**US Army Corps of Engineers**
Philadelphia District

# FINAL ENVIRONMENTAL ASSESSMENT

## Maurice River Federal Navigation Channel
## and
## Beneficial Use of Dredged Material
## Cumberland County, New Jersey

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**March 2023**

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# FINDING OF NO SIGNIFICANT IMPACT

## MAURICE RIVER FEDERAL NAVIGATION CHANNEL AND BENEFICIAL USE OF DREDGED MATERIAL CUMBERLAND COUNTY, NEW JERSEY FINAL ENVIRONMENTAL ASSESSMENT

The U.S. Army Corps of Engineers, Philadelphia District (USACE) has conducted an environmental analysis in accordance with the National Environmental Policy Act of 1969 (NEPA), as amended. Based on when NEPA was initiated, this Environmental Assessment (EA) was developed in accordance with the applicable regulations, policies, and procedures, including the Corp's NEPA regulations in Engineers Regulation (ER) 200-2-2 and the previous CEQ NEPA regulations at 40 CFR Part 1500 (NEPA Implementing Regulations). The Final Environmental Assessment (EA) addresses maintenance dredging and a beneficial use of dredged material placement opportunity in the lower Maurice River, Cumberland County, New Jersey.

The Maurice River Federal Navigation Channel, adopted as HD 59-644 in 1910 and modified as HD 73-275 in 1935, provides for a channel 7 feet deep and 150 feet wide in Delaware Bay across Maurice Cove to the mouth; thence a channel 7 feet deep, 100 feet wide to the fixed bridge at Millville, 21.5 miles above the mouth, and then 60 feet wide to the mill dam, a further distance of one-half mile, including a turning basin 7 feet deep at Millville. The total length of the Federal navigation project is about 24 miles. The lower section of the Federal channel requires periodic maintenance dredging to authorized depth. This section was last dredged in 1996. USACE conducts regional sediment management and engineering with nature practices to beneficially use the dredged material to keep the dredged sediments within the natural system.

In addition to a "no action" plan, 2 other dredged material placement alternative plans were evaluated and described in Section 3.0 of the EA. The recommended plan is to dredge 75,000-100,000 cubic yards within a portion of the lower Maurice River federally-authorized navigation channel between stations 1+500 to 13+000 in 2023 and beneficially use the material by hydraulically pumping it into two eroded (flooded) marsh areas approximately 9 acres in size within the Heislerville Wildlife Management Area (WMA). The initial sediment placement operation will be monitored to observe sediment properties and will inform future placement operations. In a second maintenance cycle, anticipated to occur 1-3 years after the initial placement, an additional 25,000-50,000 cy will be dredged between these stations where needed, to the authorized depth of 7 ft MLLW with 2 ft allowable over-depth. The objective of the beneficial use placement of the dredged material within the flooded marsh system is to raise the substrate elevation within intertidal mudflats and vegetated low marsh that has been continually subjected to inundation and erosion. Dredging will remove critical shoaling to maintain a safe and reliable navigation channel for commercial and recreational vessels.

For all alternatives, the potential effects of the proposed operation were evaluated, as appropriate. A summary assessment of the potential effects of the recommended plan are listed in Table 1:

**Table 1: Summary of Potential Effects of the Recommended Plan**

| | Insignificant effects | Insignificant effects as a result of mitigation* | Resource unaffected by action |
|---|---|---|---|
| Aesthetics | ☒ | ☐ | ☐ |
| Air quality | ☒ | ☐ | ☐ |
| Aquatic resources/wetlands | ☒ | ☐ | ☐ |
| Invasive species | ☐ | ☐ | ☒ |
| Fish and wildlife habitat | ☒ | ☐ | ☐ |
| Threatened/Endangered species/critical habitat | ☒ | ☐ | ☐ |
| Historic properties | ☐ | ☐ | ☒ |
| Other cultural resources | ☐ | ☐ | ☒ |
| Floodplains | ☐ | ☐ | ☒ |
| Hazardous, toxic & radioactive waste | ☐ | ☐ | ☒ |
| Hydrology | ☐ | ☐ | ☒ |
| Land use | ☒ | ☐ | ☐ |
| Navigation | ☒ | ☐ | ☐ |
| Noise levels | ☐ | ☐ | ☒ |
| Public infrastructure | ☐ | ☐ | ☒ |
| Socio-economics | ☐ | ☐ | ☒ |
| Environmental justice | ☐ | ☐ | ☒ |
| Soils | ☒ | ☐ | ☐ |
| Tribal trust resources | ☐ | ☐ | ☒ |
| Water quality | ☒ | ☐ | ☐ |
| Climate change | ☐ | ☐ | ☒ |

All practicable and appropriate means to avoid or minimize adverse environmental effects were analyzed and incorporated into the recommended plan. Best management practices (BMPs) as detailed in the EA will be implemented, if appropriate, to minimize impacts. Avoidance and minimization measures will include scheduling dredging and placement operations during the low productivity months of the year. During construction, stabilization of the area may include a combination of a turbidity curtain, earthen berms, hay bales and/or coir logs to contain the fluidized sediments. The placement site will be monitored before, during, and after operations to assess the intertidal mudflats and low marsh development. Since this is a beneficial use of dredge material to provide sediment enrichment to the marsh ecosystem, no compensatory mitigation is required as part of the recommended plan.

Public review of the draft EA has been conducted and all comments submitted during the public review period have been addressed in the final report.

Pursuant to Section 7 of the Endangered Species Act of 1973 (ESA), as amended, the USACE determined that the recommended plan may affect but is not likely to adversely affect the following federally listed species or their designated critical habitat: piping plover, red knot, eastern black rail, Atlantic sturgeon and roseate tern. Consultation with the U.S. Fish and Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) has been completed.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, the USACE determined that the recommended plan has no effect on historic properties. Consultation with the state historic preservation officer has been completed.

Pursuant to the Clean Water Act of 1972, as amended, the discharge of dredged or fill material associated with the recommended plan has been found to be compliant with section 404(b)(1) Guidelines (40 CFR 230). The Clean Water Act Section 404(b)(1) Guidelines evaluation is found in Appendix C of the EA.

A water quality certification pursuant to Section 401 of the Clean Water Act has been obtained from the New Jersey Department of Environmental Protection (NJDEP) prior to construction. All conditions of the water quality certification shall be implemented in order to minimize adverse impacts to water quality.

A determination of consistency with the New Jersey Coastal Zone Management program, pursuant to the Coastal Zone Management Act of 1972, has been obtained from the NJDEP and pursuant to the Delaware Coastal Management Program from the Delaware Department of Natural Resources and Environmental Control (DNREC) prior to construction. All conditions of the consistency determinations shall be implemented to minimize adverse impacts to the coastal zone.

All applicable environmental laws have been considered and coordinated with appropriate agencies and officials with the public review of this EA. An Essential Fish Habitat

(EFH) assessment was completed and provided to the NMFS, pursuant to the Magnuson Stevens Fisheries Conservation and Management Act.

Technical, environmental, and cost effectiveness criteria used in the formulation of alternative plans were those specified in the Water Resources Council's 1983 Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies. All applicable laws, executive orders, regulations, and local government plans were considered in evaluation of alternatives. Based on this report, the reviews by other Federal, State and local agencies, Tribes, input of the public, and the review by my staff, it is my determination that the recommended plan would not cause significant adverse effects on the quality of the human environment; therefore, preparation of an Environmental Impact Statement is not required.

14 March 2023

Date

RB Digitally signed by BRIGANTTI.RAMON.1181985263 Date: 2023.03.14 13:26:56 -04'00'

Ramon Brigantti
Lieutenant Colonel, Corps of Engineers
District Engineer

# EXECUTIVE SUMMARY

The U.S. Army Corps of Engineers, Philadelphia District, (USACE) has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, for the Maurice River Maintenance Dredging and Beneficial Use of Dredged Material Project in Cumberland County, New Jersey.

The Maurice River Federal Navigation Channel, adopted as HD 59-644 in 1910 and modified as HD 73-275 in 1935, provides for a channel 7 feet deep and 150 feet wide in Delaware Bay across Maurice Cove to the mouth; thence a channel 7 feet deep, 100 feet wide to the fixed bridge at Millville, 21.5 miles above the mouth, and then 60 feet wide to the mill dam, a further distance of one-half mile, including a turning basin 7 feet deep at Millville. The total length of the Federal navigation project is about 24 miles. The Maurice River supports local fishing, the oyster industry and ship repair industries.

For the initial maintenance dredging operation scheduled to begin in 2023, the Philadelphia District proposes to dredge approximately 75,000-100,000 cubic yards (cy) of a portion of the lower Maurice River federally-authorized navigation channel between stations 1+500 to 13+00 and beneficially use the material by placing it in eroded marsh area within the Heislerville Wildlife Management Area (WMA). In a second maintenance cycle, an additional 25,000-50,000 cy is anticipated to be dredged between these stations, where needed, to the authorized depth of 7 ft MLLW with 2 ft allowable over-depth. Additional future maintenance dredging cycles will occur as needed, pending surveying and funding. The initial dredging operation will employ a hydraulic pipeline dredge and will require a minimum of 12 weeks of in-water work and will occur within a September to February environmental window.

Hydraulic dredging will periodically remove critical shoaling in priority areas within this reach identified by channel users to maintain a safe and reliable navigation channel for commercial and recreational vessels. Dredging of the Federal navigation channel in Maurice River last occurred in 1996. A secondary objective is to beneficially use the channel sediments removed from the channel for sediment enrichment within a nearby flooded degraded marsh system.

Tidal wetlands provide some of the most productive natural ecosystems in the world and are widely recognized for their important ecological functions. The services they provide include flood protection for coastal communities, maintenance of water quality, habitat for many species of fish and wildlife, and carbon sequestration. This EA evaluates a No Action alternative and alternative placement plans to restore protective marsh habitat within an area that is now flooded marsh. Excessive inundation within a marsh over time results in the loss of vegetation. Normally, tidal wetlands build vertically (accrete) through the accumulation of organic matter from autochthonous below-ground root production and the importation and trapping of suspended sediments in tidal flow by saltmarsh vegetation. The importation and deposition of new sediments is essential to the long-term sustainability of coastal wetlands. Once inundated long-term vegetation dies off, the extensive mudflats and open water areas can no longer accrete sediments to counter land subsidence or sea level rise.

The preferred alternative plan entails pumping channel dredged material into a rapidly degrading and excessively flooded area within the Northwest Reach of the Heislerville Wildlife Management Area. During the operation, stabilization measures such as turbidity curtains, earthen berms, and/or coir logs may be implemented to build the natural features and minimize adverse effects on water quality. The initial sediment placement will be monitored to observe sediment properties and will inform future placement operations. A second maintenance dredging and placement cycle is anticipated to occur approximately 1-3 years later. Building elevation with mixed sediments will create a varied landscape that will augment the mudflats, intertidal shallows, and encourage more resilient low marsh vegetation. The proposed project is a channel maintenance project with a beneficial use component in support of a flooded and degrading salt marsh under threat by sea level rise. The first-year placement will provide storm surge protection to the Heislerville dike and the Heislerville Wildlife Management Area and improvement of water quality through the reduction of marsh erosion.

Impacts associated with implementing the maintenance dredging/beneficial use placement project include temporary, short-term effects from construction to the bottom substrate within 11,500 linear feet of channel and to approximately 18 acres of flooded marsh edge consisting of subtidal, intertidal and low marsh habitats, increased temporary water turbidity and noise; temporary impacts to aesthetics, and the temporary displacement of wildlife from the area during a low productivity period (September through February).

Through the NEPA process every effort has been made to maximize environmental and ecosystem benefits while minimizing impacts through the use of stabilization techniques, off-season project implementation, and application of adaptive management measures during construction. The proposed plan incorporates lessons learned from projects of the Seven Mile Island Innovation Lab (SMIIL) that have beneficially placed fine-grained and sandy sediments in or adjacent to wetlands. Primary partners in the SMIIL include the New Jersey Department of Environmental Protection, the Wetlands Institute, and the U.S. Army Corps of Engineers. The University of Pennsylvania is partnering on SMIIL projects and has been contracted to assist with monitoring and landscape architecture design assistance for the Maurice River dredging and placement project. Environmental compliance coordination will be ongoing with responsible resource agencies as documented in the EA.

**ENVIRONMENTAL ASSESSMENT**

**MAURICE RIVER FEDERAL NAVIGATION CHANNEL**

**AND**

**BENEFICIAL USE OF DREDGED MATERIAL**

**Cumberland County, New Jersey**

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## 1.0 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Philadelphia District has prepared this Environmental Assessment (EA) in compliance with the National Environmental Policy Act (NEPA) of 1969, as amended, for the Maurice River Maintenance Dredging and Beneficial Use of Dredged Material Project in Cumberland County, New Jersey. The recommended plan is to conduct maintenance dredging of a portion of the lower Maurice River federal navigation channel to authorized depth of 7 ft MLLW with 2 ft allowable overdepth between Station 1+500 and Station 13+000 in the lower river. A hydraulic dredge will remove critical shoaling in priority areas identified by channel users to maintain a safe and reliable navigation channel for commercial and recreational vessels. Dredging of the Federal navigation channel in Maurice River last occurred in 1996. A secondary objective is to beneficially use the dredged channel sediments by placing them in a degraded (flooded) marsh within the Heislerville Wildlife Management Area (WMA). The selected placement locations for the beneficial use (BU) placement of dredged material were done in partnership with the state of New Jersey Department of Environmental Protection (NJDEP).

### 1.1 Study Authority

The Maurice River Federal Navigation Channel, adopted as HD 59-644 in 1910 and modified as HD 73-275 in 1935, provides for a channel 7 feet deep and 150 feet wide in Delaware Bay across Maurice Cove to the mouth; thence a channel 7 feet deep, 100 feet wide to the fixed bridge at Millville, 21.5 miles above the mouth, and then 60 feet wide to the mill dam, a further distance of one-half mile, including a turning basin 7 feet deep at Millville. The total length of the Federal navigation project is about 24 miles. The Federal channel requires periodic maintenance dredging to authorized depth. A portion of the channel was last dredged in 1996.

The regulation of dredged material placement within waters of the United States is a shared responsibility of the U.S. Environmental Protection Agency (USEPA) and USACE. The Water Resources Act of 1992, Section 204 Beneficial Use of Dredged Material (Public Law (PL) 102-580) first established the authority for USACE to implement ecosystem benefit projects in connection with dredging. The USEPA (2007) prepared a national guidance document that explains the role of the Federal Standard in implementing beneficial uses of dredged material from USACE maintenance dredging projects. It serves as a companion document to the joint USEPA/USACE (2007) Beneficial Use Planning Manual. USACE conducts regional sediment management and engineering with nature practices in order to keep dredged sediments within the natural system as the least cost option rather than removing the much-needed sediments in eroded areas to be placed upland in confined disposal facilities (CDFs).

### 1.2 Project Location and Setting

The project area is located in Maurice River Township, Cumberland County, New Jersey (39.2279, -75.0211). Maurice River Township is located 33 miles southwest of Atlantic City, New Jersey and 50 miles south of Philadelphia, Pennsylvania. The project area includes the Maurice River navigation channel at the confluence with the Delaware Bay up to Bivalve and the northwest reach of the of

the Heislerville Wildlife Management Area and dike. Commercial Township lies to the west of Maurice River and Maurice River Township lies to the east of the river (**Figure 1**).

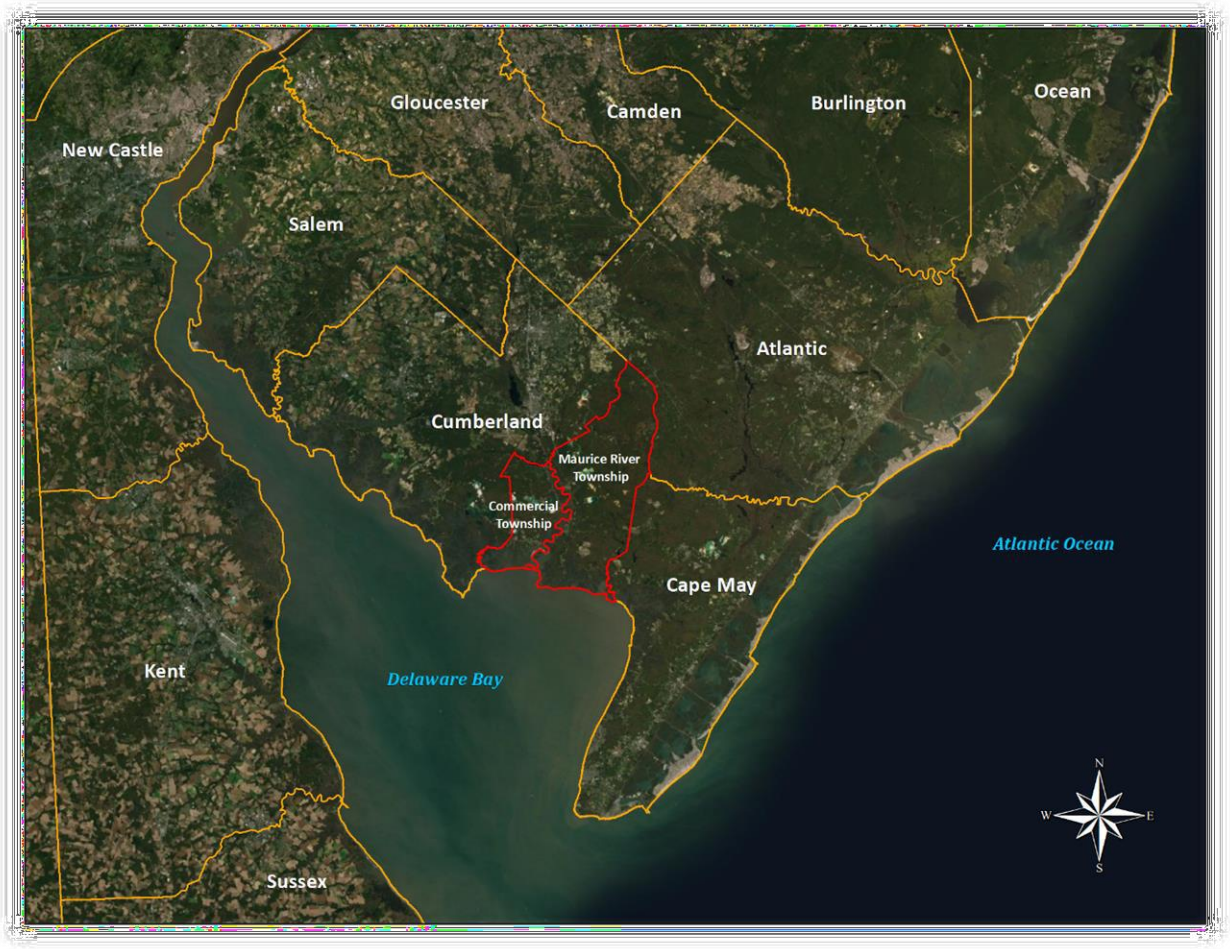



**Figure 1: Maurice River Township and Commercial Township, Cumberland County, New Jersey.**

The majority of New Jersey's coastal wetlands occur along the Delaware Bay shoreline. These areas serve as breeding grounds and migratory stopover area for many important coastal avian species. The surrounding rural landscape provides expansive tidal wetlands, farmland, forested areas, and narrow sand beaches, all part of the nationally designated Delaware Estuary. Salt marshes in the Cumberland Bayshore landscape have played a defining role in the region. The marshes act as nurseries for a wide variety of organisms and are an essential habitat for more than 300 species of migratory birds, including the red knot, sanderlings, bald eagles and other raptors.

The Heislerville Fish and Wildlife Management Area (WMA) is located on the eastern side of the Maurice River. It is managed by the New Jersey Department of Environmental Protection (NJDEP) and comprises 7,670 acres of tidal marsh, shoreline, woodlands, and fields (**Figure 2**). It also possesses 310 acres of coastal impoundments. The impoundments provide exposed mudflat for waterfowl and shorebird foraging in the spring. During the growing season, emergent aquatic vegetation grows and provides a further contribution to the mudflat's natural seed bank until fall when the impoundments are flooded again for waterfowl.

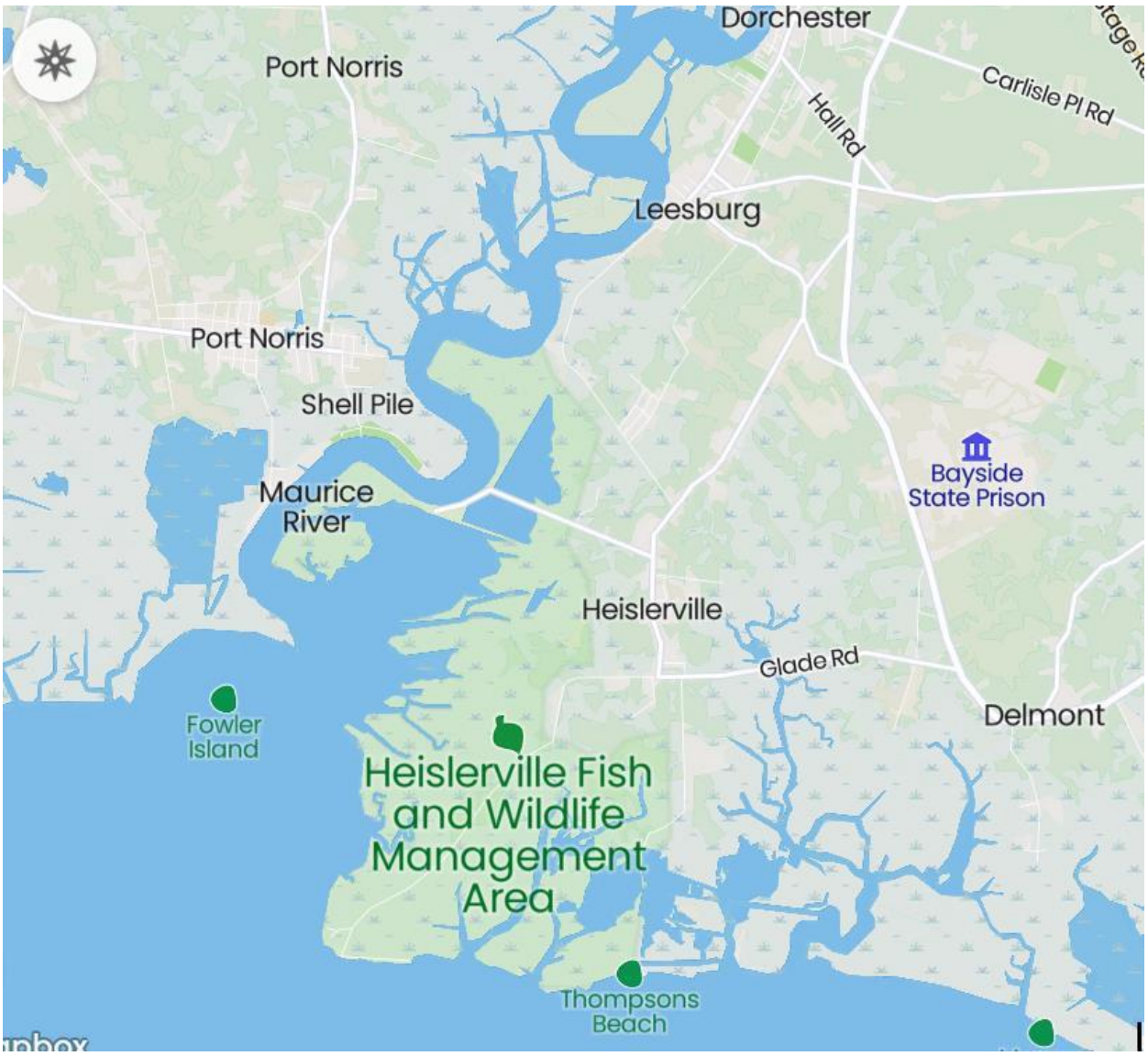



**Figure 2: Heislerville Fish and Wildlife Management Area (Google Maps).**

Located on the developed east side of the river are several businesses such as Surfside Foods, Port Norris Marina and Cape May Salt Oyster Farm as well as Rutgers University's Haskin Shellfish Research Laboratory and the Bayshore Center at Bivalve. On the opposite riverbank near Matts Landing Road are several marinas (**Figure 3**).


