the long term, the Proposed Action would result in beneficial, long-term impacts to soil resources by restoring the Project area to its previous function and reducing future erosion at the site. The two human-made creek channels proposed for dredging (i.e., East and West creeks) were originally constructed to bring tides and silt back into the marsh as part of the Estuary Enhancement Program, but have silted-in since they were constructed. Dredging of these creeks for beneficial reuse would allow the movement of sediment through the ecosystem, resulting in long-term beneficial impacts.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar long-term beneficial impacts to soils, sediment, and topography.

4.3 Water Resources and Wetlands

4.3.1 No Action Alternative

The No Action Alternative would have no immediate impact on flood zones as no placement of dredged material would occur. Under the No Action Alternative, no dredging would occur in East and West creeks and sediments would continue to accumulate. Over time, the marsh area would continue to degrade and would continue to be vulnerable to flooding and other storm surge impacts.

Under this alternative, there would be no improved marsh ecosystem benefits on hydrology. Salt marshes are necessary to improve water quality by filtering groundwater, reduce erosion by holding sediments in place, and attenuate wave action. These important ecosystem services provided by salt marshes would not be enhanced under the No Action Alternative. Additionally, the sediments would continue to accumulate in East and West creeks, which could eventually affect hydrology. The result of the No Action Alternative would be a long-term, minor adverse impact to surface waters and hydrology.

Under the No Action Alternative, there would be no immediate change to wetland habitat in the Project area because no dredging or placement of dredged materials would occur. East and West creeks would continue to be filled with silt and continued development of mudflats would disrupt and eventually limit hydrology and sediment influx to this region of the marsh. Over time, wetland areas would continue to degrade, eventually resulting in loss of wetland areas due to sea level rise.

4.3.2 Proposed Action

4.3.2.1 Flood Zones

The placement of dredged material to increase the height of the marsh and vegetation establishment would improve the ecosystem's ability to buffer storm surges and coastal flooding. The removal of accumulated sediment in East and West creeks would also improve coastal resiliency to flooding and storm surges in the future by allowing greater movement of water through the system.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar beneficial impacts to flood zones.

4.3.2.2 Surface Waters and Hydrology

The Proposed Action would enhance salt marsh habitat by increasing sediment accretion rates (adding dredged materials) and improving the ecosystem services provided by the habitat, resulting in improved capacity for the Project area to handle future storm events. Marsh vegetation growth, a result of increased marsh elevation, would improve water quality by

filtering surface and groundwater inputs to remove pollutants and excess nutrients. Marsh restoration would also reduce the potential for erosion and sediment runoff into adjacent open water areas with the growth of desirable coastal wetland plant species, resulting in a long-term beneficial impact.

Dredging of East and West creeks would restore the natural hydrology of the marsh and promote marsh recovery by allowing for an increase in local tidal flow velocity and enhanced sediment transport capacity. The increased velocity would not increase the tidal prism or volume of water entering the marsh, which is governed by the area of the inlet throat at Thompsons Beach (the narrowest and deepest part of the inlet) and the surface area of the marsh. Consequently, the restoration would not result in any impacts to the adjacent Thompsons Beach.

Dredging and sediment placement would result in minor, temporary, and localized increases in turbidity and reduced water quality in the creeks and restoration area. Coir logs would be used to contain sediment/runoff while the dredged sediments dewater, which would reduce this effect. Furthermore, the USACE permit limits the disturbance or alteration of waters of the United States from construction activities to no greater than 16.33 acres (Appendix C10).

Areas outside the Project area, such as watercourses, would be protected from dredge material using coir logs. Coir logs would be left to biodegrade over time. The elevation of coir logs would be adjusted as needed to ensure they are at or below mean high water to allow for overtopping and flooding of the placement area during high tides. At this elevation, containment would have little impact on tidal hydrology. Water levels inside and outside of containment would be monitored in order to gauge the impact on tidal hydrology, and if necessary, additional modifications would be made to the coir log elevation.

The placement of material at the Eastern marsh restoration area would result in altered hydrology to a limited degree from the increase in marsh elevation and change in tidal inundation. However, the restoration site is small compared to the overall marsh plain, and placement of material would not have a large impact on the area. Overall, the long-term beneficial impacts to surface water and hydrology, including increased marsh accretion, reduced erosion, and improved water quality, would outweigh the temporary, minor impacts during the Project activities.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to surface waters and hydrology.

4.3.2.3 Wetlands

Under the Proposed Action, existing salt marsh wetlands would be improved and expanded. Placement of dredged material would increase the height of the marsh above sea level, and the ecosystem services provided by the salt marsh would be enhanced, resulting in improved habitat for wildlife, improved water quality, and greater capacity for the ecosystem to handle future storm events. The Proposed Action would result in beneficial, long-term, moderate impacts to wetlands by increasing marsh elevations to levels that can support resilient low-marsh

vegetation, protect against storm surge and sea level rise, and provide improved marsh habitat for wildlife.

Dredging would temporarily increase turbidity within East and West creeks, resulting in temporary, localized, and minor impacts to these wetland areas. However, dredging would also result in immediate and long-term impacts by improving the function and purpose of these channels to provide the sediments and nutrients the marsh requires to continue growth and help maintain the long-term health of the marsh.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to wetlands.

4.4 Biological Resources and Vegetation

4.4.1 No Action Alternative

Under the No Action Alternative the existing mudflats would not revegetate and would remain as open water or mudflats. The East and West creeks would continue to fill with silt, forming additional mudflats. Although mudflats would continue to provide foraging habitat for migrating shorebirds, over the long-term, the marsh habitat in the Project area would continue to degrade and erode and would ultimately result in a reduced diversity of habitat for migrating birds and other resident bird and wildlife species.

Because dredging would not occur under this alternative, the continued filling of East and West creeks with silt would result in restrictions to aquatic species' movements. Continued erosion of the marsh area would also result in decreased water quality, which would negatively impact aquatic species.

4.4.2 Proposed Action

4.4.2.1 Common Flora

Thompsons Beach Marsh currently comprises predominately *Spartina alterniflora* low marsh, and the Eastern marsh restoration area contains mostly mudflats, with approximately 43 percent vegetated with low marsh species. Another PSEG restoration project in Dennis Township, New Jersey, on the Delaware Bay succeeded in recovering a site previously used for salt hay farming and converted it into a functioning salt marsh. Hinkle and Mitsch (2005) observed rapid natural colonization of vegetation, with 70 percent vegetation cover achieved at target elevations within 2 years. The proposed Project is located in the same ecosystem and has similar target elevations as the Dennis Township project; therefore, rapid natural colonization is expected to occur at the Eastern marsh restoration area, providing beneficial impacts to flora (ALS, pers. comm., 2017).

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to common flora species.

4.4.2.2 Common Fauna

The Proposed Action would restore marsh elevations to more closely reflect natural conditions that existed prior to salt hay farming within the Project area. The conversion of 1 acre of existing, sparsely vegetated mudflats to low marsh would decrease the acreage of foraging habitat for some shorebirds, but the establishment of low marsh would be beneficial to other bird and wildlife species such as marsh wren and saltmarsh sparrow. Mudflat habitat in the area is abundant and the Proposed Action would not substantially reduce the foraging area available to shorebirds that use these areas.

Diamondback terrapins were frequently observed during wildlife surveys of the Project area. In order to protect possible habitat for hibernating diamondback terrapins within East and West creeks, a Diamondback Terrapin Dredging Protocol has been developed by ALS as required by a special condition of the Coastal General Permit 24 (Appendix C1).

Fish and other aquatic species would be temporarily disturbed by dredging activities. Dredging of East and West creeks would result in temporary impacts to water quality, including increased turbidity and suspended sediments. Increased suspension of sediments in the water column can alter fish and invertebrate behavior, clog respiratory structures, reduce feeding rates, interrupt spawning, and reduce hatching rates in fish; however, the Maurice River and its tributaries are already typified by extremely high turbidity levels. Natural turbidity is the source of sediments that marsh systems rely upon to regulate their elevation. The additional turbidity and disturbance to aquatic species would be limited to an approximately 1-week window or less, resulting in temporary and minor impacts to these species.

Anadromous fish could be present within the Project area, but the Proposed Action would not block fish passage, alter stormwater drainage patterns, increase erosion, or affect sediment accretion. Impacts to anadromous fish may include a temporary increase in noise and turbidity during restoration dredging and placement. Anadromous fish are mobile and capable of avoiding the Project area, and work would be conducted from September through March, when river herring are not present, resulting in negligible impacts to these species.

A shift in benthic infauna would be expected when open mudflat is converted to vegetated salt marsh. Areas of marsh and the organisms within would also be subject to compaction by heavy equipment. However, benthic infauna would be expected to recover over time, and open mudflat habitat is abundant in the vicinity. Macroinvertebrates (e.g., ribbed mussel and marsh crabs) would be temporarily disturbed but would be expected to recolonize (Appendix B2). Full recovery of benthic infauna has been documented within 2 to 3 years following thin-layer application of materials during other restoration projects (Ray 2000; Wilber and Clarke 2007) (Appendix B2); therefore, impacts to benthic infauna and macroinvertebrates would be expected to be minor.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to common wildlife species.

4.4.2.3 Federally Listed Species

Red knot is the only federally listed species that occurs in the Project Area. Noise from Project activities could disturb migrating red knots if they take place during the spring or fall migration seasons. During consultation with USFWS, it was determined that no injury would occur to red knot from the Proposed Action because Project activities would not take place on beach habitat, which is the primary feeding and roosting area for red knot. In addition, red knot have access to similar habitat in the immediate vicinity and are able to move if noise levels are disturbing. If Project activities occurred between May 1 and June 7, red knot monitoring would be required by USFWS to identify potential impacts to birds during spring migration as a special condition of the Coastal General Permit 24 (Appendix C1). As a result, the USFWS issued a finding of "may affect, not likely to adversely affect" red knot for the Proposed Action (Appendix C4).

The majority of EFH-designated species that may be present in the backbay tributaries or the vicinity of the proposed dredge sites are mobile and have the ability to avoid the Project area during restoration dredging. During consultation with NMFS, it was determined that placement of dredged material into mudflats at the Eastern marsh restoration area would affect EFH through the loss of forage and refuge habitat for federally managed species, and impacts to prey species and their habitat. Some of these impacts would be temporary, occurring during Project implementation, while others would result from the permanent conversion of one aquatic habitat type to another. However, NMFS concluded that the habitat conversion of mudflat to low marsh under the Proposed Action would not result in a significant impact to EFH in the long term. NMFS requires ALS to develop and submit a long-term monitoring and adaptive management plan for review prior to initiation of work (Appendix C11). In addition, the USACE has stipulated in their permit (Appendix C10) that ALS shall hold a meeting with NOAA NMFS, EPA and the USACE to discuss further development of the long term Monitoring and Adaptive Management Plan and that a final long term Monitoring and Adaptive Management Plan would be submitted to USACE for coordination with NOAA NMFS and EPA for final review and written approval.

The proposed dredging and marsh restoration would convert 1 acre of existing, sparsely vegetated mudflats to low marsh, which would decrease the acreage of foraging habitat for some birds protected under the MBTA; however, mudflat habitat in the area is abundant and the Proposed Action would not substantially reduce the foraging area available to migratory bird species that use mudflat habitat. The establishment of low marsh vegetation would improve existing habitat quality and diversity by increasing the availability of salt marsh areas dominated by *Spartina alterniflora* and other desirable plants, which would be beneficial to other bird and wildlife species.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to federally listed species.

4.4.2.4 State-Listed Species

With the exception of black rail, all state-listed species have been confirmed at the Project area during wildlife surveys. The Proposed Action would not negatively alter nesting or perching

habitats for state-listed species. The conversion of existing, sparsely vegetated mudflats would decrease the acreage of foraging habitat for some state-listed species; however, mudflat habitat in the area is abundant and the Proposed Action would not substantially reduce the foraging area available.

Two osprey nests have been observed within 1,000 feet of the proposed dredging locations. In order to protect sensitive habitat for the state-listed threatened osprey, a seasonal restriction on the use of heavy machinery within 300 meters (984 feet) of active nests is in effect from April 1 to August 31 of each calendar year as a special condition of the Coastal General Permit 24 (Appendix C1). If osprey nests are occupied by bald eagles at the time of Project implementation, timing restrictions would be adjusted as appropriate.

Bald eagles are listed as endangered by the State of New Jersey and have additional protections under the Bald and Golden Eagle Protection Act. Bald eagles have been observed in the Project area; however, no nests have been identified nearby and impacts to bald eagles would be limited to possible disturbance from Project activity noise while foraging. This impact would be minor as eagles would be expected to avoid areas of disturbance as needed.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar impacts to state-listed wildlife species.