**Figure 3: Businesses along Maurice River in the project vicinity (Google Maps).**

### 1.3 Scope of Action

The Maurice River project is designed to beneficially use dredged sediments as a resource to raise elevations incrementally within a flooded marsh area within the Heislerville WMA in order to assist in the re-establishment of valuable mudflats and vegetated wetlands.

**Figure 4: Looking south from the Heislerville dike towards the mouth of Maurice River (Photo courtesy of J.Benigno, USACE).**

**Figure 5: Heislerville dike looking east from the cross-dike junction-stable dike area (photo courtesy of J. Benigno, USACE).**

**Figure 6: Heislerville dike looking west from the cross-dike junction: critical area of the Heislerville dike (photo courtesy of J. Benigno, USACE).**


**Figure 7: Highly vulnerable area of Heislerville dike ~1,500 linear feet (Google Earth)**

## 1.4 Relevant Prior Actions Near the Maurice River Project Area

While various physical and environmental conditions along Maurice River, Maurice Cove, and the surrounding area have been in flux for over 100 years, a number of efforts have been undertaken more recently to improve the health and sustainability of this region against further degradation. The following sections briefly summarize a selection of various actions undertaken by federal, state, and other entities to manage the health of the region in the face of shoaling, erosion, subsidence, flooding, sea level rise, and other ongoing threats.

### 1.4.1 Prior Federal Actions

*1987 Delaware River Comprehensive Navigation Study Maurice River, New Jersey, Early Action Study*

The objective of the study was to consider modifications to the existing federal navigation project in Maurice River cove.

*1991 Delaware Bay Coastline- Delaware and New Jersey Reconnaissance Report*

This study was conducted in response to a resolution adopted by the Committee on Public Works and Transportation of the U.S. House of Representatives, dated 1 October 1986. The principal purpose was to investigate the erosion problems along the Delaware Bay shorelines of Delaware and New Jersey and determine whether further Federal studies were warranted.

*1995 Environmental Assessment, Maintenance Dredging and Beneficial Use of Dredged Material at Maurice River, Cumberland County, New Jersey*

The primary objective of maintenance dredging of the Maurice River channel is to provide safe navigable passage into Maurice River from the Delaware Bay, as authorized by Congress. A secondary objective was to utilize the dredged material beneficially for erosion control of the surrounding marsh habitat and adjacent communities. Dredging was completed in 1996. The dredged material was placed in an upland confined disposal facility (CDF) 30 miles away in Cape May.

*2006 East Point, Maurice River Township, Cumberland County, New Jersey Section 14 Flood Control Act of 1946, as amended, Emergency Shoreline Protection*

For storm damage and protection and erosion control along the unprotected beachfront road in East Point, the selected plan was to place three layers of stone-filled gabion baskets along 342 feet of beachfront. The total footprint of the gabion revetment structure is approximately 4,752 square feet.

*2020 New Jersey Dredged Material Utilization Feasibility Study*

The Maurice River communities of Bivalve, Shellpile, Port Norris, and Maurice River Township were included in the Dredged Material Utilization Study (DMU)(USACE,2020) for potential levee/dike construction. The area was not selected for beneficial use of material dredged from the Delaware River main channel because the material was insufficient for levee construction. Overall, the available dredged material does not appear to be suitable for USACE levee construction and would

require augmentation to improve its suitability. Further, the anticipation of a high cost of levee construction offsets the potential for significant damage reduction.

### 1.4.2 Prior Nonfederal Actions

*1997 Maurice River Dike*

In 1996 the NJDEP Division of Engineering and Construction received permission to reconstruct ~4000 feet of dike in Heislerville WMA along the Maurice River. The top elevation of the dike ranges from 4.7 feet to 11.4 feet above mean low water, top width was built to 12 feet, 1. 5: 1 side slopes with a toe width of 35 inches. The dike is constructed with dense grade aggregate and/or 1-5 roadway fill, and the side slopes armored with 12-24 inch recycled concrete rubble.

*1998 Maurice River Breakwater*

NJDEP used barges in 1998 as foundations for breakwaters along the point of Basket Flats (**Figure 8**). The project consisted of tying the barges off to driven piles and filling them with concrete rubble with 2-4 ton capstones in order to form a breakwater with an elevation of 13 ft above MLW. The barges were utilized in order to provide buoyancy and minimize settlement. Erosion protection involved stone filled gabion baskets or Tensar mats on 100 feet of either side of the breakwater.

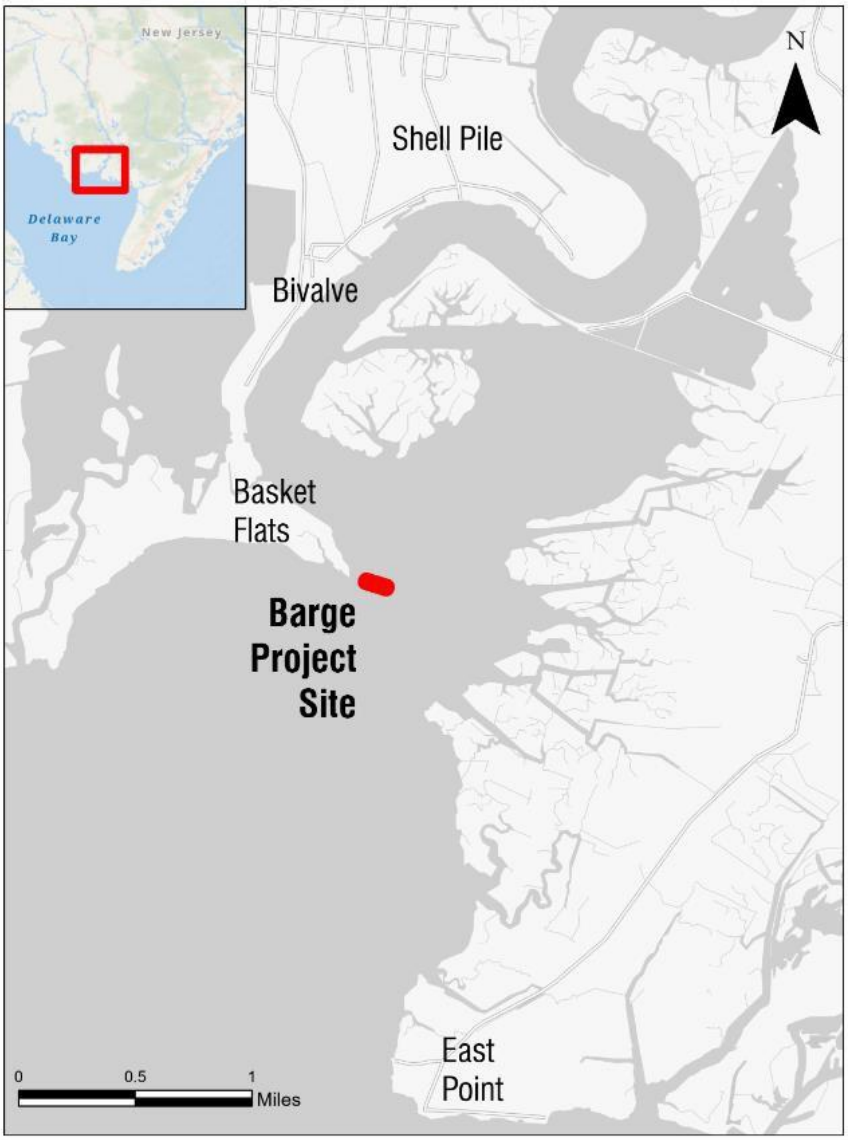



**Figure 8: Basket Flats sunken barge breakwater project site.**

*2007 New Jersey Marine Police Station Bulkhead Replacement*

The Port Norris marine police station has incurred extension damage due to erosion. A bulkhead was erected in October 2007 to combat the continued shoreline deterioration and structural damage.

*2012 – 2013 Dike Break and Temporary Repair*

The dike that protects Matts Landing Road was breached during Hurricane Sandy in October 2012, fixed temporarily, and breached again in December 2012. The dike was subsequently breached during successive high tides. Repairs were completed in April 2013 to halt the continuous breaching (2015 Maurice River Strategic Recovery Planning Report).

*2013 Heislerville Impoundment Drawdown*

NJDEP's Division of Fish and Wildlife coordinated with Ducks Unlimited in 2013 to obtain North

American Wetlands Conservation Act funds to refurbish the Heislerville WMA's impoundments. The impoundments, located immediately east of Maurice River along Matts Landing, were transformed from stagnant lakes into palustrine wetland, thereby improving habitat conditions and foraging areas for migratory and local birds. The 2013 work updated the water control structures. The impoundments (**Figure 9)** are now managed in such a way that Impoundment 1 is always flooded, Impoundment 2 is managed to provide habitat for shorebird migration, and Impoundment 3 is drawn down in the spring to expose mudflat, allowing emergent aquatic vegetation during summer before it is flooded during fall.

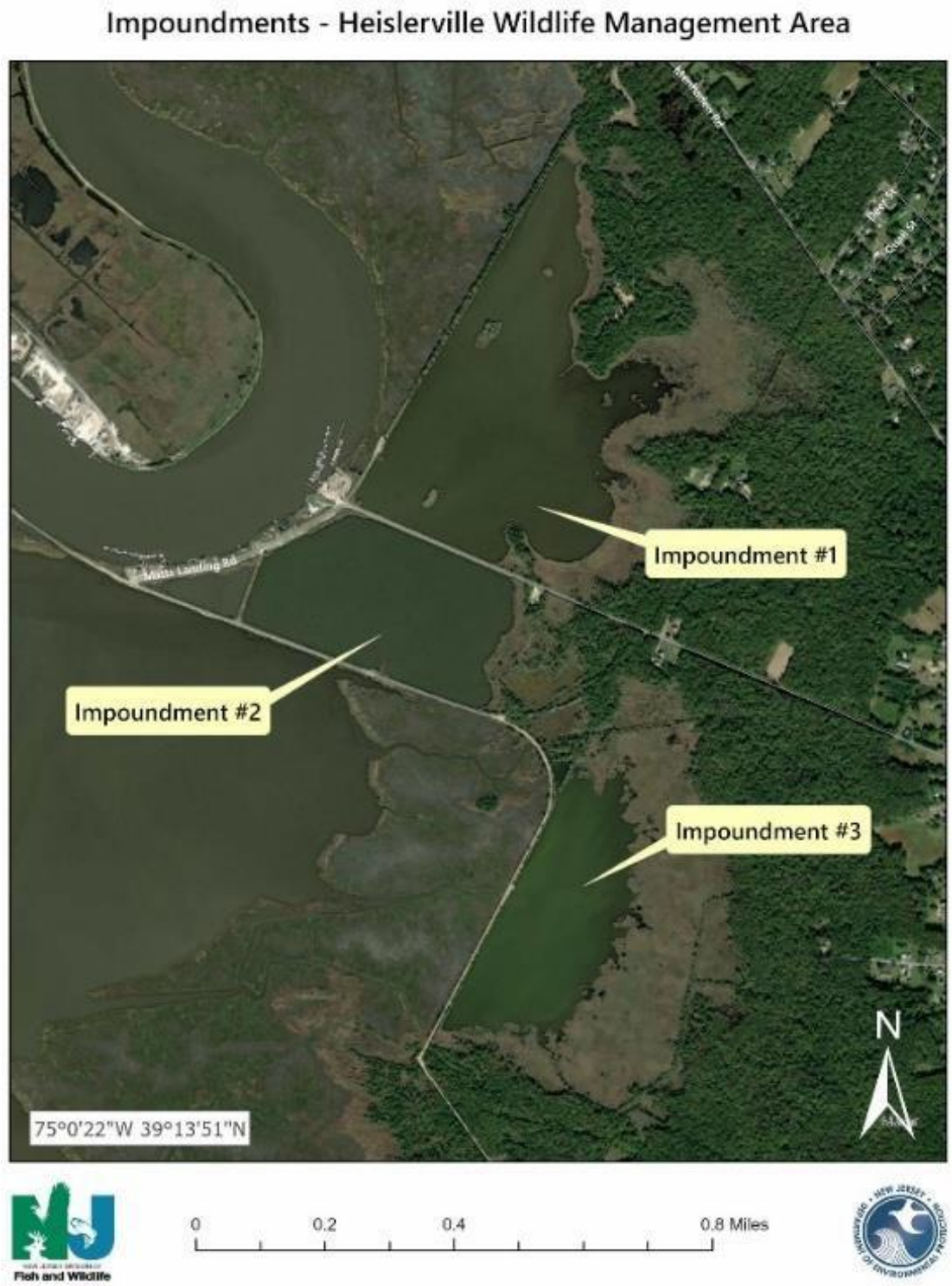



**Figure 9: Heislerville Wildlife Management Area Impoundments.**

*2014 Thompsons Beach Restoration*

From 2013 to 2014 a cooperative effort between NJDEP's Office of Natural Resource Restoration and Office of Engineering and Construction, the Maurice River Township, USFWS, and NOAA worked to address degradation of Thompsons Beach. The area over time has incurred both development and erosion. Thompsons Beach lies to the immediate east of the mouth of the Maurice River at the southeast end of the Heislerville WMA, where it fronts the same greater marsh complex adjoining the mouth of the Maurice River. The effort restored the beach habitat there through removal of rubble, timber, and debris in order to improve the coastal habitat.

*2018 Heislerville Dike Repair*

Following approval in 2017, NJDEP's Office of Coastal Engineering repaired and reinforced the Heislerville dike following a series of recent winter storms. According to plans submitted through an Army Nationwide Permit (NWP) in 2016, the work consisted of placement of concrete armor stone, riprap, dense grade aggregate, and geotechnical fabric along the sides of the dike. The plans also provided for raising 250 feet of the dike's western end. Overall, the project targeted 15 primary areas along the dike within the area shown in **Figure 10**. Following approval and bids, the repair and restoration work was conducted and completed during the summer of 2018.


**Figure 10: Planned extent of the 2018 Heislerville dike repair.**

*2019 East Point Shoreline Stabilization Project*

In 2019, a NJDEP project involved transporting sediment to East Point (along the southeast mouth of the Maurice River) in order to temporarily stabilize the shoreline there and protect the East Point Lighthouse, which has been impacted by years of continued shoreline erosion. Protection was provided along approximately 500 feet of shoreline and consisted of large geotubes and sand mattresses. The lighthouse is located within NJDEP's Division of Fish and Wildlife's Heislerville WMA (**Figure 11**).

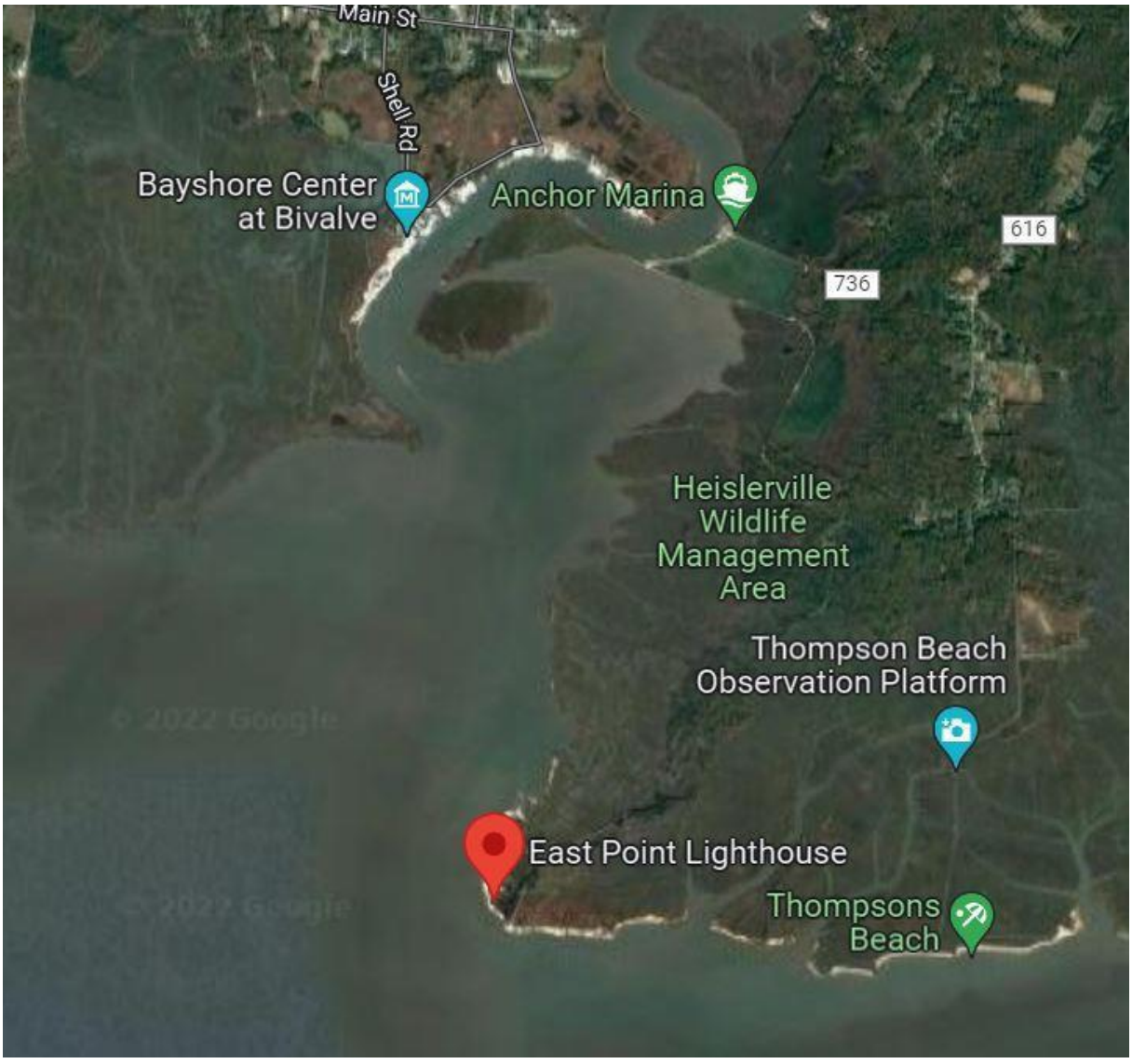



**Figure 11: Eastpoint lighthouse shore stabilization project site.**

*2020 Delaware Estuary Living Shoreline Initiative*

In 2008 Rutgers University developed the Delaware Estuary Living Shoreline Initiative (DELSI) to help stabilize eroding shorelines using a combination of plants, natural structures, and intertidal shellfish to trap sediment, absorb wave energy and provide water filtration. DELSI has worked with public, private, and academic partners to install living shorelines in locations across the estuary, to date, to meet several site-specific goals: stopping landward erosion and/or build shoreline and wetland elevation. The program is funded through grants to reduce water quality impairment through implementation of nonpoint source pollution control projects by the USEPA, the New Jersey Corporate Business Tax, and the Department of Defense Readiness and Environmental Protection Initiative Program.

Across ten different locations within the Maurice River area, DELSI living shoreline projects in total to date, have created approximately 1,630 feet of living shorelines that have led to an increase of 7,775 square feet of wetlands, for an overall net gain of 34,688 square feet of vital wetland habitat. In 2020, Rutgers University's Haskin Shellfish Research Lab, funded by a NJDEP 3019(h) grant, placed 200 feet of oyster castles and oyster shell bags along an eroded wetland bank along the lower east Maurice River bank (**Figures 12 and 13**) to prevent erosion and provide shellfish habitat.


**Figure 12: Location of 2020 DELSI Maurice River living shoreline projects (photo courtesy of J. Benigno, USACE).**

**Figure 13: DELSI Maurice River oyster castles and oyster shell bags 2020 living shoreline project (photo courtesy of D. Bushek, Rutgers University Haskin Research Lab).**

Also under DELSI, and in partnership with the Rutgers University Haskin Research Lab, living shorelines were established immediately north of the current project area in two locations. One living shoreline was installed at Anchor Marine in Heislerville (Matts Landing) in 2010 for shoreline stabilization and habitat enhancement (**Figure 14**). The Matts Landing living shoreline consisted of 1,322 square feet of oyster shell bags and coir logs. Additional shell bags and coir logs were added in 2014 to repair damaged areas; in 2015 to stabilize water outflow paths; and again in 2018 to replaced damaged coir logs. In 2009, further north at the Upper Maurice River site, 130 linear feet of oyster shell bags and coir logs were established (**Figure 14**). At the Upper Maurice River site, the treatment was left to deteriorate naturally. The coir logs deteriorated within two years. The shell bags were able to maintain vegetation however, erosion continued with full deterioration by 2019, whereupon the living shoreline was re-established using shell bags in 2021.