4.5 Human Health and Safety

4.5.1 No Action Alternative

Under the No Action Alternative, the existing degraded salt marshes would continue to degrade and flooding of the surrounding communities during intense storm events would continue. As sea levels continue to rise and storms become more frequent and intense, the salt marshes in the Project area would continue to be lost along with the ecosystem functions, services, and resiliency they provide to surrounding communities. Similar to Hurricane Sandy, future severe weather events and flooding would likely cause damage to homes, marinas, shipping channels, and fishing and oyster beds, as well as weaken susceptible infrastructure, such as roads, electric transmission lines, natural gas and telecommunications systems, and dikes, leading to increased vulnerability to future storm and tidal surge. Similar to the impacts seen to human health post-Hurricane Sandy, after these initial impacts to regional infrastructure, local residents could experience mental health distress, exacerbated asthma symptoms, and potentially other health concerns from issues related to ongoing building repairs, recurrent mold, and insurance claims.

4.5.2 Proposed Action

No contaminated materials would be encountered and no solid or hazardous wastes would be generated by the Proposed Action. The dredged materials are not contaminated and are suitable for placement at the restoration area, resulting in no adverse impacts to human health.

Dredging of East and West creeks and placement of dredged material in the Eastern marsh restoration area would increase community resiliency to coastal storms, flooding, and sea level

rise by buffering against storm damage, preventing erosion, improving hydrology, and increasing energy dissipation and coastal flood attenuation functions.

The Proposed Action would also result in long-term, moderate, beneficial impacts by increasing marsh elevations to support resilient marsh vegetation species. Marsh vegetation improves water quality by filtering surface and groundwater inputs to remove pollutants and excess nutrients, which would benefit human health.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay to the benefit of local communities.

4.6 Cultural Resources

4.6.1 No Action Alternative

There are no buildings, structures, sites, objects, or historic districts in the Project area that are listed in, or have been identified as eligible for listing in, the New Jersey Register of Historic Places or NRHP; therefore, there would be no effects to known historic properties under the No Action Alternative. However, under this alternative, continued long-term erosion has the potential to disturb previously unknown historic, cultural, or archaeological remains, which could result in adverse impacts.

4.6.2 Proposed Action

The NJDEP HPO noted that there are no buildings, structures, sites, objects, or historic districts on or adjacent to the Project area that are listed in, or identified as eligible for listing in, the New Jersey Register of Historic Places or NRHP (Appendix C9). Furthermore, there is a low potential for discovery of previously unknown archaeological resources during restoration activities that disturb the ground, such as through dredging or the movement of coir logs. In the event that this occurs, work would be stopped and the HPO would be notified of the discovery in accordance with the USACE permit (Appendix C10). Treatment of the discovery would be determined in consultation with the HPO. Restoration activities would not proceed until consultation had been completed.

During the USACE permit process and tribal consultation, the Stockbridge-Munsee Community Band of Mohican Indians indicated no interest in the Project area, and the Seneca Nation of Indians indicated they have no issues with the proposed Project. The Proposed Action would have an overall long-term benefit to environmental resources and communities, which may also benefit tribes with interests in the area. In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in the Delaware Bay. Potential projects could result in similar effects to cultural resources and consultation with HPO and tribes would occur if these conceptual restoration projects move forward.

4.7 Socioeconomics, Environmental Justice, and Protection of Children

4.7.1 No Action Alternative

Under the No Action Alternative, no dredging or restoration activities would occur and the salt marsh would continue to degrade and be susceptible to erosion, coastal flooding, and sea level

rise. The local economy in Maurice River Township relies on sand mining, boating, fishing, crabbing, and ecotourism, which are dependent on healthy coastal ecosystems. Continued degradation of salt marsh habitat under the No Action Alternative could result in long-term adverse impacts on socioeconomics by impeding or disrupting local industries and infrastructure, including potential impacts to EJ populations in Maurice River Township. Impacts to children could occur in the event that exacerbated flooding and coastal storms reached inland residential communities located 1.5 miles from the site.

4.7.2 Proposed Action

The Proposed Action would create temporary jobs during implementation of dredging activities, placement of materials, and post-Project monitoring, all of which would temporarily benefit the local job market. Furthermore, purchases made by the workforce and expenses associated with the acquisition of materials and equipment to complete the Project would benefit local businesses.

The Proposed Action would contribute to long-term beneficial impacts to socioeconomics and the local community by strengthening the marsh ecosystem on which bayshore economic activities depend, including boating, fishing, crabbing, and ecotourism. Overall, implementation of the Proposed Action would have beneficial impacts to socioeconomics, including beneficial impacts to EJ populations and children.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar beneficial impacts to socioeconomics.

4.8 Land Use, Recreation, and Coastal Zone Management

4.8.1 No Action Alternative

The No Action Alternative would not change existing open space land use. However, over time the Project area could continue to degrade and erode, resulting in loss of open space. The No Action Alternative would result in increased vulnerability of coastal communities to flooding, storm surges, and sea level rise. Loss of open space and tidal wetlands would have a long-term adverse impact to recreation opportunities in the area including wildlife viewing. Under the No Action Alternative, East and West creeks would not be dredged and the silt that impedes access to the existing boat ramp would remain, resulting in adverse impacts to recreational boating in the Project area.

Under the No Action Alternative, current conditions in the coastal zone would persist and erosion would worsen over time, resulting in a diminished coastal area. Furthermore, the No Action Alternative would not address vulnerabilities to sea level rise, flooding, habitat loss, and erosion, resulting in long-term, negative impacts to the coastal zone.

4.8.2 Proposed Action

Under the Proposed Action, existing open space land uses in the area would not change. However, marsh restoration would stabilize the salt marsh lands, preventing future erosion and

loss of marsh habitat and a greater capacity to handle future storm events and sea level rise, which would result in positive impacts to coastal and inland land uses including those of the Heislerville Wildlife Management Area.

With regard to recreation, the improved marsh ecosystem would have a long-term beneficial impact on tourism and bird watching. The improved water quality expected as a result of the Proposed Action would benefit fish and thus recreational fishing. Furthermore, dredging in East and West creeks would improve navigation to and from the existing boat ramp, whose use has become increasingly prohibited due to the accumulation of sediment, resulting in beneficial impacts to recreational boaters.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar beneficial impacts to land use and recreation.