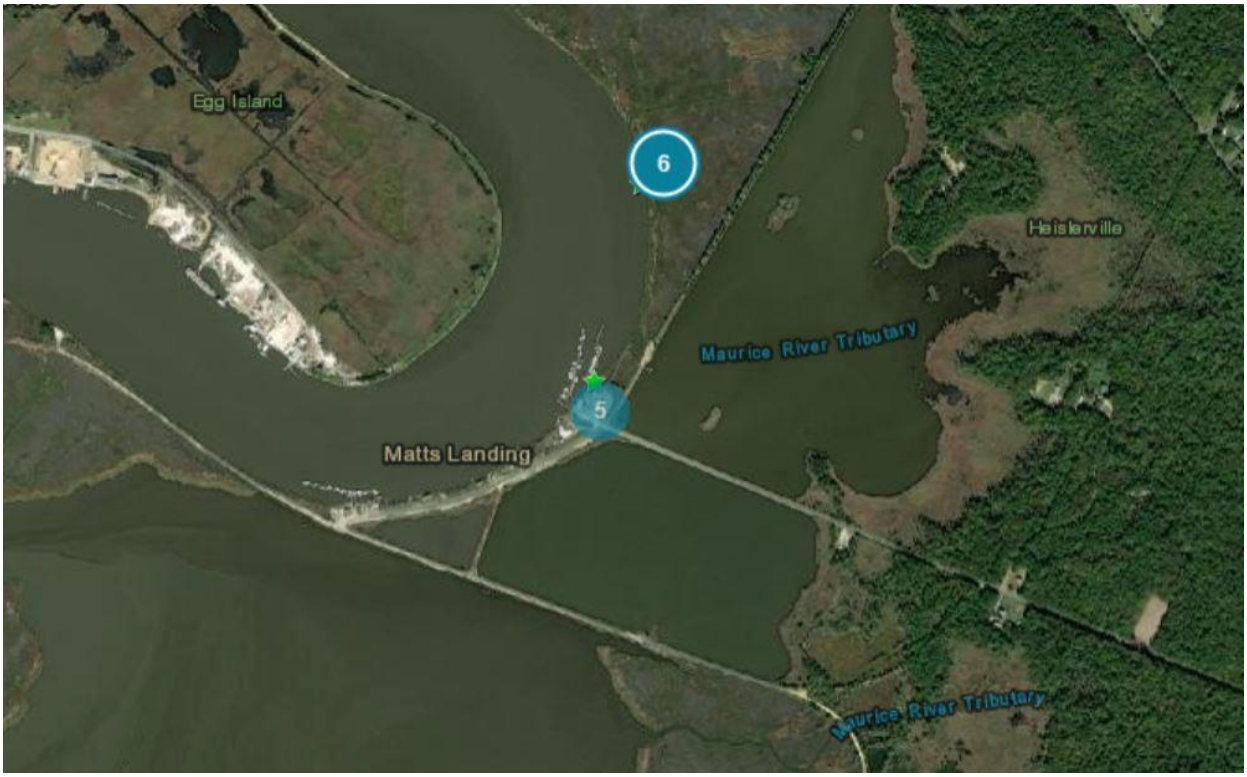



**Figure 14: DELSI Matts Landing (5) and Upper Maurice River (6) oyster castles and oyster shell bags living shoreline project (photo courtesy of the Partnership for the Delaware Estuary).**

## 2.0 PURPOSE, NEED, AND OBJECTIVES

### 2.1 Purpose

The Maurice River Federal channel maintenance dredging will clear shoals to maintain safe navigable depths to 7 feet MLLW plus 2 feet overdepth in areas determined by the project manager in coordination with local maritime users. The dredged material placement location has been developed in coordination with natural resource regulatory agencies and other local project stakeholders. Placement operations of the dredged material is a beneficial use (BU) for the purpose of raising elevations incrementally within the flooded marsh system consisting of expansive subtidal areas, intertidal mudflats and saltmarsh vegetation. Saltmarshes are protective features that provide natural infrastructure protection to the dike and important habitat within the state's WMA.

### 2.2 Need

Periodic maintenance dredging is needed in the lower portion of the Federal channel (between approximately Station 1+500 to Station 13+000) in to remove sediments for navigation safety for recreational and commercial users. Only the lowermost reach of the Federally-authorized channel south of Bivalve to the river mouth at the confluence of Delaware Bay requires the proposed maintenance dredging in 2023 (approximately 11,500 linear feet of channel). Authorized depths are 7 feet deep and

150 feet wide within this reach. The remainder of the Federal-authorized channel continues north with a 100-foot-wide channel of the same depth extending to the fixed bridge upriver at Millville, a total distance of about 24 miles (**Figure 15**). Only the lower section that is proposed for maintenance dredging is less than the authorized depth of 7 feet (MLLW)(**Figure 16).**

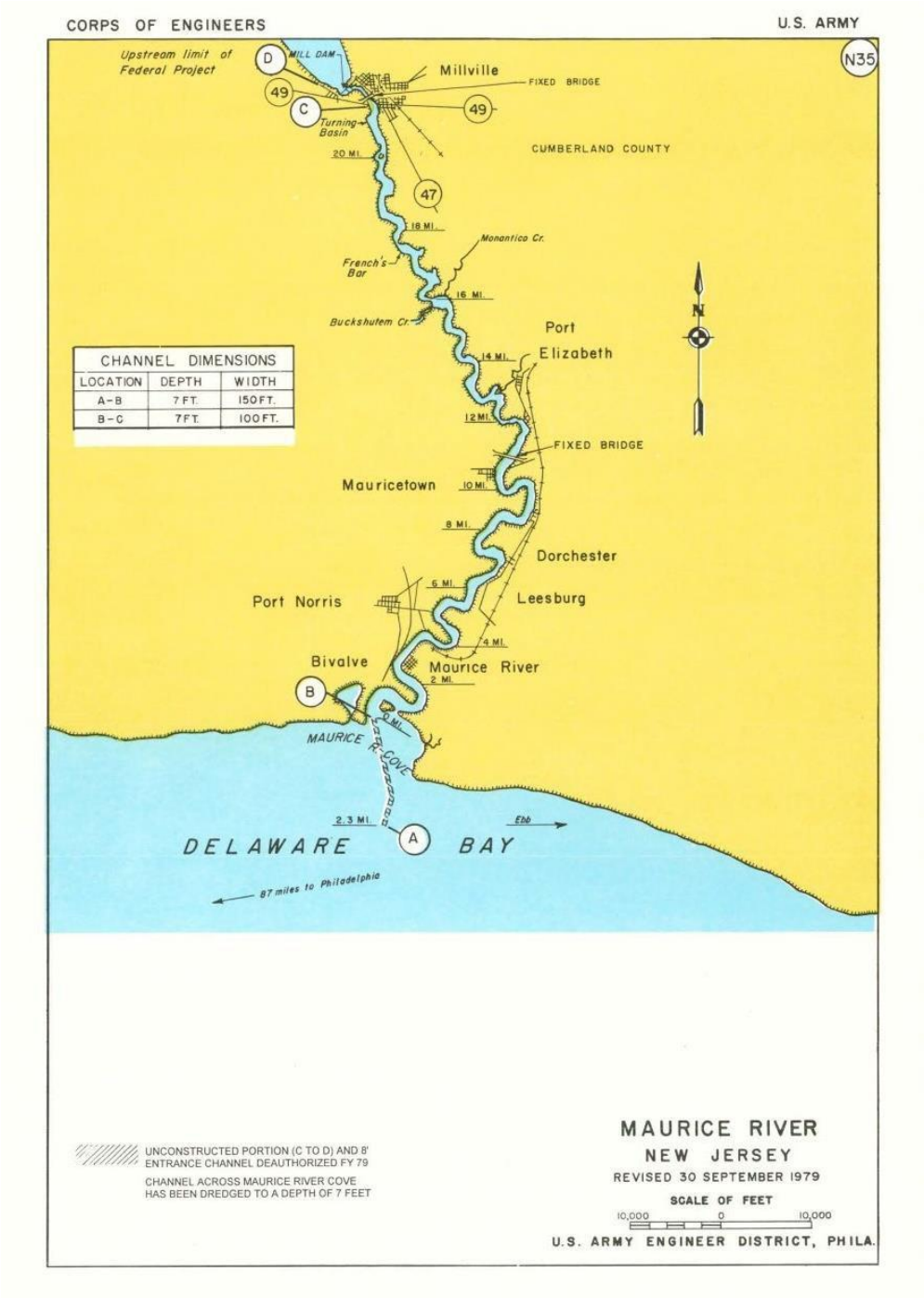



**Figure 15: Maurice River federally-authorized navigation channel.**


**Figure 16: Lowermost section of the Maurice River Federal channel.**

Maintenance dredging within the Maurice River Federal navigation channel has not occurred since 1996. Coastal wetlands throughout the U.S. have been detrimentally altered by diking. These areas have low elevation associated with long-term lack of tidal inundation that prevents sediment accretion. The surrounding area of the lower Maurice River was historically used for salt hay farming (*Spartina*). In the 1930s, wetlands were diked and the hydraulic connection to the river was blocked. Without the diurnal tidal flushing, the area no longer received sedimentation and could not keep pace with sea level and quickly converted to mudflats and open shallow water as farming plots were abandoned (**Figures 17 and 18**). The adverse impact of salt hay farming continues as these farmlands did not naturally restore and became mudflats and open water. Some areas that did revegetate sit at lower elevations due to the long-term restricted tidal flow and lack of sediment accretion over time. This left most previously farmed areas submerged for much longer periods, thereby reducing their capacity for vegetative growth. Given current rates of sea level rise, these marshes cannot recover elevation deficits naturally in order to keep pace with sea level. The loss of wetlands from decades of salt hay farming practices has left Matt's Landing Road, the Heislerville WMA dike, and the surrounding infrastructure directly exposed to storms and reduced available vital habitat to fish and wildlife.


**Figure 17: Maurice River and Heislerville dike – 1930. (Photo courtesy of NJDEP I-map).**


**Figure 18: Maurice River and Heislerville dike – 2002 (Photo courtesy of NJDEP I-map).**

Weinstein and Weishar (2002) found that the beneficial use of dredged materials fulfills several aspects of the marsh restoration process: it enhances the sediment budget at low elevations; it accelerates the restoration trajectory that would have most likely not have initiated naturally; it improves the geomorphology of the marsh platform; and reduces erosion and further stabilizes shorelines, providing habitat for wetland species as well as increased protection to nearby infrastructure. Saltwater marshes along the New Jersey coastline have been disappearing over the past hundred years due to sea level rise, lower accretion rates, land subsidence, and higher rates of anthropogenic erosion. The U.S. Environmental Protection Agency (EPA) estimates that 35% of Delaware Bay's rare species and 70-90% of the Estuary's fish and shellfish depend on wetland habitats.

The abundance of dredged materials from channel maintenance provides a valuable and needed resource as well as opportunities to combine dredging needs with coastal marsh rehabilitation and restoration. Beneficial use of dredged material removed from navigation channels is preferrable to disposal of the sediments in upland contained disposal facilities (CDFs). The U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) support implementing positive and sustainable measures to meet the needs of the living resources and communities of the Maurice River because of the area's increased rates of erosion, sea level rise, loss of living resources (*e.g.* fish, shellfish, invertebrates, vegetation) and habitat. Placement of the dredged material on former but now flooded marsh is needed to raise the elevation to re-create intertidal mudflats accessible to fish and avian species for foraging and bolsters vegetated low marsh habitat such that they are able to perform their ecological services. Commercially and recreationally important living resources are dependent upon tidal marshes for foraging, spawning and nursery areas. Wetlands represent a defining characteristic of a healthy estuarine ecosystem and help to maintain water quality through the interception of and filtering of upland runoff and tidal flushing.

### 2.3 Objectives

USACE's Engineering Manual (EM 1110-5025) Dredging and Dredged Material Management provides guidance on implementing Beneficial Use (BU) of dredged material. A companion guide, prepared in collaboration with the USEPA, provides practical guidance in further support of BU. The manual is titled "*Identifying, Planning, and Financing Beneficial Use Projects Using Dredged Material*" (USEPA/USACE, 2007). Interest in using dredged material as a manageable beneficial resource as an alternative to conventional disposal practices has increased. BU reduces the adverse effects of both land and water dredged material placement. By considering dredged material as a resource, a dual objective is achieved.

The objective of the Maurice River dredging project and beneficial use of dredged material is to maintain channel depths for navigation safety while enriching flooded wetland areas to increase the resiliency of intertidal mudflats and low marsh vegetation. The Heislerville WMA provides valuable remote saltmarsh habitat for wildlife and flood water attenuation. Vibrant saltmarshes provide a first-line defense to the Heislerville dike and wildlife impoundments during storms. Healthy saltmarshes in the Maurice River Cove vicinity are in need of a supplemental sediment source to enhance the ecological services that they provide (Schuster and Doerr, 2015).

The Maurice River dredging project aligns with the objectives of the Delaware Estuary Regional Sediment Management Plan (RSMP Workgroup, 2013) which provides a comprehensive master plan that addresses the economic benefits and long-term needs of sediment quality, sediment quantity, dredged material management and beneficial use within the Delaware Estuary. The Philadelphia District USACE has been participating in the national Regional Sediment Management (RSM) and Engineering with Nature (EWN) Programs with considerable lessons learned and developed for navigation dredging and placement activities in New Jersey, especially since Superstorm Sandy in 2012. Navigation managers from the Philadelphia District continue to partner with USACE's Engineer Research and Development Center (ERDC), the State of New Jersey, various stakeholders, and the dredging industry to utilize EWN and RSM strategies in an innovative regional approach to restore navigation as well as enhance coastal resilience.

Over the last decade, beneficial use placements involving shoreline stabilization and marsh restoration have significantly increased in the region, helping to advance practices and policies that keep dredged material in the natural sediment system.

The Philadelphia District USACE is embracing a new goal of beneficially using 100% of clean New Jersey coastal channel sediments and developing cost effective ways to do so. USACE is a provider when it comes to sediment, a much-needed currency in the natural coastal system in the Maurice River region. In April 2019, USACE, the state of New Jersey, and the Wetlands Institute launched the Seven Mile Island Innovation Lab (SMIIL). The SMIIL encompasses about 24 square miles of tidal marshes, coastal lagoons, tidal channels and bays between the Cape May County mainland and the barrier island communities of Stone Harbor and Avalon, NJ. The New Jersey Intracoastal Waterway (NJIWW) is a federal channel maintained by USACE and bisects the SMIIL. The initiative is designed to advance and improve dredging and marsh restoration through innovative research, collaboration, knowledge-sharing, and practical application.

Under the SMIIL, USACE and partners completed a dredging and habitat creation project at Great Flats near Stone Harbor, NJ in December 2018. The work entailed dredging the NJIWW and using the dredged material to create habitat in the adjacent water/saltmarsh complex. In 2019, colonial nesting habitat was created at Ring Island (near Stone Harbor, NJ) for black skimmers, common and least terns, and American oystercatchers-all state-listed endangered bird species or species of concern. More recently, NJIWW material dredged from the NJIWW was placed at Sturgeon Island, owned by the Wetlands Institute and Gull Island, part of the Cape May Wetlands Wildlife Management Area (WMA). These projects a) enhance and fortify inundated marsh elevation; b) restore unvegetated marsh interior mud flats to low marsh habitat; c) create high marsh areas suitable for salt marsh sparrow and wading bird colonies; d) reduce marsh edge erosion; and e) enhance tidal flats and shallows for submerged aquatic vegetation (SAV) and fish habitat.

The collaborative team has developed and implemented a comprehensive monitoring program at the project sites to assess island subsidence, material placement evolution work, turbidity monitoring, as-built surveying, and colonial nesting bird assessments. Monitoring parameters also evaluate dredge technology innovation effectiveness and plan adaptive management approaches. With ongoing partnerships, coordination at all levels, improvements to design and project implementation and strong science to support innovation, USACE proposes to conduct similar efforts within the lower Maurice River region and will continue to work to advance best practices through strategies and solutions that address the long-term issues and sustainability of the coastal region.

## 3.0 ALTERNATIVES

### 3.1 Alternative 1: No Action

The No Action Alternative would entail that no maintenance dredging of the Maurice River federal navigation channel would occur. The navigation channel was last dredged in 1996. No longer maintaining the authorized navigation depths would result in the current channel continuing to silt in and pose navigation hazards to vessels traversing the river.

There is currently no feasible substitute action in lieu of maintenance dredging. Periodic dredging is necessary to maintain sufficient navigable depths for vessels to transit Maurice River safely. Portions of the lower channel are currently at less than authorized depths and require dredging.

### 3.2 Alternative 2: Cape May CDF

Maintenance dredging would continue to periodically occur in portions of the Federally-authorized channel as needed and as funding is available. The channel has only been dredged one time since 1925 and that was in 1996. At that time, Regional Sediment Management (RSM) and Engineering with Nature EWN) practices, with the goal of keeping sediment in the natural system, were not practiced and the dredged material was barged and placed in an upland confined disposal facility (CDF) owned by the USACE with no beneficial use (BU) component (*i.e.* no ecosystem benefits). The CDF utilized in 1996 is located along the Cape May Canal in the vicinity of the Cape May Lewes Ferry about 30 miles away from the Maurice River dredging location. Disposal of the dredged material in a CDF this considerable distance away and requires double handling from dredging to barge then upland disposal. This disposal method is very costly and was only utilized because marsh restoration was not considered implementable or cost effective in 1996. At the same time, the operation in 1996 removed much needed dredged sediments from the Maurice River vicinity, a system that has been experiencing severe shoreline erosion and marsh loss for many years. Additionally, the CDF has limited capacity that must remain available for material from the NJIWW Cape May Lewes Ferry channel.

USACE's goal is to promote regional sediment management (RSM) and engineering with nature (EWN) practices; and incorporate beneficial use objectives (BU) into the channel maintenance program. By keeping the dredged material in the natural system and using sediment as a resource for coastal resilience, this alternative to place dredged material into the Cape May CDF was eliminated from further consideration.

### 3.3 Alternative 3 – East Point

East Point is a small residential community located on the Delaware Bay at the southern end of Maurice River cove. The East Point Lighthouse is located within the NJDEP's Heislerville WMA at the end of East Point Road, on land managed by the State of New Jersey. The Lighthouse, as well as the bayfront homes within the community, have been subjected to severe erosion due to wave action for decades. Many

homes have installed concrete rubble or bulkheading for storm protection. The NJDEP has constructed erosion protection gabion baskets on the shoreline to help protect the lighthouse from inundation. This alternative to place dredged material at East Point beach was considered for the purpose of a BU to provide storm and erosion protection along the shoreline. This alternative was subsequently eliminated due to infeasible constructability and open exposure of the area to the bay's hydrodynamic forces after grain size analyses ascertained that the dredged material consists primarily of fine silts not suitable for sandy beaches.

### 3.4 Alternative 4 – Heislerville WMA Northwest Region

For maintenance dredging operations, USACE utilizes RSM and EWN principles and practices in a natural infrastructure approach. Since 1996 and especially post-Hurricane Sandy, technical advancements in design and construction of natural and nature-based features using dredged sediments in other areas such as the Cape May WMA continue and have led to advancing BU implementation in New Jersey through the SMIIL with the same primary project partners for Maurice River. Alternative placement actions entailing BU of dredged material were developed and evaluated in collaboration with coastal engineers, scientists, landscape architects, and resource managers from the Philadelphia District USACE, NJDEP, the U.S. Army's ERDC, the UP, and local officials.

Maintenance dredging of the authorized Maurice River federal channel will likely continue to occur periodically. This alternative will dredge the lower navigation channel and place the dredged material within the Heislerville WMA northwest region near the Heislerville dike. The dike is currently in a vulnerable condition and has experienced significant damage over the past several decades. NJDEP maintains the dike and impoundment water levels to monitor shorebird migratory patterns and it has become a popular birding location. This placement location was chosen as the preferred plan to beneficially use the Maurice River dredged material for marsh restoration, dike stabilization, and for aesthetic benefits to an underserved community. The marsh fronting the dike structure protects the impoundments from the large fetch conditions that exist due to the flooded marsh having a direct connection to the Delaware Bay. The dike has been repaired multiple times by NJDEP as it protects private property that is integral to the local community and also prevents the Maurice River and the Delaware Bay from being directly hydraulically connected. Compromise to this structure could result in significant changes to the geomorphology of the area which would have a negative impact on the commercial/private facilities north of it, and in turn the entire local economy.

Based on lessons learned in the SMIIL, marsh edge protection, marsh elevation enhancement, and resilient intertidal shallows can be achieved using fine-grained material. Restoring the natural infrastructure in the vicinity of the Heislerville dike will likely require repetitive placements where the sediments consolidate over time. Each successive placement will allow sediments to consolidate and contribute to bolstering the mudflat elevation and the potential re-establishment of intertidal vegetated low marsh habitat for bivalves, fish, and birds. This will create natural infrastructure that improves resilience against storms and climate change impacts. This alternative plan serves to retain sediment within the local system while enhancing natural habitat.

Similar technical advancements in wetland restoration design and construction and monitoring have

been ongoing at the Cape May WMA. Alternative 4 will utilize the lessons learned on creating natural infrastructure with cohesive sediments at the Cape May WMA in collaboration with NJDEP, one of the co-leaders in the SMIIL. A primary success of these efforts has been a paradigm shift leading to momentum for advanced science and improved practices for BU implementation in New Jersey and supports the BU placement project proposed herein at Maurice River.

Two placement areas have been identified within the northwest region of the Heislerville WMA for future beneficial use placements (**Figure 19**). Approximately 50,000 to 75,000 cy of predominately fine-grained sediments will be dredged from approximately 11,500 linear feet of channel within the lower Maurice River. The first-year placement will occur within the primary placement area shown on **Figure 20**, the majority of which is within an old railroad bed located bayward of the Heislerville dike. A subsequent placement will occur 1-3 years later, placing an additional 25,000-50,000 cy dredged from this reach, where needed, to the authorized depth of 7 ft MLLW with 2 ft allowable over-depth. Containment will be incorporated into the design utilizing the stable foundation of the old railroad bed to build elevation adjacent to the dike. Containment efforts may include the use of turbidity curtains, coir logs, and/or hay bales, and earthen berms. A turbidity curtain plan would be similar to that used during the Mordecai Island restoration (USACE, 2022) since it adapted with phases of the tide and successfully stabilized the fine-grained sediment portion over time. The turbidity curtain at Mordecai Island was ultimately left in place and now continues to protect SAVs, supports terrapins and avian species (M. Budd, Mordecai Land Trust monitoring reports) (**Figure 21**)

There are no known areas of submerged aquatic vegetation (SAV) in the proposed dredging or placement areas. The primary placement area is comprised of approximately 60 percent mudflat and 30 percent subtidal and 10 percent low marsh and abuts with the Heislerville dike, which consists of broken concrete and stone and will serve to help contain the sediments. The secondary placement area is comprised of approximately 16 percent mudflat, 48 percent subtidal, and 36 percent low marsh. Deposition of dredged sediments will vary in the placement area but will not exceed 3.5 feet NAVD88. In the primary placement area, sediments that settle in subtidal habitat may convert a portion of habitat to intertidal mud flat habitat. Sediments that settle on existing intertidal mud flat may convert naturally to low marsh if sufficient elevations allow saltmarsh vegetation to establish. Any thin-layer placements within the low marsh will enrich the low marsh habitat resiliency. The sediment characteristics are not conducive to building above a low marsh elevation. In the secondary placement area, dredged sediments may serve to raise elevations to those that existed as low marsh prior to 1991 but are currently intertidal and subtidal.


**Figure 19: Proposed location of beneficial use placement areas and channel dredging.**

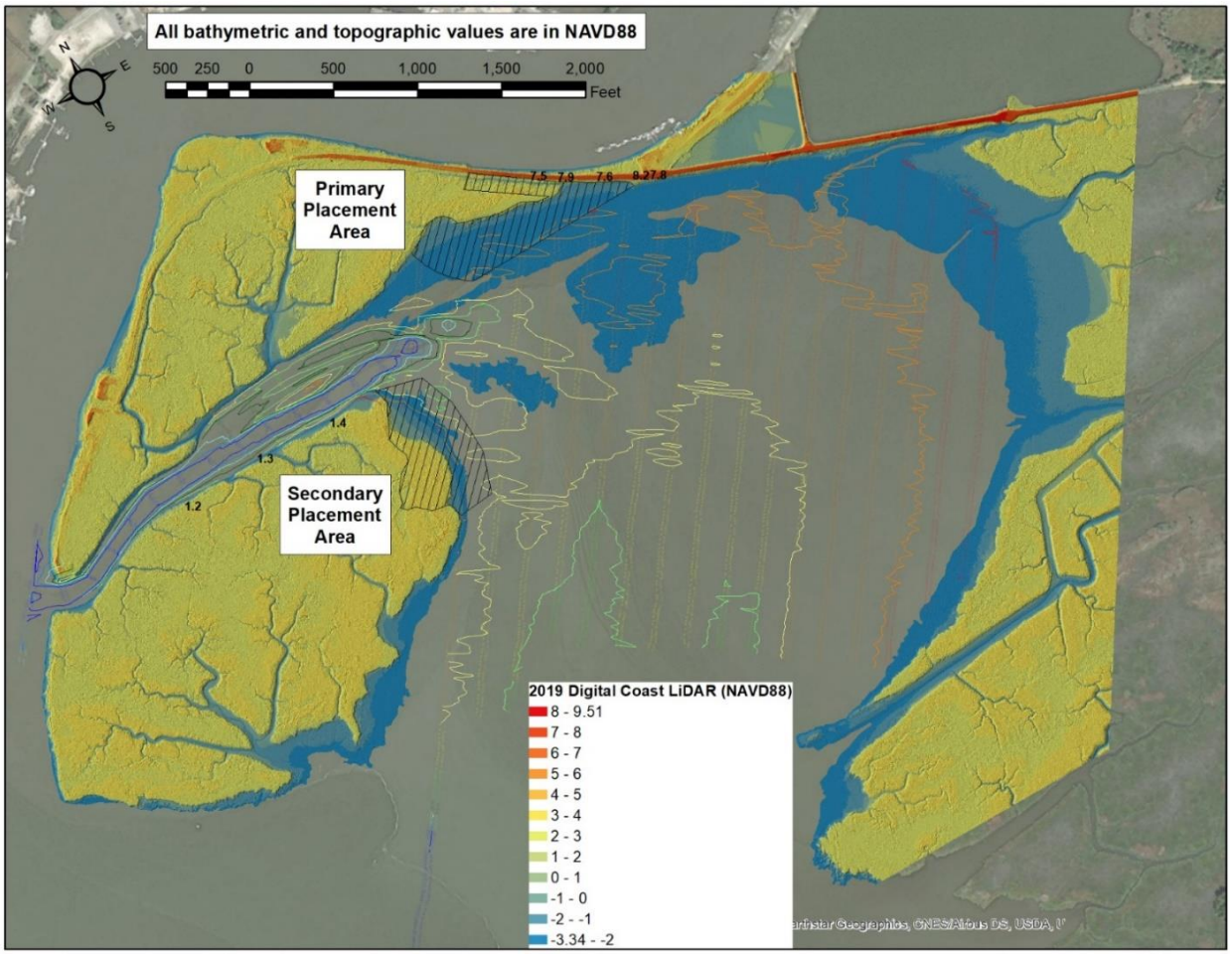



**Figure 20: Proposed dredged material placement areas, primary and secondary locations.**

The initial dredging and placement operation is currently scheduled to occur in 2023. Monitoring of placement elevations and sediment consolidation via traditional and remote sensing techniques will be conducted by USACE, ERDC, and UP, and will occur prior to, during, and post-placement operations. Lessons learned from the first placement will inform the design and construction of the follow-on dredging and placement operation in one to three years, based on elevation and consolidation data from the first placement. If sediment placement at the primary site fronting the dike requires an extended consolidation period when subsequent channel maintenance dredging is needed, the material will be placed at this secondary placement location.

Figure 21: turbidity curtain at Mordecai Island, New Jersey.

## 4.0 AFFECTED ENVIRONMENT

### 4.1 Physical Environment

#### 4.1.1 Topography, Physiography, and Geology

Based on the Bedrock Geologic Map of New Jersey, dated 2014, the project site lies within the outer Coastal Plain Physiographic Province. A physiographic province is a geographic region with distinct landscape characteristics and commonly distinct rock types. The Coastal Plain Province is characterized by the Kirkwood formation, Belleplain Member (middle Miocene) which consist of gray to white, fine to medium grained, micaceous sand, wood and shell fragments. The lower part consists of gray-brown, laminated silty clay, diatoms and shell fragments.

The Maurice River is located approximately 26 miles from Atlantic City, New Jersey and 34 miles from both the Philadelphia, Pennsylvania and Wilmington, Delaware metropolitan areas. Maurice River Township is a 93.1 square mile (241 $km^2$) community located at the southern coastal mainland of New Jersey, where the mouth of the Maurice River meets the Delaware Bay. The Township of Buena Vista is located to the north, the Township of Commercial and City of Millville are located to the west, Ocean City and Sea Isle City to the east, and Cape May to the south. Commercial Township shares coastline with the Delaware Bay. Maurice River Township is located along the eastern bank of the Maurice River and is the municipal boundary between Commercial and Maurice River Townships. The Maurice River is a tidally influenced river which connects the Delaware Bay to Millville, Union Lake and Willow Grove

Lake (50 miles inland). Aside from a few population/commercial centers, the vast majority of the surrounding land is undeveloped or used for agricultural production. There are numerous wetland complexes within the predominantly rural study area. These include salt marshes and coastal shrub and forested wetlands. The Northwest Reach of the Heislerville WMA, formerly saltmarsh, is now flooded shallow water and mudflats. Topography of the Maurice River vicinity is shown in **Figure 22**.

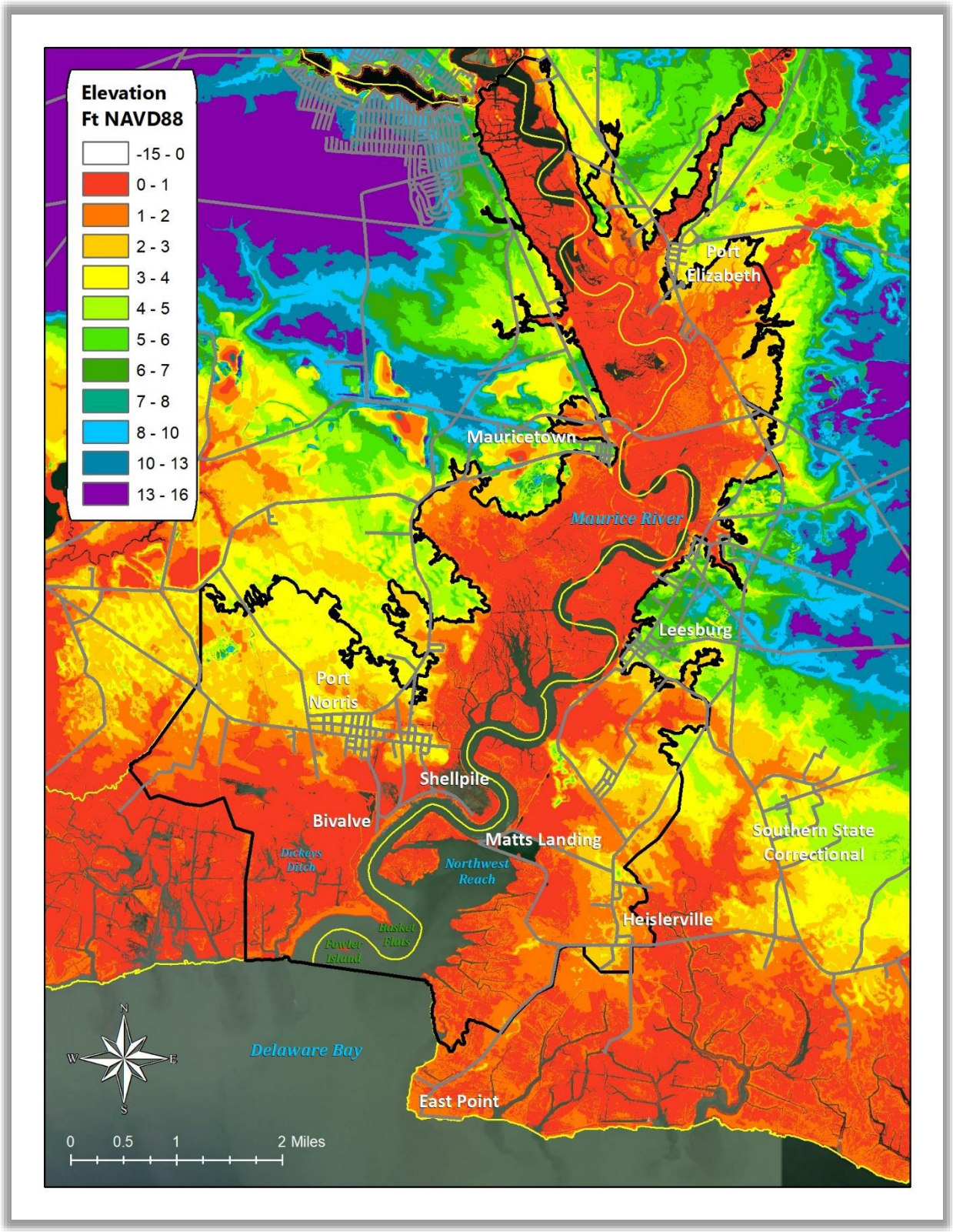



**Figure 22: Topographic map of the Maurice River project area and vicinity.**

### 4.1.2 Climate and Sea Level Rise

Climate. The Maurice River region experiences a moderate climate (*i.e.* primarily humid subtropical) associated with the low elevations of the Coastal Plain region and the presence of the Delaware Bay and Atlantic Ocean. The climate during winter months is moderate as a result of winds heated by warmer bay and ocean water temperatures in summer. The summer season is moderate as well, due to sea breezes. Temperatures within the state average -1C (30F) in winter and 23C (74F) in summer. Average annual precipitation along the southeast coast is about 40 inches and well distributed throughout the year. Tropical storms and hurricanes occasionally bring excessive rainfall to the area. The bulk of winter precipitation results from storms that move northeastward along the east coast of the United States.

Sea Level Rise. Research by climate scientists predict continued or accelerated climate rise (SLR) for the 21st century and possibly beyond, which would cause a continued or accelerated rise in global mean sea level. NOAA (2022) provides updates to the 2017 Task Force report (Sweet *et al.,* 2017) on global mean sea level rise scenarios. The report provides information for Federal agencies, state and local governments, and stakeholders in coastal communities about current and future SLR. One of four key messages provided is as follows:

> *"By 2050, the expected relative SLR will cause tide and storm surge heights to increase and will lead to a shift in U.S. coastal flood regimes, with major moderate high tide flood events occurring as frequently as moderate and minor high tide flood events occur today. Without additional risk-reduction measures, U.S. coastal infrastructure, communities, and ecosystems will face significant consequences."*

Table 1 is from New Jersey's Rising Seas and Changing Coastal Storms: Report of the 2019 Science and Technical Advisory Panel and suggests that New Jersey will likely face a rise of 0.9 to 2.1 ft of sea level rise above 2000 levels. The same report suggests that under moderate emissions scenarios, by 2050 areas along South Jersey will see 40 to 260 high tide flooding days on average as a result.

**Table 1: New Jersey's sea level rise above the year 2000 (1991-2009 average) baseline (ft)***

| | | 2030 | 2050 | 2070 | | | 2100 | | | 2150 | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Emissions | | | | | | | | |
| | Chance SLR Exceeds | | | Low | Mod. | High | Low | Mod. | High | Low | Mod. | High |
| Low End | > 95% chance | 0.3 | 0.7 | 0.9 | 1 | 1.1 | 1.0 | 1.3 | 1.5 | 1.3 | 2.1 | 2.9 |
| Likely Range | > 83% chance | 0.5 | 0.9 | 1.3 | 1.4 | 1.5 | 1.7 | 2.0 | 2.3 | 2.4 | 3.1 | 3.8 |
| | ~50 % chance | 0.8 | 1.4 | 1.9 | 2.2 | 2.4 | 2.8 | 3.3 | 3.9 | 4.2 | 5.2 | 6.2 |
| | <17% chance | 1.1 | 2.1 | 2.7 | 3.1 | 3.5 | 3.9 | 5.1 | 6.3 | 6.3 | 8.3 | 10.3 |
| High End | < 5% chance | 1.3 | 2.6 | 3.2 | 3.8 | 4.4 | 5.0 | 6.9 | 8.8 | 8.0 | 13.8 | 19.6 |

**2010 (2001-2019 average) Observed = 0.2 ft*

In addition to flood impacts affecting communities and infrastructure, the rate of these rising water levels will interact with sediment availability, coastal storms, nutrients, development, and other forces to impact the sustainability of marshes and other coastal ecosystems within low- lying coastal regions, such as that of the lower Maurice River. South Jersey has already been experiencing significant sea level rise. The plot illustrated in **Figure 23** shows the monthly mean sea level without regular seasonal fluctuations due to coastal ocean temperatures, salinities, winds, atmospheric pressures, and ocean currents at Cape May. The relative SLR trend is 4.8 millimeters/year with a 95% confidence interval of +/- 0.47 mm/yr based on mean month sea level data from 1965 to 2020 which is equivalent to a change of 1.57 feet in 100 years.

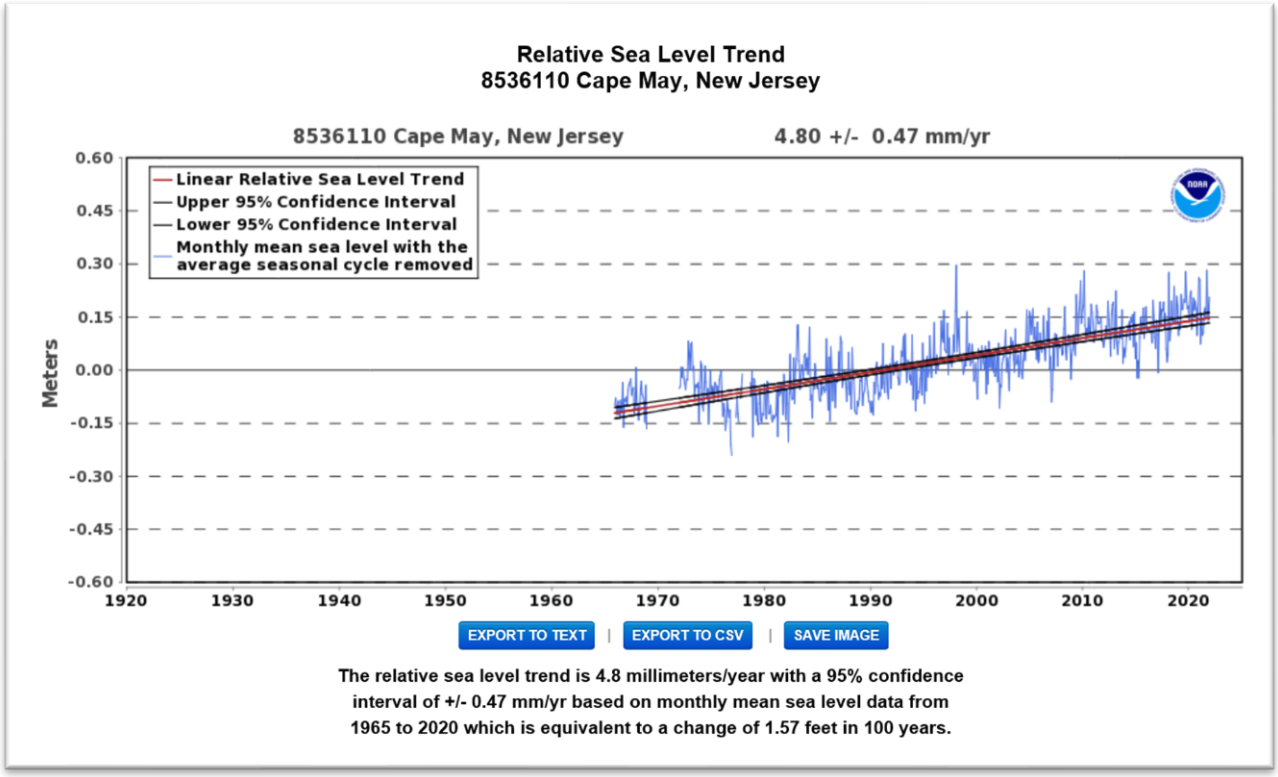



**Figure 23: Relative sea level trend at Cape May, New Jersey.**

### 4.1.3 Air Quality

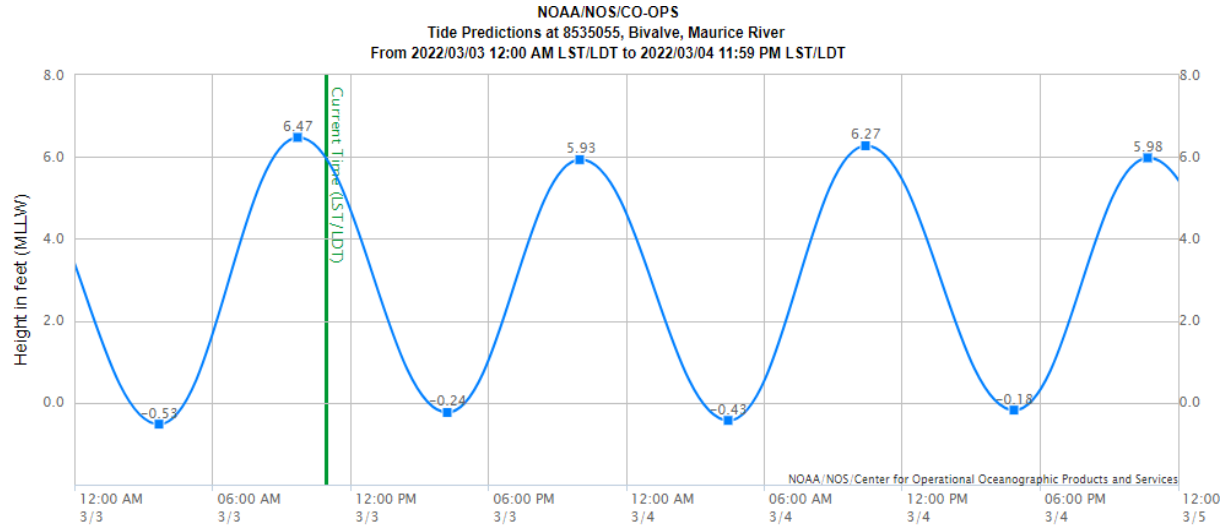
As required by the Clean Air Act, the U.S. Environmental Protection Agency (EPA) sets National Ambient Air Quality Standards (NAAQS) for six (6) common air pollutants known as "criteria pollutants" (*i.e.* ozone (O3), carbon monoxide (CO), sulfur dioxide (SO2), nitrogen dioxide (NO2), particulate matter (PM10 and PM 2.5), and lead (Pb). After the EPA sets the NAAQS, it determines which areas of the country meets those standards. If the air quality in a geographic area meets or is cleaner than the standard, it is called an attainment area. Areas that do not meet a standard are called nonattainment areas. Air quality is generally good in the Delaware Bay region, however, the Maurice River project area is located within the Philadelphia-Wilmington-Atlantic City, PA- NJ-MD-DE nonattainment area for the 8-hour ozone NAAQS

and is classified as "marginal." "Marginal" is the lowest classification, meaning that the ozone levels in this area are closer to the standard than in those areas with a higher classification. As required by the Clean Air Act, the State of New Jersey has a State Implementation Plan (SIP) in place describing how the 8-hour ozone NAAQS will be achieved and maintained in nonattainment areas.

General Conformity is a process to implement Section 176(c) of the Clean Air Act to ensure actions conducted or sponsored by Federal agencies in nonattainment or maintenance areas are consistent with the SIP. General Conformity requires that reasonably foreseeable emissions from Federal actions will not cause or contribute to new violations of a NAAQS, increase the frequency or severity of existing NAAQS violations, or delay timely attainment of the NAAQS or any interim milestone towards achieving attainment. However, a General Conformity determination is not required if the emissions from the federal action will fall below the *de minimis* levels set forth in the Clean Air Act regulations. The *de minimis* emission threshold for a Marginal ozone nonattainment area is 100 tons/year of NOx or 50 tons/year VOC.

### 4.1.4 Tides and Currents

The tides affecting the study area are semi-diurnal with two nearly equal high tides and two nearly equal low tides per day (or approximately 12 hours and 25 minutes per tidal period, as shown in **Figure 24**. According to the water level monitoring gauge owned by USGS, the mean range is 5.66 feet while the Diurnal Range is 6.28 feet. The tidal benchmarks adopted for the project area were taken from the USGS Tide Gauge (NOAA station 8535055; Bivalve, Maurice River), which is located within the project vicinity on the southwest side of the refueling dock within Long Reach Marina. The station was installed in January 2017.




Note: The interval is High/Low, the solid blue line depicts a curve fit between the high and low values and approximates the segments between.
Disclaimer: These data are based upon the latest information available as of the date of your request, and may differ from the published tide tables.

**Figure 24: Tide predictions for Bivalve, Maurice River (USGS Tide Gauge NOAA station 8535055).**

Table 2 summarizes the 1983 – 2001 tidal epoch datums relative to Mean Lower Low Water (MLLW) and NAVD88 from NOAA's Tide and Currents (2022). Note these values have been calculated only from the past 5 years.

**Table 2: Tidal datum values for Maurice River tide gauge at Bivalve, NJ**

| Datum | Description | Elevation (ft. MLLW) | Elevation (ft. NAVD88) |
|---|---|---|---|
| MHHW | Mean Higher-High Water | 6.27 | 2.86 |
| MHW | Mean High Water | 5.84 | 2.43 |
| MTL | Mean Tide Level | 3.02 | -0.39 |
| MLW | Mean Low Water | 0.19 | -3.22 |
| MLLW | Mean Lower-Low Water | 0.00 | -3.41 |

Beyond the Bivalve station's limited datasets, Cape May, NJ – Station 8536110 provides the full suite of NOAA CO-OPS products and verified, higher frequency real-time data. The Cape May station is in closer proximity to the ocean and along a canal rather than project area's location at Maurice River cove. As shown in **Figure 25**, the tidal harmonics appear similar, with the exception of the greater tidal range along the Maurice River relative to the Cape May Canal. NOAA provides tidal current predictions for the Maurice River, as illustrated by **Figure 26**. For year 2022, NOAA Tidal Current Tables forecast maximum flood currents of 1.39 m/s and maximum ebb tide of 1.24 m/s. It should be noted that the station for these predictions is reference to data at the Delaware Bay Entrance (~25 miles to the south).

While data on current real-time magnitudes in the lower Maurice River are limited, USACE did a study in the project area in 1994 that presented maximum flood current as 3.13 feet per second (0.95 m/s) and maximum ebb current as 3.6 feet per second (1.1 m/s) for the center of the main channel near Bivalve under normal tidal conditions. While these values may have evolved through time with the evolution of the river, they fall within similar magnitudes of current tide predictions. Erosion over time of the river's oxbows in the cove vicinity has increased exposure of the marsh to the Delaware Bay.