The Project area is within the coastal zone and subject to federal consistency review under the CZMA and the NJCMP. The NJDEP reviewed the Proposed Action in the application for a Coastal General Permit 24, which encompasses the CZMA and the NJCMP. The NJDEP approved the application on September 13, 2017, and the Project is authorized under and in conditional compliance with the applicable Coastal Zone Management Rules (Appendices C1 and C2).

Dredging and restoration activities under the Proposed Action would result in a more resilient coastal zone and greater capacity for the area to handle future storm events and sea level rise, resulting in beneficial long-term impacts to the coastal zone. Furthermore, the Proposed Action would result in a net benefit to the marsh plain and increase vegetated tidal wetland area within the Project area.

Creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which would likely result in similar net benefits to the marsh plain and increase vegetated tidal wetland area within the Delaware Bay area.

4.9 Air Quality and Noise

4.9.1 No Action Alternative

Under the No Action Alternative, no dredging or restoration activities would occur and therefore, there would be no impacts to air quality or noise.

4.9.2 Proposed Action

Air quality impacts associated with Project activities would include emissions from fossil fuel-fired equipment and vehicles, and potential fugitive dust from ground disturbance and transportation. Fossil fuel-fired equipment is a source of combustion emissions, including NOx, CO, VOCs, SO_2, PM-10, PM-2.5, greenhouse gases, and small amounts of hazardous air pollutants. Gasoline and diesel engines must comply with the USEPA mobile source regulations in 40 CFR Part 85 for on-road engines and 40 CFR Part 89 for non-road engines. These

regulations are designed to minimize emissions and require a maximum sulfur content in diesel fuel of 15 ppm.

Fugitive dust is a source of respirable airborne particulate matter, including PM-10 and PM-2.5, that could result from ground disturbance activities and mobile source traffic on paved and unpaved roads. The amount of dust generated is a function of activity, silt and moisture content of the soil, wind speed, frequency of precipitation, vehicle traffic, vehicle types, and roadway characteristics. Fugitive dust is an air contaminant and may be considered air pollution if it unreasonably interferes with the enjoyment of life and/or property according to the air pollution regulations in N.J.A.C 7:27-5.2. The generation of fugitive dust and combustion emissions would be minimal due to the small size of vehicle and equipment fleet, short time required to implement Project activities, and high moisture content of soils in the Project area. Consequently, potential air impacts would be localized, minor, and temporary.

Cumberland County has been designed as a nonattainment area for the 2008 8-hour ozone standard (and pending 2015 8-hour ozone standard) and is part of the OTR. Because of these designations and since the Proposed Action is a federal action by the DOI, the General Conformity Regulations under 40 CFR 93 Subpart B would be applicable. Potential Project emissions are expected to be below the general conformity de minimis thresholds. Therefore, the proposed Project would not be subject to a conformity determination, and it would not be expected to have a negative impact on the State Implementation Plan and efforts to achieve or maintain the NAAQS.

Project-related noise effects would result from the use of vehicles and equipment, which typically produce roughly 75 to 85 dBA of noise at 50 feet from the source (Federal Transit Administration 2006). These noise levels would be temporary and rarely steady; they would fluctuate depending on the number and type of equipment in use at any given time. At times no equipment would be operating and noise would be at or near existing ambient levels, and at other times multiple types of equipment may be operating, which would result in noise impacts.

Activities carried out under the Proposed Action would occur during daylight hours only over a short period of time, and would use minimal equipment. As a result, noise impacts from the Proposed Action would be minor, intermittent, and temporary for nearby land uses. Furthermore, there would be no noise impacts to residences since the nearest community is 1.5 miles from the Project area.

In addition, the creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay, which could result in similar impacts to air quality and noise if those projects eventually move forward.

4.10 Weather Intensity

4.10.1 No Action Alternative

Implementation of the No Action Alternative would not result in increased coastal resiliency resulting in a loss of the ecosystem benefits provide by the marshes to coastal communities and the coastal economy. Salt marshes provide habitat for economically and ecologically important

fish, crabs, and shellfish, provide nesting and foraging habitat for birds, and improves water quality. Without restoration and increased marsh elevation, the Project area would be vulnerable to sea level rise since the marshes within the Project area are not likely to recover elevation and keep pace with sea level rise without the addition of sediment. As a result, the No Action Alternative would not address vulnerabilities to sea level rise, flooding, habitat loss, and erosion, resulting in long-term, negative impacts. Similar to Hurricane Sandy, future severe weather events and flooding would likely cause damage to homes, marinas, shipping channels, and fishing and oyster beds, as well as weaken susceptible infrastructure, such as roads, electric transmission lines, natural gas and telecommunications systems, and dikes, leading to increased vulnerability to future storm and tidal surge.

4.10.2 Proposed Action

Healthy Delaware Bay marshes are likely to be among the most resilient to sea level rise in the region because they have a moderate tidal range, high suspended sediment load, accretion rates that meet or exceed current rates of sea level rise, and a large frontage of undeveloped transition zone between uplands and salt marshes to allow for inland marsh migration. The marshes currently existing in the Project area have been degraded over time and do not provide strong resiliency to storm surge or sea level rise in their present state.

Implementation of the Proposed Action would create long-term, beneficial impacts to marsh within the Project area in response to sea level rise as a result of global climate change. Salt marsh restoration would increase the resiliency of the surrounding natural systems by enabling these systems and the existing community infrastructure to more effectively manage flooding, storm surge, and sea level rise. Increased community resiliency would be achieved through implementation of the Proposed Action by buffering against storm damage, preventing erosion, and increasing energy dissipation and coastal flood attenuation functions. The placement of dredged sediments on the marshes would also increase existing marsh elevation and marsh accretion rates, allowing the area to potentially maintain pace with sea level rise. Additionally, the Proposed Action would create educational and public outreach opportunities associated with salt marsh restoration. This effort has the potential to educate visitors on climate change preparedness, and represents an opportunity to monitor changes to the salt marsh that could result from coastal storms, sea level rise, flooding, erosion, and associated threats.

Creation of the Maurice River conceptual plan would provide a basis on which to implement future restoration projects in Delaware Bay to address increased weather intensity and sea level rise, resulting in beneficial long-term benefits to water resources, biological resources, vegetation, socioeconomics, and human health, similar to those identified for restoration actions at Thompsons Beach Marsh.