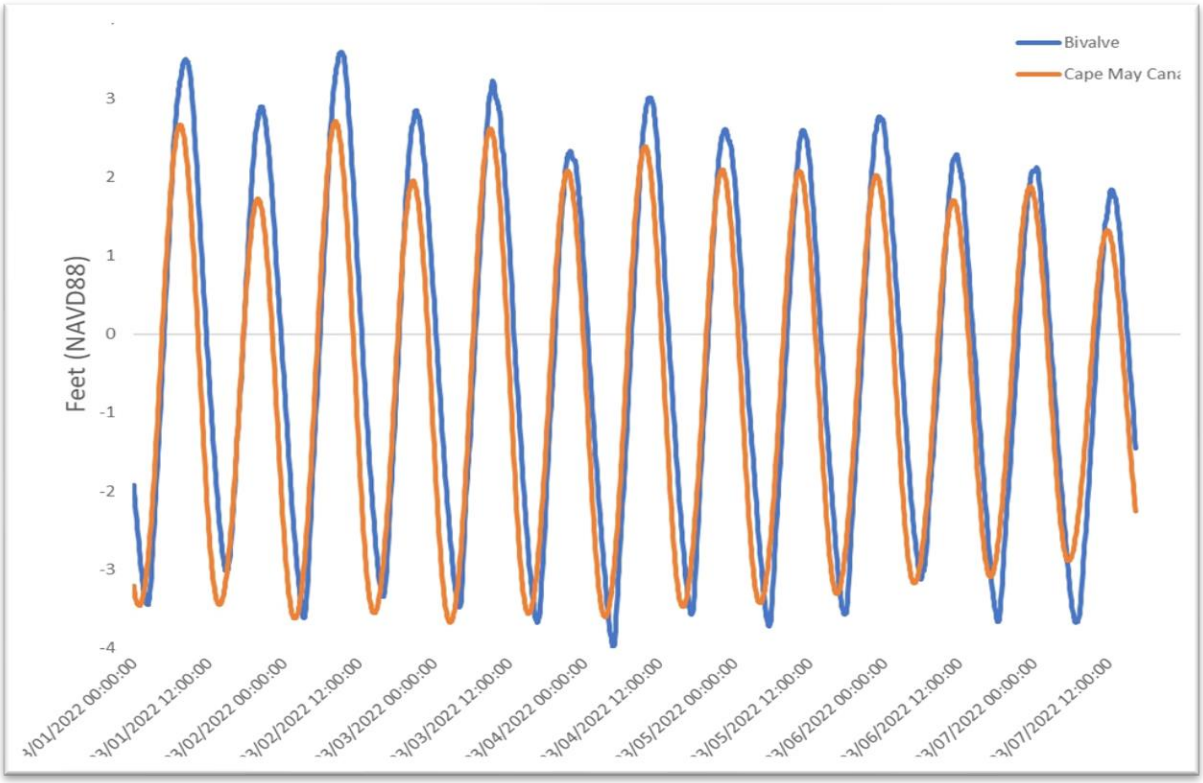



**Figure 25: Comparison of tide predictions for Bivalve (blue) against Cape May (orange) for March 3 – 7, 2022.**

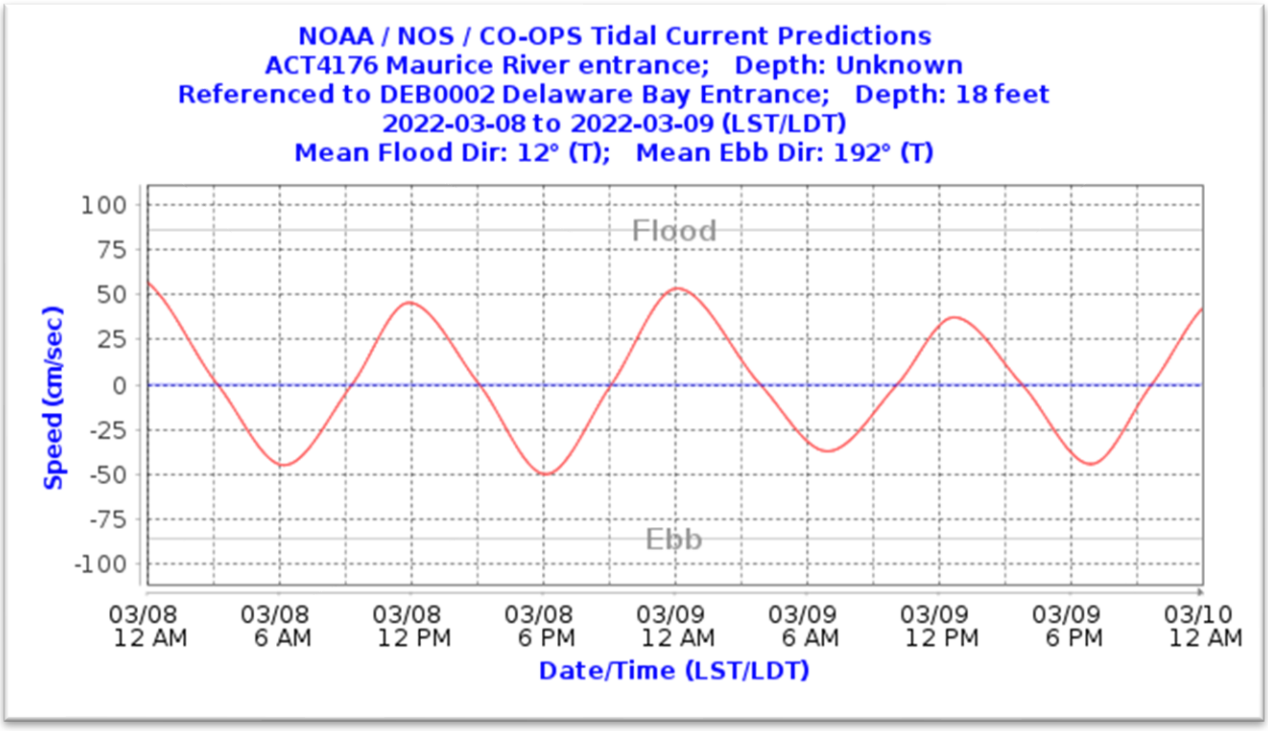



**Figure 26: NOAA tidal current predictions at Maurice River entrance (referenced against Delaware Bay entrance).**

### 4.1.5 Water Levels, Water and Sediment Quality

Water levels in the Maurice River cove area are predominately driven by astronomical tides; however, other factors such as sustained wind (*i.e.,* fetch), freshwater inflow from the river, rainwater runoff, and strong tides driven by storms can also affect water levels in the project area. The Maurice River empties into the polyhaline zone of the Delaware Bay, but locally influenced by the river water.

Water quality is a primary determinant of habitat quality for fish and wildlife and affects recreational opportunities and the overall aesthetics of the area. Water quality within the coastal waters of the Delaware Bay is comparable to that of similar estuarine water bodies which possess little development. Waters in this region of the Maurice River are turbid due to high concentrations of suspended sediments produced by strong tidal and wind-generated currents. Other than ocean input, the water that flows into the Delaware Bay comes primarily from two sources: indirect runoff, which comes through the rivers of the drainage system; and direct runoff, which enters from the land or marshes. The water column in Delaware Bay is well mixed throughout most of the year. The concentration of oxygen in the bay waters is typically high due to high rates of mixing by the tidal currents and wind.

The NJDEP conducted a water quality degradation source track-down study in the Maurice River and Maurice River Cove in 2006. Analysis of 856 water samples found that the source of the water quality

decline was due to changes in hydrography (erosion) at the mouth of the river, not due to wetland restoration work, septic systems, or shorebird populations. The study also determined that microbial pollution was attributed to sources north of the Mauricetown Bridge.

The U.S. Army Corps of Engineers (USACE) conducts pre-dredge sediment and water quality sampling and analyses for maintenance dredging operations to make the determination whether the dredged material can obtain state and federal approvals for beneficial use placement or if the dredged material will be required to be removed from the water system and placed in an upland confined disposal facility due to contaminant levels.

USACE conducted sediment quality studies within the Maurice River entrance channel in Maurice River cove in 2017 and in 2022 (Tetra Tech, Inc. 2017; 2022). Grain size analyses of the bulk sediment samples was conducted. Sediment samples taken within the channel are predominantly fines (43.65 % to 95.1%) with fine, medium sand and coarse sands (9.8% to 38.8%). One sample contained 37% gravel (Table 3).

**Table 3: Soil classification of Maurice River entrance channel samples (Tetra Tech, 2017, 2022).**

**2017**

| SOIL CLASSIFICATION | MR-1 % | MR-2 % | MR-3 % | MR-4 % |
|---|---|---|---|---|
| Coarse Sand | 0 | 0.2 | 0.6 | 6.5 |
| Fine Sand | 3.9 | 7.2 | 7.6 | 5.7 |
| Fines | 95.1 | 87.1 | 86 | 43.6 |
| Gravel | 0 | 0 | 0.4 | 37 |
| Medium Sand | 1 | 5.5 | 5.4 | 7.2 |
| Sand | 4.9 | 12.9 | 13.6 | 19.4 |

**2022**

| SOIL CLASSIFICATION | MR 5 % | MR 6 % | MR 7 % | MR 8 % | MR 9 % | MR 10 % | MR 11 % | MR 12 % |
|---|---|---|---|---|---|---|---|---|
| Coarse Sand | 2.4 | 0.1 | 0.6 | 0.1 | 0.2 | 1 | 1 | 1.5 |
| Fine Sand | 29 | 5.7 | 8.2 | 2.6 | 35.5 | 3.4 | 3.1 | 4.3 |
| Fines | 61 | 91.6 | 83.7 | 96.1 | 36.2 | 93.3 | 92.8 | 91.3 |
| Gravel | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Medium Sand | 7.6 | 2.6 | 7.5 | 1.2 | 28.1 | 2.3 | 3.1 | 2.9 |
| Sand | 39 | 8.4 | 16.3 | 3.9 | 63.8 | 6.7 | 7.2 | 8.7 |

The sampling design and analysis plan followed the recommended field and analytical methods in *The Management and Regulation of Dredging Activities and Dredged Material in New Jersey's Tidal Waters, October 1997*. Bulk sediment results were compared to the New Jersey Department of Environmental Protection (NJ DEP) Residential and Nonresidential Remediation Standards for Soil (N.J.A.C 7:26D Remediation Standards, 2017). The samples were analyzed for inorganics, pesticides, PCBs (as aroclors), volatile organics, semivolatile organics, cyanide, and TOC. Of the tested analytical parameters in the 2017 sediment samples, the only exceedance of NJDEP Remediation Standards for soil occurred in inorganics (metals). Arsenic was detected in one sample which slightly exceeded NJ DEP residential and non-residential standards. F or the 2022 samples, there were no exceedances of NJ Soil Residential and Non-Residential Remediation Standards for soil in any of the sediment samples.

Elutriate analyses are conducted for the same chemical parameters as are analyzed from the sediment core samples (USEPA Priority Pollutant List) to evaluate whether the dredging activity may significantly affect the aquatic environment. Elutriate testing is a means of simulating the effect of dredging (that results in the chemical dissolution of sediment when agitated by the cutterhead) on local water quality (*i.e.* if dredging might degrade water quality and threaten aquatic biota). The elutriate methodology is a standard test that involves the mixing of native water with bottom sediment followed by both filtration and no filtration (Plumb, 1981).

Because of the mixing associated with dredging, it is appropriate to compare the average concentrations of the contaminants in the sediment to the NJ sediment ecological screening criteria Effects Range-Low

(ER-L) and Effects Range-Medium (ER-M). Comparison of the average metals concentrations shows that averaged manganese is the only analyte that exceeds an ER-M (454 mg/Kg compared to 260 mg/Kg). Manganese is naturally occurring, and the concentration ranges in 2022 sampling are similar to those detected during 2017 sampling of the channel. For manganese, there are no available acute or chronic aquatic life criteria (for water) for comparison to the sediment-generated elutriate samples.

The average concentrations for arsenic and mercury both slightly exceed their respective ER-L in the 2022 samples. Mercury (154 ug/kg compared to 150 ug/Kg) and arsenic (10.7 mg/Kg compared to 8.2 mg/Kg). Arsenic is naturally-occurring and at 10.7 mg/kg is similar to regional concentrations. The unfiltered and filtered elutriates for arsenic and mercury do not exceed NJ acute or chronic aquatic life criteria (for water). The chemical analytical tables are included in Appendix B.

Portions of the Maurice River are part of the National Wild and Scenic River System (WSRA) (https://rivers.gov/rivers/Maurice.php) The project area is located outside of the portion of the lower river classified under the WSRA as "recreational" (**Figure 27**). Irrespective of each river stretch WSRA classification, the goal of the WSRA is to protect and enhance the values of the river's designation. For the recreation designation the WSRA objective is to preserve the river's recreational opportunities through voluntary stewardship by landowners and river users as well as through programs of federal, state, local or tribal governments. The National Park Service prepared a Comprehensive Management Plan and Environmental Impact Statement (NPS, 2001) to encourage coordination between existing levels of governments, businesses, and organizations to implement protection and enhancement of the Maurice River's natural, cultural, and recreational resources.

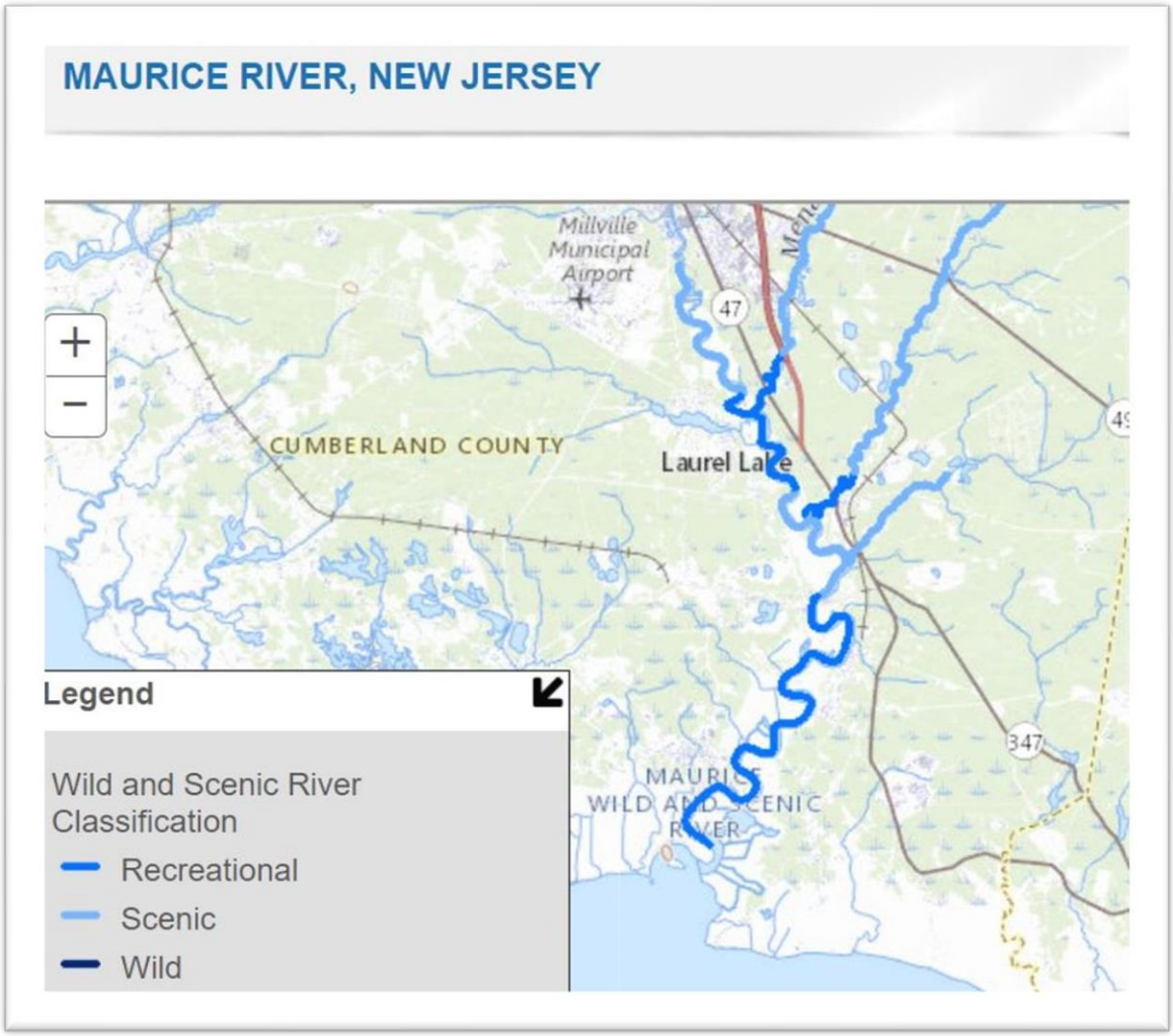



**Figure 27: Wild and Scenic River designation (https://www.rivers.gov/rivers/maurice.php).**

While 2.5 miles of the upper Maurice River have been described as Outstanding National Resource Waters in a 2018 National Wild and Scenic Rivers Coordinating Council Report, over recent years more of the river has been listed as impaired. The same report identified 47.6 miles of the river as being impaired, including impairments on the 303(d) list such as levels of arsenic, mercury, *E.Coli*, phosphorus, dioxin and low dissolved oxygen. The 303(d) list signifies that the waterbody has been identified as a Category 5 water in state water quality reports until the pollutant sources have been identified and the state has a strategy to assess it. Over 43% of Wild and Scenic Rivers (which the Maurice is one) have impairments that are on the 303(D) list. While these impairments are present, relative to the overall Delaware Estuary, nitrogen and phosphorus nutrient concentrations in the project area are low (**Figure 28**).

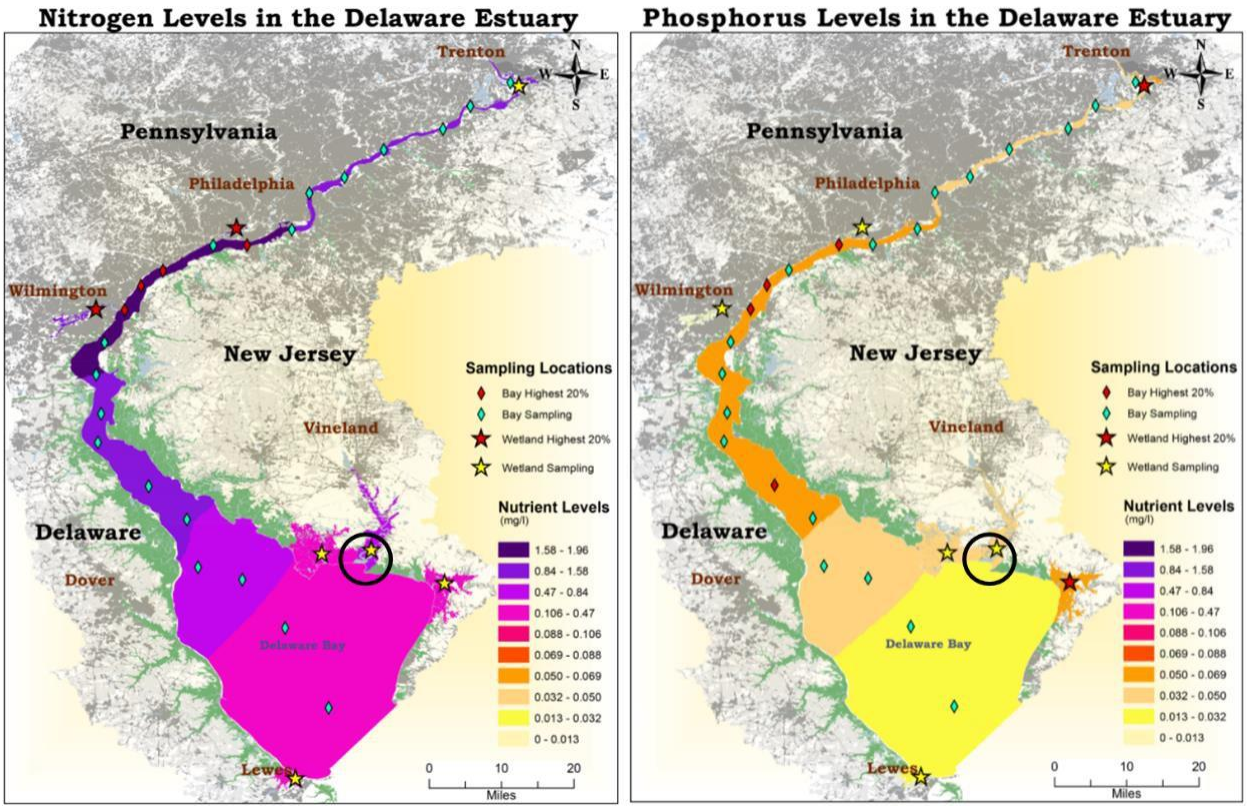



**Figure 28: Nutrient levels in the Delaware River and Bay based on samples collected by the Delaware River Basin Commission between 2008 and 2018. Data and figures are from The Partnership for the Delaware Estuary story map (O'Hara and Haaf, 2020). The Maurice River project area is depicted in the black circles.**

### 4.1.6 Wind, Wave, and Storm Surge Conditions

While limited wind data exists for Maurice River itself, winds at Brandywine Shoal Light (located approximately 15 miles south of the project area), predominantly originate from the NW (**Figure 29**).

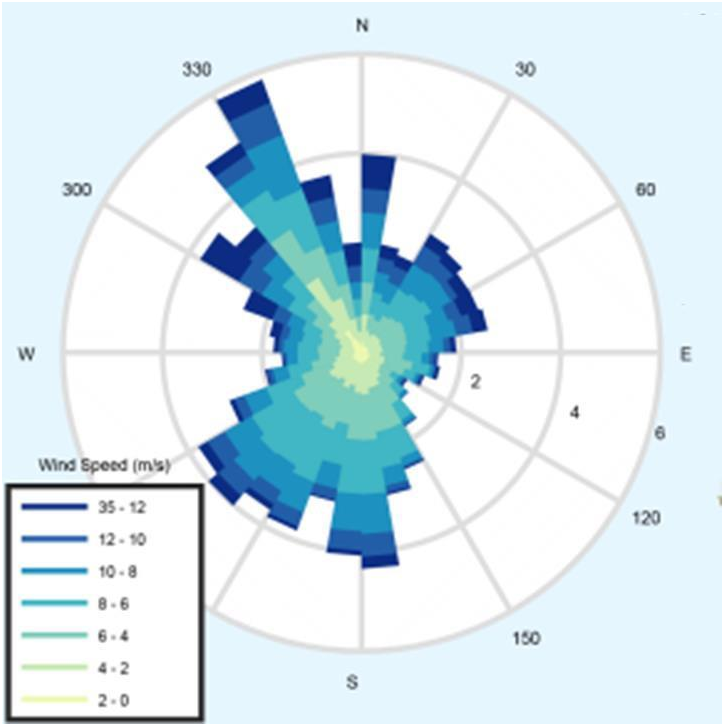



**Figure 29: Wind rose for winds at Brandywine Shoal Light, 15 miles south of the Maurice River mouth for the period 2015-2018 (data is from the National Data Buoy Center. Station BRND1-8555889-Brandywine Shoal Light, DE. Figure from Psuty *et al*., 2018.)**

This predominant wind direction varies by season, swinging to the south during summer. **Figure 30** illustrates how winds within the lower Delaware Bay and nearby continental shelf vary by season, along with wave climate (suing data from 2005 -2012). As Kukulka *et al*. (2017) illustrate how the lower Delaware Bay is generally protected from energetic longer period ocean swell and that more energetic waves are generally driven by winds. Of the ocean swell that does enter the bay, much of this energy impacts shorelines along the northern shoreline of the lower Delaware Bay (such as where the Maurice River enters the Bay). As the wave energy in the bay approaches the shoreline, it is limited by the shallow water depths around Maurice Cove. Normal wave heights are therefore generally low (less than 2 feet).

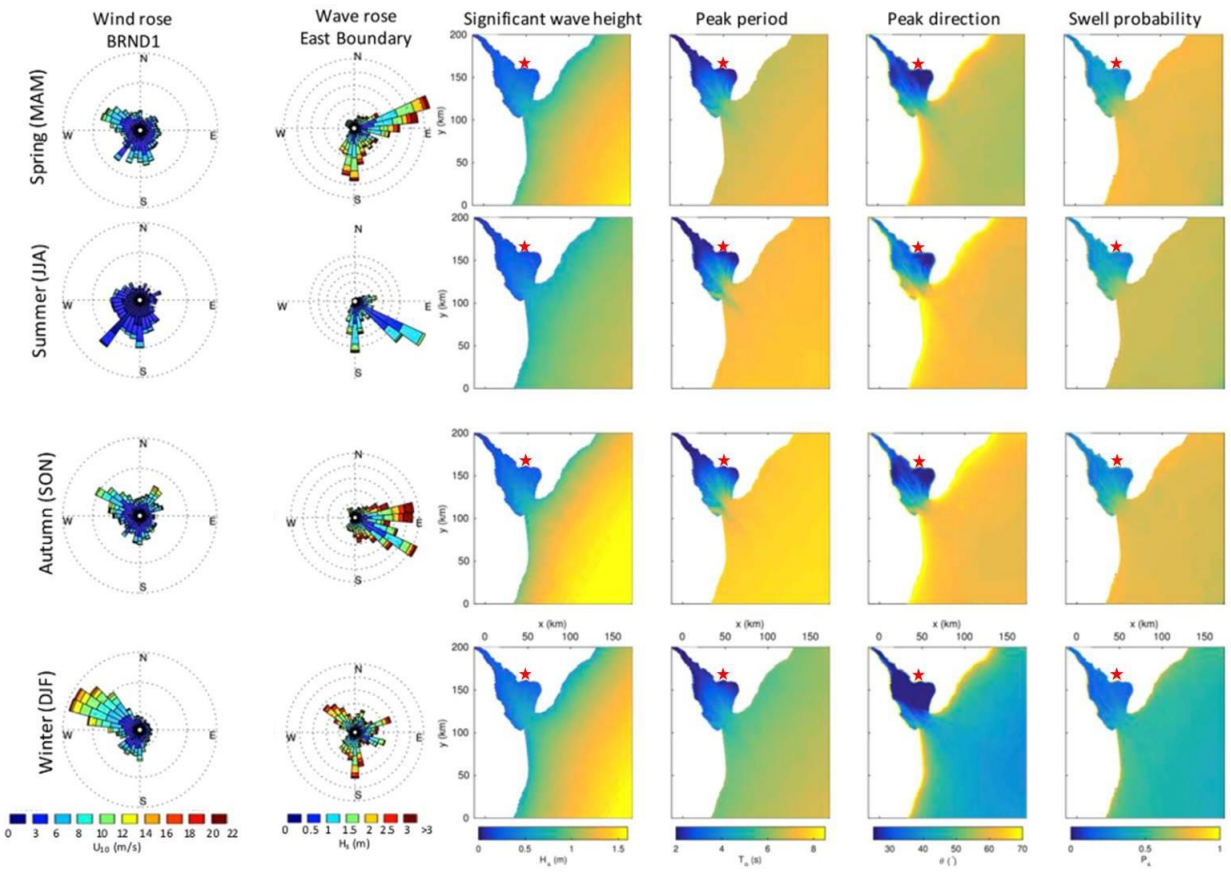



**Figure 30: Modeled variation in significant wave height, peak wave period, wave peak direction, and swell probability within the Delaware Bay and nearby continental shelf (modified from Kukulka *et al.,* 2017). Red star denotes approximate Maurice River entrance.**

Storm surge is the increased water level above the predicted astronomical tide due to storm winds over the bay and the resultant wind stress on the bay surface. The magnitude of the storm surge is calculated as the difference between the predicted astronomic tidal elevation and the actual water surface elevation at any time. These components of water level and current must be added to the ambient sources of currents and wave set-up to determine the cumulative conditions at a given location.

Two types of storms generally are responsible for serious damage to the study area, tropical storms and extra-tropical nor'easters. Tropical storms in which wind velocity reaches or exceeds 74 miles per hour are considered to be hurricanes, and typically reach the project area with hurricane force in summer and fall, although hurricanes can occur at any time during the year. Extra-tropical storms, commonly referred to as nor'easters, occur when intense low pressure centers form in the mid- to north-Atlantic coasts.

In the project area, nor'easters are not excluded from the warm season, but they are more prevalent during the fall and winter. Hurricanes typically can produce a higher peak surge than nor'easters, due to much higher wind speeds. However, hurricanes are limited in duration. They can cause the greatest shore erosion in the shortest period of time. The more frequently occurring nor'easters, although having

lower wind speeds, can cause equal or greater damage than hurricanes due to their longer duration.

Over the years, storms of note along the Delaware Estuary have included the March 1962 storm which caused many miles of shoreline along the Delaware Bay to retreat up to 75 feet, and more recently Hurricane Sandy (**Figure 31**). As Sandy made landfall on the NJ coastline, it generated intense onshore winds, waves, and a storm surge that was augmented by astronomical spring tides associated with the full moon of 29 October. The combined effects of wind, waves, and elevated tidal water levels led to significant erosion damage to the Delaware bayshore. Sandy caused significant flooding along the Maurice River, and Maurice River Township's records indicated three municipal levees were breached. The Maurice River at Bivalve, NJ tide gage, just north of the study area, recorded Sandy water level maximums as 7.0 ft NAVD 88.

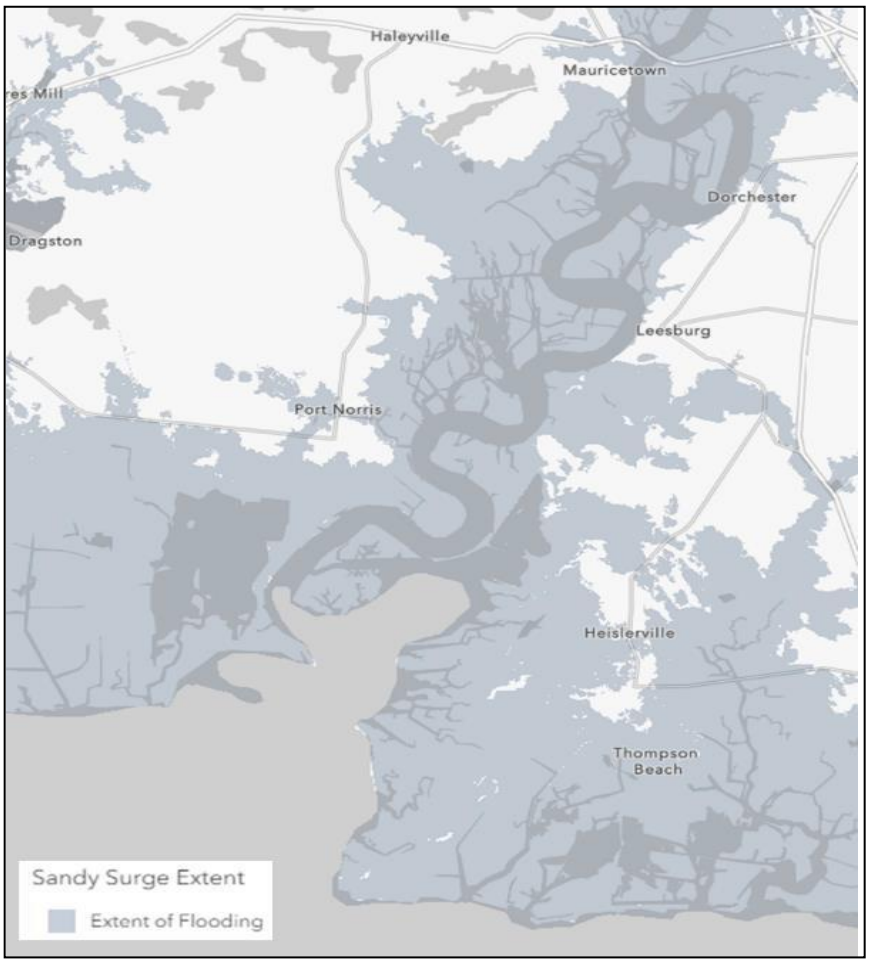



**Figure 31: Extent of Hurricane Sandy storm surge flooding along the lower Maurice River created from field-verified High Water Marks (HWMs) and storm surge sensor USGS data (extracted from NJFloodMapper.Org).**

The study area continues to be subjected to progressive erosion of the shoreline and marshes due to long-term shore processes relating to storm events and SLR. Over the past several decades, the mouth of the Maurice River has been undergoing a rapid transition into a muddy delta. Silting, channel erosion, and flooding have inundated the once pristine wetlands and meadows. While erosion of the former flats

separating deltas have been relatively stable over time in general, they are often driven by storm events. Eroded material from wetlands has long been recognized as a source of shoal material. In addition to other sources of sediment, **Figure 32** illustrates the extent to which marsh dominates the greater project area.

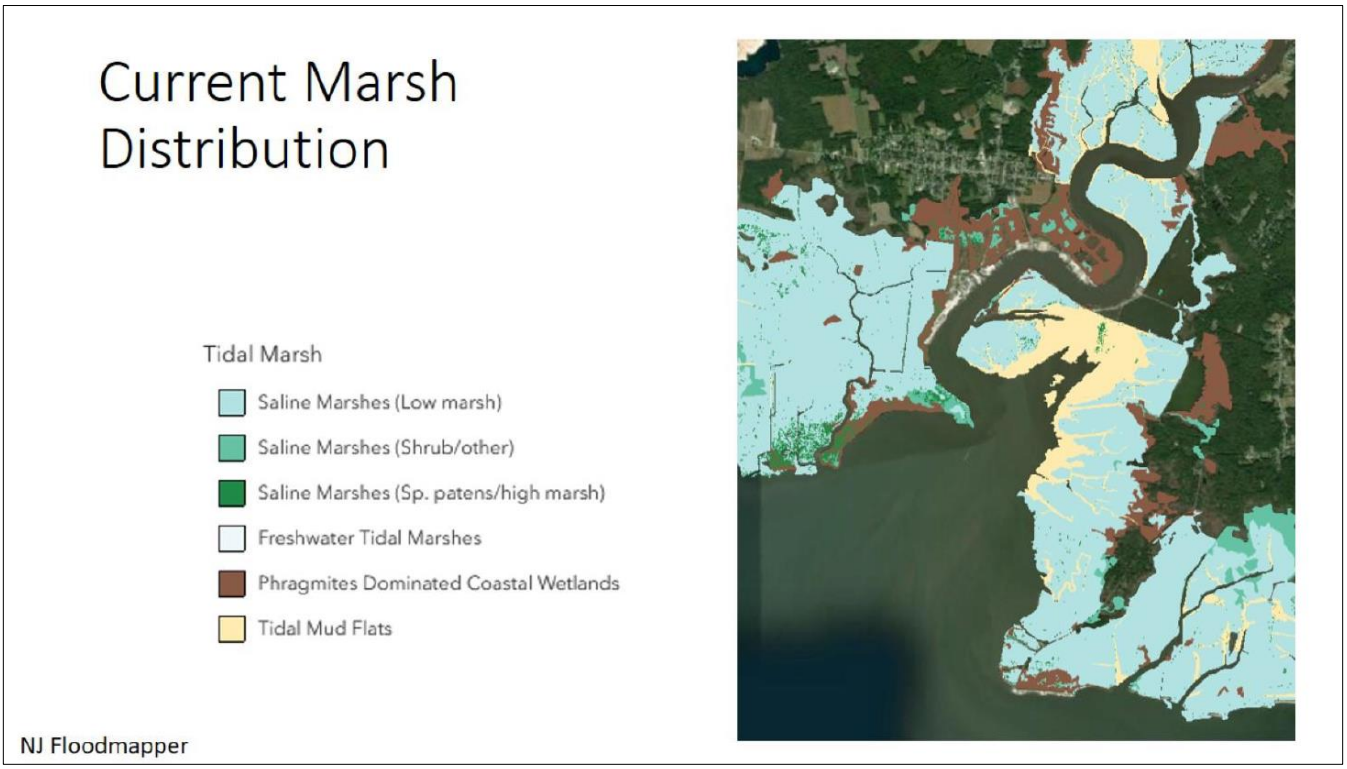



**Figure 32: Current landcover data for the area (courtesy of L. Tedesco, The Wetlands Institute).**

The commercial and recreational fishing communities and infrastructure of Bivalve, Shellpile, and Matts Landing have become increasingly exposed to the bay due to the loss of protective marsh (**Figure 33**. Erosion of the saltmarshes and adjacent beaches reduces available habitat for fish, waterfowl, and shorebirds.

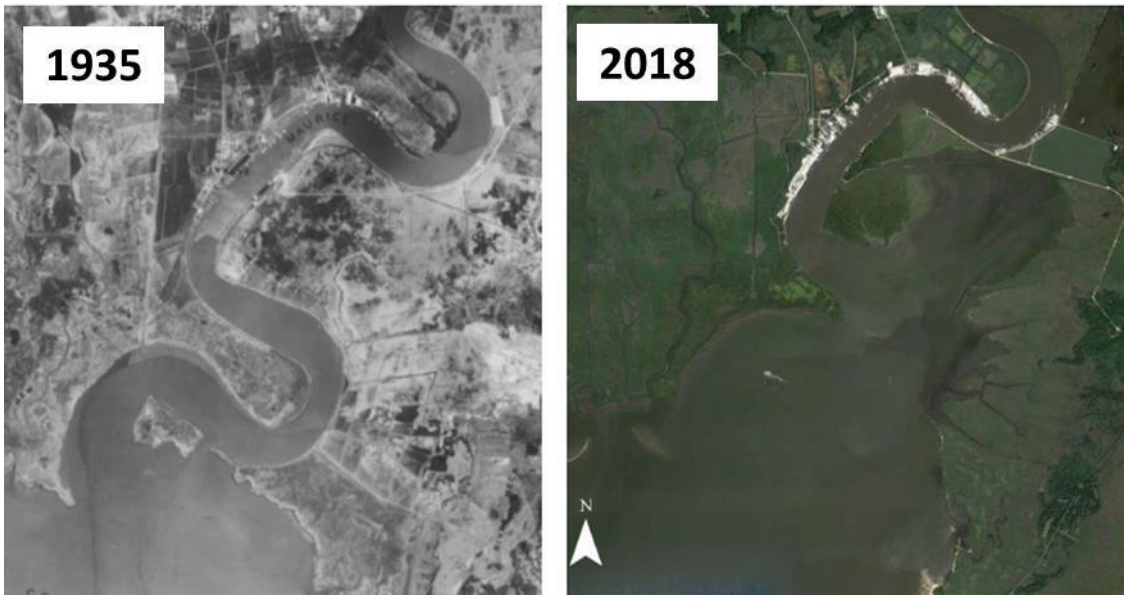



**Figure 33: Change in shorelines along the mouth of the Maurice River between 1935 and 2018 (Figure modified from Crist *et al*., 2019. Coastal Resilience Assessment of the Delaware Bay and Coastal Watersheds).**

### 4.2 Aquatic Resources

#### 4.2.1 Wetlands and Intertidal Mudflats

The vast majority of the wetlands in the general project surroundings are emergent intertidal estuarine wetlands. Brackish marsh vegetation extends inland. Smooth cordgrass high vigor *(Spartina alterniflora*) is the dominant plant species. More inland, downstream of Port Norris on the Maurice River the dominant plant species are salt meadow hay *(Spartina patens*) and salt grass *(Distichlis spicata)* with common reed *(Phragmites australis)* and *S. alterniflora* as secondary species.

Wetlands play a vital role in the overall well-being of coastal ecosystems. Slightly elevated adjacent areas that undergo intertidal flushing contain low saltmarsh, high saltmarsh and common reed (Phragmites). Many plants and animals depend on wetlands and intertidal vegetated habitat for survival, including threatened and endangered species. Wetlands provide a nursery habitat for many commercially and recreationally important fish species that are harvested outside the wetland. Wetlands also play an important role in flood protection. The roots of wetland plants help bind the shoreline together, resisting erosion by wind and waves and providing a physical barrier that slows down storm surges and tidal waves, thereby reducing their height and destructive power.

Wildlife species utilizing the low saltmarsh habitats include birds such as clapper rails (*Rallus longirostris*), waterfowl, and other species that feed on insects, crabs and other invertebrates that this community supports. The low marsh and tidal channel complex provides significant habitat for

numerous fish species that depend on estuaries for nursery and spawning grounds, as well as smaller resident fish such as mummichog, killifish and silversides (Mitsch and Gosselink, 1993; Tiner, 1985). High saltmarsh provides habitat for many breeding species of waterfowl such as black ducks (*Anas rubripes*) and mallards (*Anas platyrhynchos*).

Within the project area, tidal wetlands continue to be subjected to erosion, subsidence and flooding and now consist primarily of shallow water and mudflats. More than 400 acres of wetlands have been converted to shallow water and mudflats due to excessive inundation. Mudflats are unvegetated, soft-sediment, intertidal habitats that support macrofaunal assemblages within the sediments. They provide food for fish and birds and other important ecological functions such as nutrient cycling. These habitats are widespread but are threatened by increasing pressure from anthropogenic activities and SLR, thereby reducing biodiversity loss. Mudflat sediments possess a seed bank of previously established marsh vegetation and macroinvertebrates found in this area include the polychaete *Eteone heteropoda* and *Nereis succinea*, the crustaceans *Ampelisca*, sp. and *Leucon americanus* (Dissanayake *et al.,* 2018).

The Maurice River area has been designated by the USFWS as a priority wetland site under the Emergency Wetlands Resources Act of 1986 (P.L. 99- 645) and is a focus area identified in the Atlantic Coast Venture of the North American Waterfowl Management Plan. In addition, the Maurice River is designated as a wetland complex of international importance under the RAMSAR Convention (Convention on Wetlands of lnternational Importance, Especially as Waterfowl Habitat; I.L.M. II: 963-976, 1972) (Schrading, 1995).

There are no known areas of submerged aquatic vegetation (SAV) in the proposed project area. NJDEP's Division of Land Resource Protection provides access to SAV maps within the state (https://www.nj.gov/dep/landuse/sav.html; https://www.nj.gov/dep/gis/geowebsplash.htm).

### 4.2.2 Benthic Macroinvertebrates

Maurice River cove and adjacent shallow water habitats support a large population of blue crabs (*Callinectes sapidus*), American oyster (*Crassostrea virginica*), horseshoe crab (*Limulus polyphemus*), and other benthic organisms.

Blue crabs spawn in Maurice River cove from May through October. Spawning occurs in the mouth of the Maurice River where salinity levels are relatively low. Female crabs return to high- salinity water after mating, while juveniles and adult males remain in the mouth of the Maurice River. Blue crabs overwinter under soft mud in the deep water of the Delaware Bay before returning to the Maurice River, and other rivers, tidal creeks, and salt marshes in the spring.

The Maurice River cove contains American oyster beds that support an important commercial industry. The oyster population in the Delaware Bay and in Maurice River Cove has fluctuated, sometimes dramatically, throughout the recorded history of the fishery. The American oyster feeds primarily on phytoplankton and is tolerant of a wide range of salinities, temperatures, currents, and turbidities. Water temperature stimulates spawning in oysters. Free-swimming oyster larvae "set" in established oyster seed beds prior to metamorphosing into sessile, juvenile oysters. Intertidal and subtidal seed beds

provide habitat for many infaunal and epifaunal species (Burrell, 1986).

The Delaware Bay is the site of the largest concentration of horseshoe crabs in the world. Botton *et al.* (2003) report an estimated spawning population in the Delaware Bay of between 1.24 and 0.39 million individuals between 1990 and 1993. Horseshoe crabs migrate into the bay from April through July to spawn within the intertidal zone of sandy beaches. Nearby East Point offers sandy habitat on the eastern side of Maurice River cove for horseshoe crab spawning Swan *et al.*, 1993; Swan *et al.,* 1997). The eggs are an extremely important food source for a variety of migrating birds, many of whom double or triple their weight before completing their migration (Bryant and Pennock, 1988). Other than East Point, the mouth of the Maurice River and Cove have few sandy beaches to support horseshoe crab spawning. However, the adjacent Delaware Bay and Maurice River Cove provides feeding habitat throughout the summer prior to the horseshoe crab migration to deeper water in fall and early winter.

#### 4.2.3 Fish

Finfish represent a major resource group in the Maurice River cove area and the Delaware Bay. Maurice River Cove ranges in depth of 1-7 feet MLLW. The Maurice River and cove support significant recreational and commercial fisheries, primarily as a result of nutrient export from wetlands. Commercially valuable fish that occur within the mouth of the Maurice River may include American shad (*Alosa sapidissima)*, Atlantic menhaden (*Brevoortia tyrannus*)*,* blueback herring (*Alosa aestivalis*)*,* bluefish (*Pomatomus saltatrix*)*,* and white perch (*Morone americana).* Species important to recreational fisheries within the mouth of the Maurice River include bluefish, striped bass (*Morone saxatilis),* spot (*Leiostomus xanthurus*), and weakfish (*Cynoscion regalis*)*.* Other fish in the Maurice River cove include Atlantic croaker (*Micropogonias undulatus*)*,* Atlantic herring (*Clupea harengus),* (New Jersey Division of Fish and Wildlife). Many of these fish species use the Maurice River as a nursery area during the early stages of their development. Fish species such as alewife (*Alosa pseudoharengus*), banded killifish (*Fundulus diaphanous*), mummichog (*Fundulus heteroclitus*), bay anchovy (*Anchoa mitchilli*), and hogchoker *(Trinectes maculatus*) are predominant forage fish and provide an important link in the food web (O'Heron, 1987).