5.0 CUMULATIVE EFFECTS

CEQ regulations stipulate that a cumulative effects analysis be conducted to consider the potential impacts to the environment potentially resulting from the incremental impact of a proposed action when added to other past, present, and reasonably foreseeable future actions (40 CFR 1508.7).

Past, present, and reasonably foreseeable future actions identified within, or in close proximity to, the Project area are shown in Table 5-1. The actions considered in the analysis are restoration of areas within and near Cumberland County, New Jersey, either through dredging of deposited material, enhancement of ecosystems, and/or protection of land close to shorelines.

Table 5-1 Projects Included in the Cumulative Effects Analysis

Project Name	Project Proponent(s)	Actions	Status
Horseshoe Crab Habitat Restoration Project: Thompsons Beach	Grantee	Repair approximately 3,200 linear feet (8.4 acres) of horseshoe crab spawning habitat through sand placement on Thompsons Beach. Sand source would be a local sand mine. (NEPA review completed by USFWS.)	Complete
Horseshoe Crab Habitat Restoration Project: Thompsons Beach Reef	Grantee	Install 6,720 square feet (0.15 acre) of experimental oyster reefs along Thompsons Beach shoreline. Reef segments consist of shell-filled mesh bags. (NEPA review completed by USFWS.)	Complete
Horseshoe Crab Habitat Restoration Project: Moores Beach Reef	Grantee	Install 12,000 square feet (0.28 acre) of oyster reefs along Moores Beach shoreline. Reef segments consist of shell-filled bags. (NEPA review completed by USFWS.)	Complete
Reeds Beach and Area Beach Restoration	Grantee	Add beach sand to Reeds Beach, Cooks Beach, Kimbles Beach, and Pierces Point in Middle Township, Cape May County to improve habitat for horseshoe crab spawning and migrating shorebirds. (NEPA review completed by USFWS.)	Complete
Dyers Cove Horseshoe Crab Habitat Restoration Project	Grantee	Remove rubble and place 20,000 cy of coarse grained sand along a 0.37–linear-foot stretch of beach at Dyers Cove located in Down Township, Cumberland County. (NEPA review completed by USFWS.)	Complete
Horseshoe Crab Habitat Restoration Project: Dyers Cove Reef	Grantee	Construct two intertidal reefs parallel to the shoreline of Dyers Cove. Each reef's footprint would be 12,000 square feet (0.3 acre). Reef segments consist of shell-filled bags. (NEPA review completed by USFWS.)	Complete
Horseshoe Crab Enhancement Project: Roadway Beach,	Grantee	Repair 1,700 linear feet (5.5 acres) of horseshoe crab spawning habitat along Roadway Beach. Sand transported to site via	Complete

Project Name	Project Proponent(s)	Actions	Status
Fortescue		truck from a local upland sand mine. (NEPA review completed by USFWS.)	
Channel Maintenance and Beneficial Use of Dredged Material Projects, NJ Intracoastal Waterway, Ocean and Cape May Counties, NJ	USACE, NJDEP Division of Fish and Wildlife, The Nature Conservancy, and Greentrust Alliance	In 2014, approximately 7,000 cy of dredge material was placed at a Middle Township site near Stone Harbor. In late 2015, about 50,000 cy of sediment from shoals in the federal channel of the New Jersey Intracoastal Waterway was placed on the marshes near Avalon.	Complete
New Jersey Intracoastal Waterway Project (117 miles of waterway)	USACE	Past activities include placing dredged material on impacted shorelines near Mantoloking and Long Beach Island to build critical habitat and restore marsh on NJDEP Division of Fish and Wildlife lands in Middle Township. Current and future activities include restoring safe navigation by dredging critical post-storm shoals that occurred along the entire waterway, repairing damaged areas of the east bulkhead along the Point Pleasant Canal, and repairing the damaged Lovelandtown bridge abutment located on the Point Pleasant Canal.	Ongoing
Money Island Bulkhead	NJDEP Division of Coastal Engineering	Coastal storm risk management	Complete
Thompsons Beach Restoration	NJDEP Division of Coastal Engineering	Ecosystem restoration	Complete
Fortescue Channel Dredging	New Jersey Department of Transportation Office of Maritime Resources	Dredging	Complete
Seabreeze Restoration	NJDEP Division of Coastal Engineering	Ecosystem Restoration	Complete

Sources: NJDEP 2017c, USACE 2014, 2016a, 2016b

The Horseshoe Crab Habitat Restoration Project: Thompsons Beach and the Horseshoe Crab Habitat Restoration Project: Thompsons Beach Reef are adjacent to the Proposed Action at Thompsons Beach Marsh. These projects, also proposed by the grantee, were previously reviewed by USFWS. Implementation of the Proposed Action would result in cumulative beneficial impacts in combination with these recently completed projects, which have provided enhanced shoreline protection and wildlife habitat. The beneficial cumulative effects would

result from improving habitat for wildlife and increasing coastal resiliency, particularly from future severe weather events like Hurricane Sandy, which would otherwise have greater adverse effects to Delaware Bay. The results of monitoring for the completed projects listed in Table 5-1 above would result in location-specific information on successes and failures which, in combination with the Maurice River conceptual plan, would result in opportunities for future restoration with a higher likelihood of success.

The projects identified in Table 5-1 in combination with the Proposed Action would result in positive cumulative effects to environmental and socioeconomic resources: navigation would be improved by removing sediments that have accumulated in navigation channels; new disposal sites for dredged materials would be created in this region of New Jersey lacking disposal facilities for dredged materials; coastal ecosystems would be enhanced with the placement of material to improve salt marsh habitat; and coastal resiliency to storm and flood damage would be improved.

No adverse cumulative effects are anticipated from implementation of the Proposed Action in combination with past, present, and reasonably foreseeable future actions.

In summary, long-term beneficial cumulative effects are expected as a result of the Proposed Action in combination with past, present, and reasonably foreseeable future actions. The Proposed Action is a part of the broader effort to develop cost-effective methodologies to restore and improve marsh elevations that are well below the needed elevations to promote and sustain healthy marsh vegetation composition and keep pace with sea level rise. Overall resiliency of coastal areas to future severe weather events, sea-level rise, and other environmental risk factors would be enhanced as a result of the Proposed Action in combination with past, present, and reasonably foreseeable future actions.

6.0 AGENCY COORDINATION AND PUBLIC INVOLVEMENT

6.1 Agency Coordination

Representatives of the following federal, state, and local agencies, and project team members were consulted during Project planning and the development of this EA:

- USFWS
- NMFS
- USACE
- NJDEP
- New Jersey Department of Transportation
- New Jersey Institute of Technology
- Larry Niles & Associates, LLC
- Conserve Wildlife Foundation
- Partnership for the Delaware Estuary
- Richard Stockton College
- Rutgers University
- Manomet Center for Conservation Sciences
- SHARP
- Stockbridge-Munsee Community Band of Mohican Indians
- Seneca Nation of Indians

ALS is working collaboratively with USFWS, NMFS, and the NJDEP Division of Fish and Wildlife to further develop a monitoring protocol and adaptive management measures for ongoing use at regional marsh restoration sites (Appendices C2 and C11).

Letters of support for the Project have been submitted to DOI and NFWF by the following entities (Appendix A):

- Cumberland County Board of Chosen Freeholders
- County of Cumberland Department of Planning
- NJDEP Office of Coastal and Land Use Planning
- New Jersey Corporate Wetlands Restoration Partnership
- Partnership for the Delaware Estuary
- Maurice River Township
- Elder Point Oyster Company
- Citizens United
- USFWS New Jersey Field Office

6.2 Public Involvement

Resource agencies, abutters, and other stakeholders have been involved throughout the planning stages of the Project. The Project is undergoing local, state, and federal permitting processes, as described in Section 7 of this document. Each permit process requires extensive environmental and planning agency circulation, as well as ample public notice and involvement. Therefore,

there are existing and suitable opportunities for a wide variety of specialists, regulators, and residents to comment on and condition the Project's potential short-term and long-term impacts.

Project notifications were sent to the following municipal and county representatives: Maurice River Township Department of Construction, Maurice River Township Environmental Commission, Maurice River Township Land Use Board, Cumberland County Department of Planning, and Cumberland Salem Conservation District.

7.0 COMPLIANCE WITH FEDERAL, STATE, AND LOCAL LAWS

The Project has been evaluated for consistency with applicable federal, state, and local laws, regulations, and programs. In addition to this EA, the following permits and/or consultations are also required by local, state, and federal agencies:

- Coastal General Permit 24, Habitat Creation, Restoration, Enhancement, and Living Shorelines (NJDEP)
- Waterfront Development Permit (NJDEP)
- Water Quality Certificate (NJDEP)
- Coastal Zone Management Federal Consistency Determination (NJDEP)
- Special Use Permit (NJDEP Division of Fish and Wildlife)
- State ESA Consultation (NJDEP)
- Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act Permit (USACE)
- National Historic Preservation Act Section 106 Consultation (NJDEP and Tribal HPOs)
- ESA, Section 7 (87 Stat. 884, as amended 16 USC 1531 et seq.) Consultation (USFWS and NOAA Office of Protected Resources)
- EFH Assessment/Consultation (NOAA NMFS)

Consultations with federal and state regulatory agencies and officials have been held to confirm the soundness of the Project and the ability to receive permits. Refer to Appendix C for agency consultation and permit authorizations received for this Project.

8.0 LIST OF PREPARERS

The following contributed to the development of this EA:

U.S. Department of the Interior

Name	Role
Andrew Raddant	Regional Environmental Officer
Diane Lazinsky	Regional Environmental Protection Specialist

American Littoral Society

Name	Role
Captain Alek Modjeski	Habitat Restoration Program Director

Cardno, Inc.

Name	Role	Project Responsibility
Jennifer Wallace	Project Manager	Project Management/EA Review
Alison Uno	Senior NEPA Specialist	EA Review
Jeanette Brena	Senior Consultant	EA Preparation
Emily Merickel	Senior Staff Scientist	EA Preparation
Adele Clouse	Senior Staff Scientist	EA Preparation
Ingrid Kimball	Senior Staff Scientist	EA Preparation
Jennifer Ferris	Senior Staff Scientist	EA Preparation/EA Review
Hannah Donaghe	Senior Staff Scientist	EA Preparation
Anna Clare	GIS	Figure Preparation

9.0 REFERENCES

American Littoral Society (ALS). 2017. American Littoral Society Proposed Thompsons Marsh Restoration: Response to Comments Received January 12, 2017 by the New Jersey Department of Environmental Protection, January 23, 2017.

Chesapeake Bay Program. 2017. Field Guide. Available at: https://www.chesapeakebay.net/discover/field-guide. Accessed on October 19, 2017.

Cornell University. 2015. Cornell Lab of Ornithology: All about birds, red knot. Available at: https://www.allaboutbirds.org/guide/Red_Knot/lifehistory. Accessed on September 22, 2016.

Cumberland County Planning Board. 2011. *Cumberland County Open Space and Recreation Master Plan*. October.

Federal Emergency Management Agency (FEMA). 2016a. Flood zones. Available at: http://www.fema.gov/flood-zones. Accessed on July 22, 2016.

Federal Emergency Management Agency (FEMA). 2016b. Flood Insurance Rate Map, Cumberland County, New Jersey. Map Number 34011C0453E.

Federal Transit Administration. 2006. *Transit Noise and Vibration Impact Assessment.* Available at: https://www.transit.dot.gov/sites/fta.dot.gov/files/docs/FTA_Noise_and_Vibration_Manual.pdf. Accessed on October 23, 2017.

Hinkle R.L., and W.J. Mitsch. 2005. Salt marsh vegetation recovery at salt hay farm wetland restoration sites on Delaware Bay. Abstract. *Ecological Engineering* 25:240–251.

Jacques Cousteau National Estuarine Research Reserve. 2015. *Maurice River Township "Getting to Resilience" Recommendations Report*. Available at: http://www.prepareyourcommunitynj.org/media/28031/final-maurice-river-township-recommendations.pdf. Accessed on October 19, 2017.

Maine Department of Marine Resources. 2017. Marine river herring fact sheet. Available at: http://www.maine.gov/dmr/science-research/searun/alewife.html. Accessed on October 19, 2017.

Maurice River Township. 2015. *Draft Strategic Recovery Planning Report.* Available at: http://www.njfuture.org/wp-content/uploads/2016/08/Strategic-Recovery-Planning-Report-Maurice-River.pdf. Accessed on October 19, 2017.

Maurice River Township. 2017. Official Maurice River Township website, homepage. Available at: http://www.mauricerivertwp.org/. Accessed on October 23, 2017.