Essential Fish Habitat. Pursuant to Section 305(b)(2) of the Magnuson-Stevens Fishery Conservation & Management Act (MSA), the USACE is required to prepare an Essential Fish Habitat (EFH) Assessment for all proposed actions that occur within coastal waters of the United States. EFH textual descriptions are contained in fishery management plans developed by the regional fishery management councils. EFH can include habitats such as wetlands, reefs, seagrass, rivers, and coastal estuaries that fish can spawn, breed, feed, and grow to maturity. NOAA Fisheries has designated Essential Fish Habitat (EFH) for 15 federally managed species in the project area based on life stages likely to be present (FishMapper accessed 7 March 2022). The EFH Assessment is provided in Appendix A.

### 4.3 Terrestrial Resources

#### 4.3.1 Terrestrial Habitats

Very little non-wetland or dry, terrestrial habitats occur in the project area. Most undeveloped terrestrial

habitats occur a good distance from the project area. Developed terrestrial habitats occur along the Matts Landing Road and Heislerville dike corridors and a few small agricultural fields. Forested areas occur near the towns of Heislerville and Port Norris approximately a mile away to the east and northwest, respectively. Species in these areas include Loblolly pine (*Pinus taeda*), American holly (*Ilex opaca*) and sweet gum (*Liquidambar styraciflua*) trees. Shrubs include marsh elder (*Iya frµtescens*), groundsel tree (*Baccharis halimfolia*) and sometimes poison ivy (*Toxicodendron radicans*).

### 4.3.2 Avifauna and other Wildlife

The Delaware Estuary lies along the Mid-Atlantic Flyway, a major migratory corridor for north and southbound birds including waterfowl, wading birds, raptors, shorebirds, and songbirds. Saltmarshes and tidal wetlands meet coastal shrub and forested habitats in the project area. Maurice River cove area provides such habitats that are used by transient birds to rest and feed during their long annual migrations each spring and fall (Schrading, 1995).

Species visiting the marshes and shoreline habitats include Virginia rail (*R.allus limicola*), clapper rail (*Rallus longirostris*), black rail (*Laterallus jamaicensis*), black-necked stilt (*Himancopus mexicanus*), ruddy turnstone (*Arenaria incerpres*), red knot (*Calidris canutus*), short-billed dowitcher (*Limnodromus griseus*), sanderling (*Calidris alba*), semipalmated sandpiper (*Calidris pusilla*), dunlin (*Calidris alpina*), and curlew sandpiper (*Calidris ferruginea)* (**Figure 34**). Many of these shorebirds stop on sandy beaches adjacent to the Maurice River cove in the spring to feed on horseshoe crab eggs. Individual birds stop to feed and rest in the Delaware Bay and Maurice River area an estimated 15 days, before leaving to complete their migration to Canadian nesting areas.

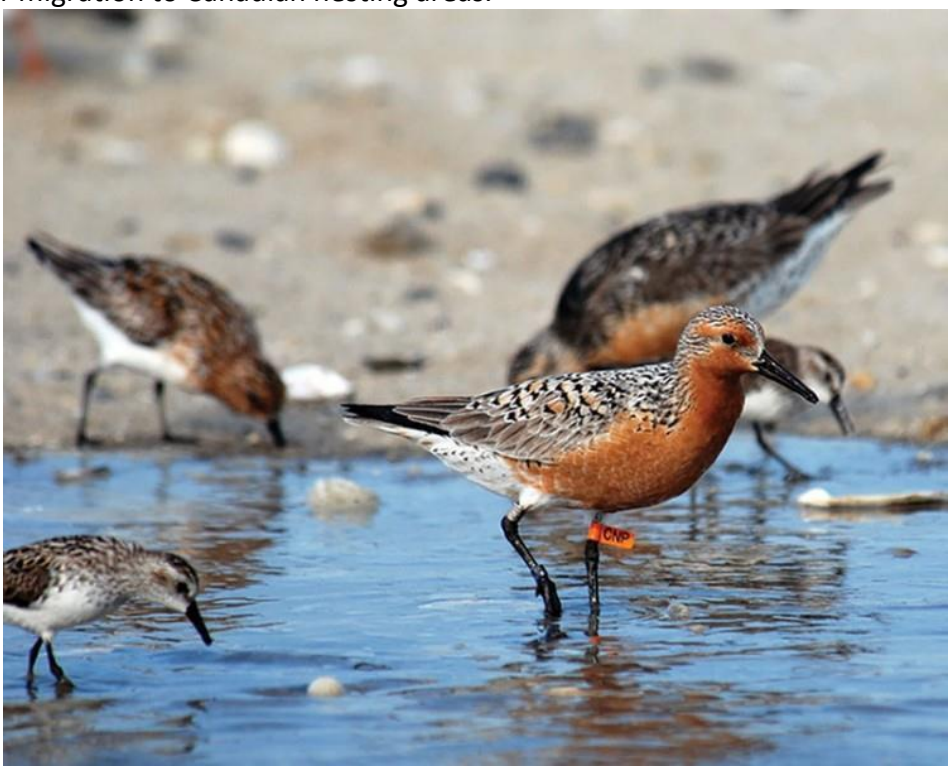


**Figure 34: Migratory shorebirds (red knots and semipalmated sandpipers).**

Great blue herons (*Ardea herodias*), black-crowned night herons (*Nycticorax nycticorax*), great egrets (*Casmerodius albus*)), and snowy egrets (*Egretta thula*) occur within the shallows of tidal creeks and emergent flats adjacent to the mouth of the Maurice River.

The Maurice River cover area also provides important waterfowl staging habitat. Waterfowl that occur within the Maurice River area include tundra swan (*Cygnus columbianus*), mute swan (*Cygnus olor*), Canada goose (*Branca canadensis*), brant (*Branca bernicla*), greater snow goose (*Chen caerulescens*), American black duck (*Anas rubripes*), northern pintail (*Anas acuca*), green- winged teal (*Anas* crecca), and blue-winged teal (*Anas dlscors*). The Maurice River area, in particular, provides critical wintering habitat for black duck. Although it was once one of the most abundant dabbling ducks in North America, the American black duck had lost more than half of their population by the 1980s. Since then, populations have stabilized, but are still below objectives set by the 2018 North American Waterfowl Management Plan.

Several raptors occur year-round in the Maurice River cover area including the northern harrier (*Circus cyaneus*), red-tailed hawk (*Buteo jamaicensis*), and bald eagle (*Haliaeetus leucocephalus*). These raptors forage in surrounding marshes during the winter. The rough-legged hawk (*Buteo lagopus)* and short-eared owl (*Asio flammeus*) also occur in the Maurice River cove area during the winter (Dunne and Sutton, 1986). The osprey (*Pandion haliaetus*) is a common resident during the summer and forages primarily in shallow water habitat. Osprey regularly nest on man-made structures (*e.g*., nesting platforms, telephone poles) and in snags adjacent to emergent wetlands.

Neotropical songbirds also migrate in and out of the project vicinity in the spring and fall. Species commonly observed include the red-bellied woodpecker (*Centurus carolinus*), blue jay *(Cyanocitta cristata),* tree swallow (*Iridoprocne bicolor*), American robin (*Turdus migratorius),* eastern bluebird (*Sialia sialis*), song sparrow (*Melospiza melodia*), mourning dove (*Zenaida macroura*), gray catbird (*Dumetella carolinensis*), northern mockingbird (*Mimus polyglottos*), and redwinged blackbird (*Agelaius phoenicues*). Many of these neotropical bird species remain in the neighboring woodlands of the Heislerville WMA to breed. The more common gull species observed in the area include the laughing gull (*Larus atricilla*), herring gull (*L. argentatus*), and ring-billed gull (*L. delawarensis*).

In addition to a variety of birds, both wetlands and uplands adjacent to the project area along the Maurice River support other wildlife species including muskrat (*Ondatra zibethicus*), river otter (*Lutra canadensis*), and raccoons (*Procyon lotor*). Many of these species permanently reside in the surrounding tidal marshes and forests near the river. White-tailed deer (*Odocoileus virginianus*), weasels (*Mustela frenata*), and red fox (*Vulpes vulpes*) are transient visitors of the Maurice River area and enter the marsh from neighboring uplands to forage.

### 4.4 Rare, Threatened, and Endangered Species

The Endangered Species Act (ESA) provides a program for the conservation of threatened and endangered species and a means for conserving the ecosystems upon which those species depend. Section 7 (a)(2) of the ESA requires federal agencies to consult with the U.S. Fish and Wildlife Service

(USFWS) and National Marine Fisheries Service (NMFS) to ensure their activities are not likely to jeopardize the continued existence of listed species or destroy or adversely modify their critical habitat. Under the ESA, an endangered species is in danger of extinction and a threatened species is likely to become endangered within the foreseeable future.

The New Jersey Endangered Species Act (NJESA) is designed to protect species whose survival in New Jersey is imperiled by loss of habitat, over-exploitation, pollution, or other impacts. Under the NJESA, endangered species are those whose prospects for survival in New Jersey are in immediate danger because of a loss or change of habitat, over-exploitation, predation, competition, or disease. Threatened species are those that may become endangered if conditions surrounding the species begin or continue to deteriorate.

The USFWS Information for Planning and Consultation (IPAC) was queried on 7 March 2022 and 19 January 2022, to determine the potential occurrence of federally listed threatened, endangered, or candidate species within the project area encompassing the proposed channel dredging area and adjacent proposed beneficial use placement areas. The piping plover (*Charadrius melodus*) is a Federally- and state-listed shorebird that breeds on sandy beaches along the Atlantic and Gulf coasts. The species was federally listed as threatened in 1986. In New Jersey piping plovers nest on coastal sandy beaches between March 15 and August 31. While nesting habitat does not exist in the project area, piping plover may visit the area foraging. Feeding areas include the intertidal zone, washover areas, mudflats, sandflats, and wrack lines along the shoreline and salt marshes. The species feed on macroinvertebrates such as worms, fly larvae, beetles, and small crustaceans.

The rufa red knot (*Calidris canutus*) is listed as Federally threatened (2015) and state-listed as endangered (2007). Red knots are primarily found along the Delaware Bay shorelines, where they occur in large numbers during the spring (mid-May through early June) and fall (late July through November) migration periods. Red knots feed on invertebrates, especially horseshoe crab eggs during the spring migration. The NJDEP reports that both horseshoe crab and red knot numbers have declined by over 75 percent since the early 1990's.

The eastern black rail (*Laterallus jamaicensis jamaicensis*) was listed as Federally threatened in October 2020. According to Conserve Wildlife New Jersey, the black rail occurs in coastal salt and brackish marshes where they often nest in areas of elevated marsh that are flooded only during extremely high tides. Nests are typically located in marshes dominated by salt hay. Black rails may seek cover within vegetation in adjacent upland fields and meadows during high tides. In the past three decades, black rails have been observed along the Atlantic Coast during the nesting season. The black rail (*Laterallus jamaicensis*) is state-listed as endangered.

The endangered northern long-eared bat (*Myotis septentrionalis*) and the candidate endangered tricolored bat (*Perimyotis subflavus*) are not anticipated to be in the project area with habitats that are primarily open water and intertidal mudflats and low marsh.

American chaffseed (*Schwalbea americana L.*) is an endangered herb that has declined from more than half of its range. Due to extirpation of the species from 10 eastern states and a decline in known

occurrences has continued. Sensitive joint-vetch (*Aeschynomene virgi*) is an annual legume native to the eastern U.S. and listed as threatened. Major causes of decline include road construction and residential or commercial development. These plant species are not expected to occur in the predominantly wet environment of the project site. Swamp pink (*Helonias bull*) is a threatened species that is a shade-tolerant obligate wetland species. It occurs along streams in a variety of palustrine forested wetlands including swampy forested wetlands, freshwater headwater wetlands, sphagnous Atlantic white-cedar swamps, and spring seepage areas. The species is not likely to occur in the project area due to water salinity levels. The major threat to the species is loss and degradation of its wetland habitat.

The salt marsh sparrow (*Ammodramus caudacutus*) is currently being evaluated by the USFWS to determine if listing under the ESA is warranted and it is listed as a species of Special Concern in the State of New Jersey. The salt marsh sparrow is a year-round resident in New Jersey, favoring coastal saltmarsh habitat. Nests consist of plant material and can be constructed directly on the ground or about 2 feet above the ground, among the stems of tall marsh grasses typically in high marsh areas.

Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was listed as Federally endangered and threatened in 2012 and is listed as endangered in New Jersey. Atlantic sturgeon spawn in the freshwater regions of the Delaware River. By the end of their first summer the majority of young- of-the-year Atlantic sturgeon remain in their natal river while older subadults begin to migrate to the lower Delaware Bay or nearshore Atlantic Ocean. Older subadult Atlantic sturgeon are known to undertake extensive marine migrations, returning to their natal river in the late spring, summer, and early fall months (Dovel and Berggren, 1983). Early (eggs, larvae, young-of-year) and juvenile life stages of Atlantic sturgeon will not likely present in the project area as they are not able to tolerate the high salinity. While sub-adult and adult Atlantic sturgeon use of marine habitat is not completely understood, they are known to use nearshore coastal waters for their marine migration (NOAA Fisheries, 2020). Atlantic sturgeon are not likely to occur in the project area.

Although not likely to occur in the Maurice River, on rare occasions, two species of whale have been known to venture into the Delaware Bay from the Atlantic Ocean: adult and juvenile fin whales (*Balaenoptera physalusand*) and North Atlantic right whales (*Eubalaena glacialis*). Other marine mammals that have been observed on occasion in the lower Delaware Bay include the harbor seal (*Phoca vitulina*), bottle-nosed dolphin (*Tursiops truncates*), and harbor porpoise (*Phocoena phocoena*). These marine mammals are unlikely to occur in the project area due to insufficient depths.

The lPaC online system provides the list of species and critical habitats under the purview of the U.S. Fish and Wildlife Service's Ecological Services Program that are known or may occur in the project vicinity. In total, eight species (and one candidate species) identified include two mammals: the northern long-eared bat and tricolor bat, threatened northern long-eared bat (*Myosis septentrionalis*); two birds: the eastern black rail (*Laterallus jamaicensis* spp.) and the red knot (*Calidris canutus rufa*); one insect the Monarch butterfly as a candidate species (*Danaus plexi*); and three flowering plants: American chaffseed (*Schwalbea americana L.*), Sensitive joint-vetch (*Aeschynomene virgi*), and Swamp pink (*Helonias bull*). No critical habitats for any listed species were observed in the project vicinity.

The roseate tern (*Sterna dougallii*) is a medium-sized tern that is primarily tropical but breeds in scattered coastal localities in the northern Atlantic temperate zone. It was Federally-listed as endangered in 1987 in the northeast region, including New Jersey. The roseate tern was state-listed in New Jersey initially as threatened in 1979 but reclassified as endangered in New Jersey in 1984. The New Jersey Natural Heritage Program considers the roseate tern to be a non-breeding species in the state and globally "very rare and local throughout its range". The IPaC search did not identify the roseate tern in the project area.

Under the purview of the NMFS, four Federally-listed threatened or endangered sea turtles have the potential to occur in the study area. These include the endangered Kemp's ridley turtle (*Lepidochelys kempii*) and leatherback turtle (*Dermochelys coriacea*) and the threatened green (*Chelonia mydas*) and loggerhead *(Caretta caretta*) turtles (NMFS 2020b). All four species of sea turtles are also listed in the State of New Jersey and could potentially forage in the Maurice River cove area. The northern diamondback terrapin (*Malaclemys terrapin*) is considered a New Jersey species of Special Concern and occupies brackish tidal marshes and nests on sandy bay beaches.

The species listed in Table 4 are USFWS' Birds of Conservation Concern that may occur in the project vicinity. The NJDEP considers the Maurice River as a Natural Heritage Priority Site and includes some of the most significant natural areas in the state.

**Table 4: Birds of Conservation Concern (BCC) (Conserve Wildlife, Foundation of New Jersey).**

| | |
|---|---|
| American oyster catcher (Haematopus pilliatus) | Breeds April 15 to August 31 |
| Black skimmer (*Rynchops niger*) | Breeds May 20 to September 15 |
| Black-billed cuckoo (*Coccyzus erythropthalmus*) | Breeds May 15 to October 10 |
| Blue-winged warbler (*Vermivora pinus*) | Breeds May 1 to June 30 |
| Bobolink (*Dolichonyx orizyvorus*) | Breeds May 20 to July 31 |
| Canada warbler (*Cardellina canadensis*) | Breeds May 20 to August 10 |
| Cerulean warbler (*Dendroica cerulea*) | Breeds April 29 to July 20 |
| Eastern whip-por-will (*Antrostomus vociferus*) | Breeds May 1 to August 20 |
| Gull-billed tern (*Gelochelidon nilotica*) | Breeds May 1 to July 31 |
| Hudsonian godwit (*Limosa haemastica*) | Breeds elsewhere |
| Kentucky warbler (*Oporornis formosus*) | Breeds April 20 to August 20 |
| King rail (*Rallus elegans*) | Breeds May 1 to September 15 |

| | |
|---|---|
| Lesser yellowlegs (*Tringa flavipes*) | Breeds elsewhere |
| Prairie warbler (*Dendroica discolor*) | Breeds May 1 to July 31 |
| Prothonotary warbler (*Protonotaria citrea*) | Breeds April 1 to July 31 |
| Red-headed woodpecker | Breeds May 10 to September 10 |
| (*Melanerpes erythrocephalus*) | |
| Ruddy turnstone (*Arenaria interes morinella*) | Breeds elsewhere |
| Rusty blackbird (*Euphagus carolinus*) | Breeds elsewhere |
| Short-billed dowitcher (*Limnodromus griseus*) | Breeds elsewhere |
| Willet (*Tringa semipalmata*) | Breeds April 20 to August 5 |
| Wood thrush (*Hylocichia mustelina*) | Breeds May 10 to August 31 |

The bald eagle (*Haliaeetus leucocephalus*) uses the Maurice River's surrounding habitats as a major wintering area. The NJDEP reported that there were 247 active bald eagle nests within the state of New Jersey in 2021. Although the bald eagle was removed from the Endangered Species list in 2007, it is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. These laws prohibit killing, selling or otherwise harming eagles, their nests, or eggs. The bald eagle has remained a state-listed species in New Jersey.

Populations of osprey *(Pandion haliaetus),* a state-listed threatened species, are also growing in New Jersey. As of 2017, NJDEP's Endangered and Nongame Species program has recorded 668 osprey nests in the state, including in the Maurice River corridor. Unlike the bald eagle, ospreys migrate out of the project area in winter.

### 4.5 Land Use and Socioeconomic Conditions

The project area is located in Cumberland County, which encompasses 678 square miles and home to approximately 157,153 (2019) people. The area around Maurice River cove consists of small rural communities within Maurice and Commercial Townships. Bivalve, a section of the community of Port Norris located on the western side of Maurice River and possesses several businesses focused primarily on fishing, boating and the crab and oyster industries. As of 2021, Port Norris has a population of 1,390. As noted in Section 1.2, the Heislerville Fish and WMA encompasses a significant portion of the surrounding lands. The Heislerville WMA is owned and managed by the NJDEP and comprises 7,670 acres of tidal marsh, shoreline, woodlands, and fields and coastal impoundments, providing habitats for a variety of wildlife. These saltmarshes support over 50% of the state's endangered non-aquatic animal species. The lower river and adjoining Delaware Bay support recreationally and commercially-important fish species that support the rural communities. Ecotourism has increased in the area over the last few decades, specifically for bird-watching.

**Economic Justice.** On February 11, 1994, President Clinton issued Executive Order 12898, Federal Actions to Address Environmental Justice in Minority and Low-Income Populations. This order requires that "each federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities, on minority populations and low-income populations" (Executive Order 12898, 59 Federal Register 7629 [Section 1-201]).

Cumberland County has a low population density and rural. The CDC National Public Health Tracking Network (2019 data) notes the average household income for Cumberland County as $51,790 while the state of New Jersey average household income is $81,777. Approximately 13.8% of Cumberland County residents live below the poverty line (NJ average: 9.1%).

The U.S. EPA cites that within a 2-mile radius of the project area (10.74 sq. mi.) there are 501 households (86% owner occupied; 14% renter occupied). The population density is 110 people/square mile and 15% people of color. Ethnicity is 72.5% white; 21.7% black; 1.6% Native American; 1.5% Asian; and 2.7% Other. Household income distribution is shown in Table 5.

**Table 5: Household income distribution for a 2-mile radius of the project area.**

| Household Income Base | 2015-2019 Estimates | Percent | MOE |
|---|---|---|---|
| <$15,000/year | 24 | 5% | 23 |
| $15,000-$25,000/year | 96 | 19% | 61 |
| $25,001-$50,000/year | 141 | 28% | 69 |
| $50,001-$75,000/year | 104 | 21% | 53 |
| >$75,000/year | 136 | 27% | 82 |
| Total | 501 | 100% | 113 |

MOE (+ or -): Margin of Error at the 90% confidence interval.
**Source:** U.S. Census Bureau, American Community Survey (ACS)

The USEPA's Environmental Justice website EJScreen: (https://www.epa.gov/ejscreen) was used to evaluate indicators for the project area to gauge if there would be potential to EJ communities in the area. Based on the Environmental Justice (EJ) indices from EJScreen for the project area, there are no potential EJ communities in the immediate vicinity. The indices consider air pollutant levels; respiratory hazards; cancer risk; traffic levels; lead paint; proximity to Superfund sites, hazardous waste, and wastewater discharge; as well as demographic indicators such as minority populations, low income, linguistic isolation, education level, and age (under 5 and over 64 years of age).

### 4.6 Cultural and Historic Resources

**Introduction.** As a federal agency the USACE has certain responsibilities for the identification, protection, and preservation of cultural resources that may be located within the Area of Potential Effect (APE) associated with the proposed Maurice River federally-authorized maintenance dredging project.

Present statutes and regulations governing the identification, protection, and preservation of these resources include the National Historic Preservation Act of 1966 (NHPA), as amended; the National Environmental Policy Act of 1969; Executive Order 11593; the regulations implementing Section 106 of the NHPA (36 CFR Part 800, Protection of Historic Properties, August 2004); and the U.S. Army Corps of Engineers Identification and Administration of Cultural Resources (33 CFR 305). Significant cultural resources include any material remains of human activity eligible for inclusion on the National Register of Historic Places (NRHP). This work is done in coordination with the New Jersey State Historic Preservation Office (NJSHPO), Tribal Nations and other consulting parties.

A review of the New Jersey State Historic Preservation Office (NJ SHPO) Cultural Resources Geographic Information System (CRGIS) database, accessed through LUCY, an ArcGIS Online Web Mapping application was conducted to identify known recorded sites within the Maurice River study area. Archaeological site files for recorded sites within the project APE were then obtained directly from the NJ State Archaeologist, Dr. Gregory Lattanzi and from Mr. Tony McNichols of the Pinewoods Commission. Town histories of Commercial and Maurice River Townships and county histories of Cumberland County were reviewed to provide background contextual information on the study along with historic maps which depicts the development of these communities over time.