McNamara, L. 2015. Restoring the "natural mosaic" of the Thompsons Beach salt marsh. Conserve Wildlife Foundation of New Jersey. September 2, 2015. Available at: http://www.restorenjbayshore.org/blog/restoring-the-natural-mosaic-of-the-thompsons-beach-salt-marsh. Accessed on October 11, 2017.

Mid-Atlantic Fishery Management Council. 2016. *Regional Use of the Habitat Area of Particular Concern (HAPC) Designation.* May 2016. Available at: http://www.habitat.noaa.gov/pdf/Regional-HAPC-Report-May-2016.pdf. Accessed on October 12, 2017.

Modjeski, A. 2015. Personal communication from Alek Modjeski, American Littoral Society, to Zeina Al Taha, National Fish and Wildlife Foundation, regarding Project No. 2300.14.043429/43429 ("Creating a Resilient Delaware Bay Shoreline in Cape May and Cumberland Counties (NJ)"). October 28, 2015.

NatureServe. 2015. NatureServe explorer. An online encyclopedia of life. Species profile for *Calidris canutus rufa*. Available at: http://explorer.natureserve.org/servlet/NatureServe?searchName=Calidris+canutus+rufa. Accessed on October 7, 2016.

National Oceanic and Atmospheric Administration (NOAA). 2012. Guide to Essential Fish Habitat Designations in the Northeastern United States. Available at: https://www.greateratlantic.fisheries.noaa.gov/hcd/webintro.html. Accessed on October 3, 2014.

New Jersey Audubon. 2010. Birding & wildlife trails. Matts Landing-Heislerville Wildlife Management Area. Available at: http://www.njwildlifetrails.org/SkylandsTrails/Sites/tabid/445/Scope/site/Guide/DELBAYSH/Site/3/Default.aspx. Accessed on May 23, 2017.

New Jersey Department of Environmental Protection (NJDEP). 2014. Model Noise Control Ordinance. December.

New Jersey Department of Environmental Protection (NJDEP). 2015. *Damage Assessment Report on the Effects of Hurricane Sandy on the State of New Jersey's Natural Resources, Final Report*. Available at: http://www.nj.gov/dep/dsr/hurricane-sandy-assessment.pdf. Accessed on October 16, 2017.

New Jersey Department of Environmental Protection (NJDEP). 2017a. News Release – Christie Administration Preserves Delaware Bay Wetlands in Cumberland County. Available at: http://www.nj.gov/dep/newsrel/2017/17_0007.htm. Accessed on November 1, 2017.

New Jersey Department of Environmental Protection (NJDEP). 2017b. New Jersey Coastal Management Program. Available at: http://www.state.nj.us/dep/cmp/. Last updated on February 7, 2017. Accessed on May 12, 2017.

New Jersey Department of Environmental Protection (NJDEP). 2017c. Division of Coastal Engineering completed projects. Available at: http://www.nj.gov/dep/shoreprotection/completed.htm. Accessed on October 23, 2017.

New Jersey Department of Environmental Protection (NJDEP) Compliance & Enforcement. 2016. Noise Control Act. Available at: http://www.nj.gov/dep/enforcement/noise-control.html. Accessed on December 7, 2016.

New Jersey Department of Environmental Protection (NJDEP) Division of Land Use Regulation. 2016. Special areas. Available at: http://www.nj.gov/dep/landuse/specialareas.html#47. Last updated January 4, 2016. Accessed on May 12, 2017.

New Jersey Department of Labor and Workforce Development. 2012. American Community Survey income page. Available at: http://lwd.dol.state.nj.us/labor/lpa/industry/incpov/2010income.html. Accessed on October 22, 2017.

New Jersey Environmental Justice Alliance. 2015. Superstorm Sandy Child and Family Health Study Finds Lingering Effects of Mental Health Distress, PTSD and Depression. Wednesday, July 29. Available at: http://njeja.org/?p=1550. Accessed on November 1, 2017.

New York State Office of Parks, Recreation and Historic Preservation. 2015. *Final Master Plan/Final Environmental Impact Statement for Governor Alfred E. Smith/Sunken Meadow State Park*. July 15.

Newark Water Group. 2014. *Stormwater and Flooding. Bringing the City of Newark's Stormwater Management System into the 21st Century.* Available at: http://newarkstormwater.com/stormwater-flooding/. Accessed on October 16, 2017.

Press of Atlantic City. 2013. Bayfront Ghost Town in Maurice River Township Undergoing an Ecotourism Transformation. Available at: http://www.pressofatlanticcity.com/news/breaking/bayfront-ghost-town-in-maurice-river-township-undergoing-an-ecotourism/article_85da9a3c-89dd-11e2-97de-001a4bcf887a.html. Accessed on November 1, 2017.

Ray, G.L. 2000. Infaunal Assemblages on Constructed Intertidal Mudflats at Jonesport, Maine (USA). Volume 40, Issue 12, December.

Saltmarsh Habitat & Avian Research Program (SHARP). 2014. *2014 Compiled Annual Report*. Available at: http://www.tidalmarshbirds.org/wp-content/uploads/downloads/2015/05/SHARP_overview_report_2014.pdf. Accessed on October 12, 2017.

Sebold, K.R. and S.A. Leach. 1991. Historic Themes and Resources within the New Jersey Copastal Heritage Trail Route, U.S. Department of the Interior, National Park Service, Historic American Buildings Survey/Historic American Engineering Record. Available at: https://www.nps.gov/parkhistory/online_books/nj2/index.htm. Accessed on October 31, 2017.

U.S. Army Corps of Engineers (USACE). 2014. *Environmental Assessment: Channel Maintenance & Beneficial Use of Dredged Material Projects, New Jersey Intracoastal Waterway, Ocean and Cape May Counties, New Jersey, June*.

U.S. Army Corps of Engineers (USACE). 2016a. New Jersey Intracoastal Waterway. Available at: http://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/490826/new-jersey-intracoastal-waterway/. Accessed on May 16, 2017.

U.S. Army Corps of Engineers (USACE). 2016b. East Point Lighthouse, NJ. Available at: http://www.nap.usace.army.mil/Missions/Factsheets/Fact-Sheet-Article-View/Article/558287/east-point-lighthouse-nj. Accessed on May 16, 2017.

U.S. Census Bureau. 2017. American Fact Finder. Available at: https://factfinder.census.gov/faces/nav/jsf/pages/index.xhtml. Accessed on November 1, 2017.

U.S. Environmental Protection Agency (USEPA). 1978. Protective Noise Levels (550979100). Available at: http://nepis.epa.gov. Accessed on August 4, 2017.

U.S. Environmental Protection Agency (USEPA). 2016a. *Designations and Permitting Requirements for the 2015 Ozone Standards. National Ambient Air Quality Standards.* Available at: https://www.epa.gov/sites/production/files/2015-10/documents/20151001designations_permitting.pdf. Accessed on July 26, 2017.

U.S. Environmental Protection Agency (USEPA). 2016. *What Climate Change Means for New Jersey.* EPA 430-F-16-032. Available at: https://www.epa.gov/sites/production/files/2016-09/documents/climate-change-nj.pdf. Accessed on July 11, 2017.

U.S. Environmental Protection Agency (USEPA). 2017a. Green Book – New Jersey nonattainment/maintenance status for each county by year for all criteria pollutants. Available at: https://www3.epa.gov/airquality/greenbook/anayo_nj.html. Accessed on July 26, 2017.

U.S. Environmental Protection Agency (USEPA). 2017b. EPA's Response to New Jersey. Available at: https://www.epa.gov/ozone-designations/ozone-designations-2015-standards-new-jersey-state-recommendations-and-epa. Accessed on January 23, 2018.

U.S. Fish and Wildlife Service (USFWS). 1991. Swamp pink (*Helonias bullata*) recovery plan. Newton Corner, Massachusetts. 56 pp. Available at: https://ecos.fws.gov/docs/recovery_plan/910930c.pdf. Accessed on October 16, 2017.

U.S. Fish and Wildlife Service (USFWS). 1993. Knierskern's beaked rush (*Rhynchospora knieskernii*) recovery plan. Hadley, Massachusetts. Available at: https://ecos.fws.gov/docs/recovery_plan/930929b.pdf. Accessed on October 16, 2017.

U.S. Fish and Wildlife Service (USFWS). 1995a. American chaffseed (*Schwalbea americana*) recovery plan. Hadley, Massachusetts. Available at: https://ecos.fws.gov/docs/recovery_plan/950929c.pdf. Accessed on October 16, 2017

U.S. Fish and Wildlife Service (USFWS). 1995b. Sensitive joint-vetch (*Aeschynomene virginica*) recovery plan. Hadley, Massachusetts. 55 pp. Available at: https://ecos.fws.gov/docs/recovery_plan/950929b.pdf. Accessed on October 16, 2017.

U.S. Fish and Wildlife Service (USFWS). 2015. Migratory Bird Treaty Act – birds protected. Updated September 16, 2015. Available at: https://www.fws.gov/birds/policies-and-regulations/laws-legislations/migratory-bird-treaty-act.php. Accessed on October 18, 2017.

U.S. Fish and Wildlife Service (USFWS). 2016a. Species profile for northern long-eared Bat (*Myotis septentrionalis*). Available at: http://ecos.fws.gov/ecp0/profile/speciesProfile.action?spcode=A0JE. Accessed on September 22, 2016.

U.S. Fish and Wildlife Service (USFWS). 2016b. USFWS environmental conservation online system species profile for red knot (*Calidris canutus rufa*). Available at: http://ecos.fws.gov/tess_public/profile/speciesProfile.action?spcode=B0DM. Accessed on January 12, 2017.

U.S. Fish and Wildlife Service (USFWS). 2016c. Bald and Golden Eagle Protection Act. Last updated February 1, 2016. Available at: https://www.fws.gov/midwest/midwestbird/eaglepermits/bagepa.html. Accessed on October 23, 2017.

U.S. Fish and Wildlife Service (USFWS). 2017a. USFWS National Wetlands Inventory. Wetlands Mapper. Available at: https://www.fws.gov/wetlands/data/mapper.html. Accessed on May 22, 2017.

U.S. Fish and Wildlife Service (USFWS). 2017b. Wetland Classification Codes. Available at: https://www.fws.gov/wetlands/Data/Wetland-Codes.html. Accessed on May 22, 2017.

U.S. Fish and Wildlife Service (USFWS). 2017c. Birds of Conservation Concern. Available at: https://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php. Accessed on October 16, 2017.

Western Hemisphere Shorebird Reserve Network (WHSRN). 2017. Delaware Bay. Available at: http://www.whsrn.org/site-profile/delaware-bay. Accessed on October 12, 2017.

Wilber, D.H., and D.G. Clarke. 2007. Defining and assessing benthic recovery following dredging and dredged material disposal. Available at: https://www.westerndredging.org/phocadownload/ConferencePresentations/2007_WODA_Florida/Session3D-EnvironmentalAspectsOfDredging/3%20-%20Wilber%20-%20Defining%20Assessing%20Benthic%20Recovery%20Following%20Dredged%20Material%20Disposal.pdf. Accessed on October 19, 2017.

10.0 APPENDICES

Appendix A American Littoral Society Proposal for Hurricane Sandy Coastal Resilience Competitive Grants: Creating a Resilient Delaware Bay Shoreline in Cape May and Cumberland Counties (NJ) submitted to National Fish and Wildlife Foundation, Federal Financial Assistance Grant Number: 43429

Appendix B Description of the Project

- B1 Thompsons Beach Marsh Restoration and Enhancement Project Description
- B2 Draft Monitoring Framework
- B3 Draft Adaptive Management Plan

Appendix C Agency Correspondence and Permits

- C1 NJDEP Coastal General Permit 24, Waterfront Development Permit, and Water Quality Certificate
- C2 Coastal Zone Management Regulations Compliance Statement
- C3 Essential Fish Habitat Assessment
- C4 USFWS Intra-Service Section 7 Biological Evaluation Form
- C5 NJDEP Special Use Permit Application
- C6 NOAA Essential Fish Habitat and HAPC Mapping Results
- C7 Natural and Historic Resources Land Management Policy Activity Review Form
- C8 USFWS Sponsor Letter
- C9 NJDEP Section 106 SHPO Consultation Email
- C10 USACE Section 404/Section 10 Permit
- C11 NMFS Essential Fish Habitat Consultation Letter
- C12 USACE Section 106 Tribal Consultation Email
- C13 Stockbridge-Munsee Mohican Section 106 Tribal Consultation Email
- C14 Seneca Nation Section 106 Tribal Consultation Email

Appendix D IPaC Query for the Project Area (accessed on May 12, 2017)

Appendix E Sediment Sampling Report