Reports of previous historic and archaeological surveys conducted within the study area, available from the Philadelphia District, were also examined to determine the current sensitivity of the project area for historic and cultural resources. Recorded National Register of Historic Places (NRHP) properties and historic districts within Cumberland County were identified and are presented here along with the site information and sensitivity analysis.

**Area of Potential Effect**. The Area of Potential Effect (APE) currently includes maintenance dredging of the lowermost portion of the Maurice River Federal Navigation channel in Maurice River Cove to authorized depth of 7 ft MLLW with 2 ft allowable overdepth and the placement of the sediments on an eroding natural system within the northwest reach of the Heislerville WMA adjacent to the Heislerville dike (see Figure 19).

**Pre-Contact Period Context**. The Pre-Contact history of North America is divided up into cultural periods, beginning with the Paleo-Indian Period (12,000 – 8,000 BC), the Archaic Period (8,000 – 1,000 BC), and the Woodland Period (1,000 – European Contact).

The Paleo-Indian cultures arose following the glaciation of the Late Pleistocene Period and were adaptable to the tundra environment in place at the time. These cultures are characterized as highly mobile people who traveled great distance in pursuit of food and lithic materials. The environment 12,000 years ago in New Jersey is characterized by tundra and forest environments composed of pine, spruce and fir, and later, birch and oak. The increase in oak stands and greater resource availability later in the Paleo-Indian period allowed for greater human population density (Scarpa 2019, 5).

The characteristic diagnostic artifact of the Paleo-Indian period is the chipped stone, fluted projectile point. Although rare in New Jersey and composed mostly of occasional, isolated finds, examples have been found in sites from Middlesex and Somerset Counties (Marshall 1982, 13). As large game moved to

the north or became extinct, the fluted points were gradually replaced by triangular, stemmed, and lanceolate-shaped points without flutes, known as Plano points during the onset of the Archaic Period. Late Paleo-Indian artifacts were found in Monmouth County at the Turkey Swamp site (Marshall 1982, 33); (Scarpa 2019, 6).

The Archaic Period (8,000 – 1,000 BC) followed the Paleo-Indian Period and is characterized by greater resource availability and what is typically known as a hunting and gathering economy supplemented with fishing. The entire range of Archaic Period artifacts have been identified from sites and excavations in southern New Jersey, as well as in unreported archaeological collections from the area. Most of the known Archaic sites are located along streams and bodies of water where hunting, fishing, and gathering can be conducted. While Archaic sites usually contain evidence of later and earlier periods of occupation, single component sites have been identified in Cumberland County in the town of Bridgeton and at the Fralinger Site beneath later cultural material (Kraft, The Archaic Period in New Jersey 1982, 52, 72-3).

The Archaic Period is further subdivided into three separate components: Early, Middle, and Late Archaic based upon artifact type, chronology and other characteristics relating to social organization and adaptation (Kraft, The Archaic Period in New Jersey 1982, 75). The Early Archaic Period generally refers to the period from 8,000 to 6,000 BC and is characterized by stemmed and notched projectile points, especially bifurcate-based points. Most of the sites from this period are typically small encampments occupied by mobile bands of people. Early Archaic sites in southern New Jersey are located near rivers or along ponds and bogs on the coast. Seeds, nuts, shellfish and small reptiles were likely exploited, and a greater range of stone tools (knives, scrapers and choppers) and bone and woodworking tools (celts and drills) indicate a greater diversity in resource availability and procurement (Kraft, The Archaic Period in New Jersey 1982, 75-6).

Middle Archaic Period (6,000 – 4,000 BC) sites indicate an environmental setting similar to the present day and are reflected in larger and more numerous locations in more diverse ecological settings. In addition to riverine and lacustrine sites, estuarine settings were occupied, and quarry sites began to be exploited. Projectile points consist more of a stemmed, similar variety along with the stone and bone tool implements of earlier periods. Sites of Middle Archaic chronology in New Jersey contain artifacts that have similarities to stratified sites in North Carolina and southern New England. Sites from the Maurice River drainage in southern New Jersey recovered by Mounier contain projectile points that correspond with the Stanly Stemmed type in North Carolina and the Neville type in New Hampshire along with scrapers and hammerstones (Kraft, The Archaic Period in New Jersey 1982, 78).

The most common Middle Archaic representation in southern New Jersey is what is known as the Poplar Island complex, with diagnostic artifacts consisting of long, slender points with tapered stems. However, sites in the Middle Atlantic Region containing Poplar Island points in stratigraphic context are relatively few; where found, they are usually associated with scrapers, hammerstones and similar implements. Poplar Island projectile points have been found frequently throughout the coastal plains of New Jersey (Kraft, The Archaic Period in New Jersey 1982, 79-80).

During the Late Archaic Period (4,000 – 2,000 BC), population densities increased and there is a greater emphasis on small game, shellfish, seeds and nuts and the presence of pestles and other milling

implements during this time. A wider range of habitats and a greater diversity of resources were exploited, primarily with a riverine focus along with coastal, estuarine, springs, and other bodies of water including drainage basins (Kraft, The Archaic Period in New Jersey 1982, 80).

There is also an increasing emphasis on elaborate ceremonialism as seen in mortuary practices during the period, which indicate the presence of stratification in these cultures. The two cultural traditions of note during this period include the Small Stemmed Point tradition and the Susquehanna Tradition. The former is characterized by a variety of small, slender stemmed and triangular projectile points, ground stone tools, and weights, choppers, knives, scrapers, pestles, and paint stones. The Susquehanna Tradition artifacts include a series of broad stemmed and notched and narrow notched points known as "fishtail" points. Elaborate mortuary practices include the practice of cremation with the ritual use of red ocher and the placement of grave goods with the burial (Kraft, The Archaic Period in New Jersey 1982, 81-2). Most Late Archaic sites in New Jersey have been excavated by Kraft and Kinsey in the Upper Delaware Valley (Shelton 1986, I-11).

The Woodland Period (2,000 BC – 1700 AD) is characterized by the presence of pottery throughout the region which increased in sophistication and design over time. In addition, the cultivation of plants, elaborate ceremonial ritual, and a rise in sedentism towards settled villages are also major characteristics (L. E. Williams 1982, 107). Early and Middle Woodland Period populations in southern New Jersey engaged primarily in fishing, shellfishing, hunting, gathering, and the practice of subsistence horticulture. The site types include fishing stations, shellfish middens, hunting and gathering camps, base camps and mortuary sites (L. E. Williams 1982, 128- 9). The major sites from this period in southern New Jersey include the Abbott Farm Site along the Delaware River, the Raccoon Point Site in Gloucester County, and the Cadwallader Complex investigated by Mounier in the Outer Coastal Plain of the Delaware Bay drainage (L. E. Williams 1982, 117-120).

The Late Woodland Period (ca. 1,000 AD) is noted by increased populations and horticulture along major river drainages along with seasonal occupation of interior and coastal areas for hunting and gathering, with evidence of extensive trade and contact throughout the region and beyond. Archaeological excavations of Late Woodland sites on and near the Maurice River are available in the literature (Kraft 1982, 141). One cultural complex of related artifacts centered around southwestern New Jersey including the Maurice River drainage is known as the Riggins Complex and consists of fabric-impressed and incised ceramic vessels, plain and decorated tobacco pipes, small triangular projectile points, and chipped stone tools. Other artifact assemblages identified in the Maurice River are said to represent the aboriginal cultures encountered by Europeans, likely the ancestral groups of the Unami Delaware or Lenni Lenape who occupied southern New Jersey during the early contact period (Kraft 1982, 165-6).

**Early European Contact Period (1,600 – 1,800 AD).** Historic references indicate that the Indian populations of central and southern New Jersey were decimated by disease, alcohol abuse, and warfare with the Susquehannocks of eastern Pennsylvania. By the 1700's, small groups of Native peoples were clustered in missionary groups at Cranbury, Crosswicks, and at Brotherton near the town of Indian Mills. Brotherton is known as one of the first Indian reservations in North America (L. E. Williams 1982, 191).

A characteristic feature of Contact Period archaeological sites is the introduction of European trade

goods and artifacts. In southern New Jersey during the 1600's, Contact sites are usually villages located along the Delaware River and its tributaries. Along the southern New Jersey coast and along rivers flowing into the Atlantic Ocean, there is evidence of Native American settlements. By 1740, there were few aboriginal sites still occupied in New Jersey. Many Native groups had moved west by this point in time. Missionary settlements were established for Indians during this period at Vincentown as well as the aforementioned Brotherton (L. E. Williams 1982, 191-4).

**History of the Study Area**. The first permanent European settlement in what is today New Jersey was by the Dutch in 1660 at Bergen (Jersey City). When the Dutch were supplanted by English rule in 1664, New Englanders moved into areas south of Bergen including Essex, Union, Middlesex, and Monmouth Counties. During the mid-1670's, Quakers began to settle the southwestern portion of the state along with Swedes and Finns who had originally settled in what is today Pennsylvania. While permanent settlement occurred in most areas of New Jersey by 1765, the Outer Coastal Plain was one of the few areas that was an exception. Little is known about the early population of this area, although New Englanders settled near Cape May and small fishing communities were established along the coast (Wacker 1982, 199-200).

Early industrial activity at this time centered around waterpower and the use of sawmills for the exploitation of timber to be used in house construction and to be transported outside of the area, in the case of white cedar from the Pinelands of southern New Jersey. Additionally, small streams were utilized for the establishment of gristmills. In the Outer Coastal Plain, where agriculture was not predominated early on, gristmills were primarily located in the same structure as the sawmill (Wacker 1982, 209-10).

The iron industry was a major user of the waterpower capabilities in the state by 1765, especially in the southern Highlands, to power the forges and furnaces. This, in turn, helped to further develop the transportation network which had been focused primarily on navigable waters and later the transformation of Indian trails into overland routes, roads, and interstate transportation. The iron industry also developed in the Outer Coastal Plain area by the time of the Revolution and was contemporaneous with the development of the glass industry from the Mullica River south (Wacker 1982, 211, 215).

The main themes of the late 19$^{th}$ and 20$^{th}$ Centuries include the expansion of industrialization, transportation, and urbanization. This can be seen the rise of the iron industry in New Jersey which led to the building of canals and railroads to access the ore sources in eastern Pennsylvania and the development of industrial communities, and over time, refinements in the manufacturing process itself. As transportation innovations allowed a ready market for the sale of local goods, it also allowed the population to live further away from the actual site of the manufacturing and industrial process and to the establishment of suburban areas outside of the urban centers of the cities. Improvements in transportation networks allowed for the rise of summer resort areas along the coast and the tourism industry (Rutsch 1982, 244-6). The Maurice River study area is located in southern New Jersey within Cumberland County and consists of Commercial Township on the western side of the river and Maurice River Township on the eastern side of the river, with Delaware Bay on the south. Cumberland County was established as a new county, set off from Salem County, in 1747 and was settled primarily by the

Dutch and Swedes (Elmer 1869, 5).

The Maurice River study area has been previously investigated by the USACE, Philadelphia District in 1986 in a Phase 1A archaeological reconnaissance study conducted as part of a comprehensive navigation study (Shelton 1986) and (Payne 1986). The historic context background is taken from these studies, (Chesler 1982) *New Jersey's Archaeological Resources* and supplemented by other sources as needed.

European settlement of the Maurice River valley began in 1691 with the survey of large tracts of land by John Worlidge and John Budd. Jeremiah Wasse was granted 10,000 acres on the west side of the river and Robert Squibb received 20,000 on the east side of the river. These tracts were later divided and sold to settlers. The Maurice River valley was originally made up of agricultural communities with milling and support operations established along major streams. Early farmers, primarily Swedes in the 18th Century, were able to grow abundant crops along the river valley including vegetables, maize, broom corn, wheat, and flax, supplemented by the hunting of small game. Levees were constructed along the river to control flooding and access arable land (Shelton 1986, I-16).

Roads were built through the valley as early as 1777, with the original road through the Maurice River area connecting Dorchester with other areas. In 1785, Port Elizabeth was chosen as a port of entry by the U.S. Government, while allowed further settlement of the Maurice River area and opened trade with the West Indies. The Battle of Dalles' Landing during the Revolutionary War was held near Port Norris on the Maurice River, when British Tories were captured, killed and buried near the riverbank in 1781. These remains were later partially excavated by a local person in 1880 to document the event, which was said to occur at the end of Main River on the west bank of the Maurice River (Shelton 1986, I-16).

In the 19th Century, the extraction of bog iron which was found in the area, was established at the Cumberland Furnace or Budd's Iron Works in 1785, along with a nail factory at Bridgeton. However, due to the scarcity of iron in Cumberland County, this industry declined by about 1850. The manufacture of glass was an important industry in Cumberland County with 19th Century factories in Port Elizabeth, Millville, Bridgeton, and Vineland. In Port Elizabeth, the Eagle Glass Works operated from 1799 to 1885, while the Union Glass Works ran from 1807 to 1818 (Shelton 1986, I-16).

An important industry that developed during the latter half of the 19th Century in the Maurice River Valley was the oystering industry which contributed to the growth of the region with the proliferation of wharfs, warehouses, and transportation facilities and the development of new towns along coastal areas and further inland along the river. Shelton and Baumgardt have documented the even distribution of population involved in agriculture, water-based, and support industries at the turn of the 20th Century in Commercial Township and Maurice River Township on the west and east side of the Maurice River, respectively. Port Norris was an important oyster producer beginning in the 1920's and, as agriculture declined in importance, the water-based and service support industries continue to play a major role in the local economy to the present day.

**Previously Documented Historic Properties**. Archaeological site data for recorded sites within the Maurice River study area was obtained from and courtesy of Dr. Gregory Lattanzi, State Archaeologist of the NJ State Museum (NJSM). See **Figure 35** and Table 6 for more information. Please note that sites

with a PC designation are managed by the NJ Pinelands Commission. Site information for these sites were obtained courtesy of Mr. Tony McNichol of the Pinelands Commission. Site files for each site are available and can be provided separately by the author upon request.

Additionally, the NJ SHPO Lucy GIS Database: https://www.arcgis.com/apps/webappviewer/index.html?id=44ce3eb3c53349639040fe205d69 bb79 contained a layer of archaeological site grids that depict areas of archaeological sensitivity that have been identified, determined eligible, or listed on the NRHP. The archaeological grid map for the Maurice River watershed (**Figure 35**) follows Table 7.

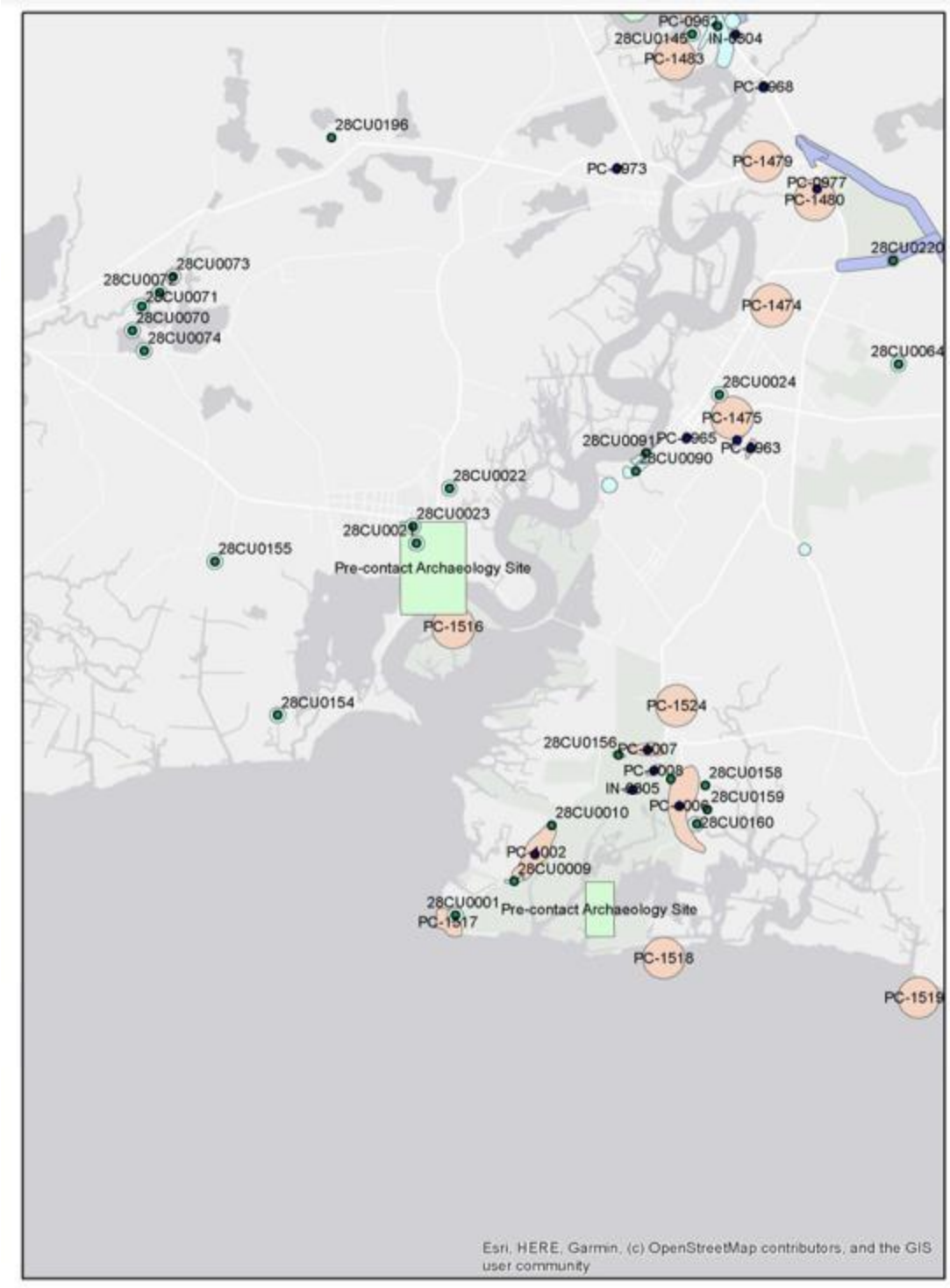



**Figure 35: Recorded archaeological sites within the Maurice River project area**
(Courtesy of Dr. Gregory Lattanzi, State Archaeologist, NJ State Museum)

**Table 6: Archaeological sites in the Maurice River project area and vicinity**

| Site Number | Site Name | Municipality | Period | Source |
|---|---|---|---|---|
| 28-Cu-01 | East Point | Vineland | Unknown-PC | ASNJ Bulletin |
| 28-Cu-02 | Shoemaker | Fairton | Unknown | ASNJ Bulletin |
| 28-Cu-10 | Cadwallader Annex Site B. | Heislerville | Unknown | NJ State Museum |
| 28-Cu-21 | Port Norris | Port Norris | Unknown-PC | NJ State Museum |
| 28-Cu-22 | Port Norris | Port Norris | Unknown-PC | ASNJ Bulletin |
| 28-Cu-23 | Port Norris SW Post Office | Port Norris | Unknown-PC | ASNJ Bulletin |
| 28-Cu-24 | Leesburg | Port Elizabeth | Unknown | ASNJ Bulletin |
| 28-Cu-64 | Dorchester | Port Elizabeth | Pre-Contact | NJ State Museum |
| 28-Cu-70 | Pennsylvania Glass | Dividing Creek | Woodland Period | NJ State Museum |
| 28-Cu-71 | Pennsylvania Glass II | Dividing Creek | Woodland Period | NJ State Museum |
| 28-Cu-72 | Pennsylvania Glass III | Dividing Creek | Woodland/Archaic | NJ State Museum |
| 28-Cu-73 | Pennsylvania Glass IV | Dividing Creek | Late Woodland | NJ State Museum |
| 28-Cu-74 | Iron Mine Brook | Dividing Creek | Late Woodland | NJ State Museum |
| 28-Cu-90 | Maurice River | Port Elizabeth | Pre-Contact | NJ State Museum |
| 28-Cu-91 | Skunic Hill Tract | Port Elizabeth | Pre-Contact | NJ State Museum |
| 28-Cu-145 | Maurice E-15 | Port Elizabeth | Pre-Contact | ASNJ Bulletin |
| 28-Cu-154 | NJSM | Commercial Township | Pre-Contact Burial | NJ State Museum |
| 28-Cu-155 | Robinson Road | Commercial Township | Late Woodland | NJ State Museum |
| 28-Cu-156 | MRT-A | Maurice River Township | Woodland and 19th C. Historic | NJ State Museum |
| 28-Cu-158 | MRT-C | Maurice River Township | Woodland and 19th/20th C. Historic | NJ State Museum |

| | | | | |
|---|---|---|---|---|
| 28-Cu-159 | MRT-D | Maurice River Township | Woodland and 19th/20th C. Historic | NJ State Museum |
| 28-Cu-160 | MRT-E | Maurice River Township | Woodland Period | NJ State Museum |
| 28-Cu-196 | Unimin 3 Site | Commercial Township | Und. Pre-Contact | NJ State Museum |
| 28-Cu-220 | Clear Run | Maurice River Township | Pre-Contact Pinelands Site #1597 | NJ State Museum |
| Pinelands-0962 | Hartman V-6 | Commercial Township | Pre-Contact | Pinelands Commission |
| Pinelands-0963 | Hartman V-7 | Commercial Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-0964 | Hartman V-8 | Commercial Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-0965 | Hartman V-9 | Commercial Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-0973 | I-23 | Commercial Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-0977 | I-39 | Maurice River Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-1002 | Hartman V-II | Maurice River Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-1006 | Hartman V-13 | Maurice River Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-1007 | Hartman V-14 | Maurice River Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-1008 | Hartman V-15 | Maurice River Township | Pre-Contact Undetermined | Pinelands Commission |
| Pinelands-1474 | 42.7 | Maurice River Township | 18/19th C. Historic Architectural | Pinelands Commission |
| Pinelands-1475 | 42.8 | Leesburg/Maurice River Township | 18th C. Historic Architectural | Pinelands Commission |
| Pinelands-1479 | 42.12 | Maurice River Township | Unknown Historic Architectural | Pinelands Commission |
| Pinelands-1480 | 42.13 | Maurice River Township | 18/19th Century Historic Architectural | Pinelands Commission |
| Pinelands-1483 | 42.16 | Maurice River Township | Unknown Historic Architectural | Pinelands Commission |
| Pinelands-1516 | 46.1 | Maurice River Township | Unknown Historic Architectural | Pinelands Commission |
| Pinelands-1517 | 46.2 (East Point Lighthouse) | Maurice River Township | 19th Century Historic Architectural | Pinelands Commission |

| | | | | |
|---|---|---|---|---|
| Pinelands-1518 | 47.1 (Thompson Beach) | Maurice River Township | Unknown Historic Architectural | Pinelands Commission |
| Pinelands-1519 | 47.2 (Moores Beach) | Maurice River Township | Unknown Historic Architectural | Pinelands Commission |
| Pinelands-1524 | 47.7 (Heislerville) | Maurice River Township | 18/19th Century Historic Architectural | Pinelands Commission |

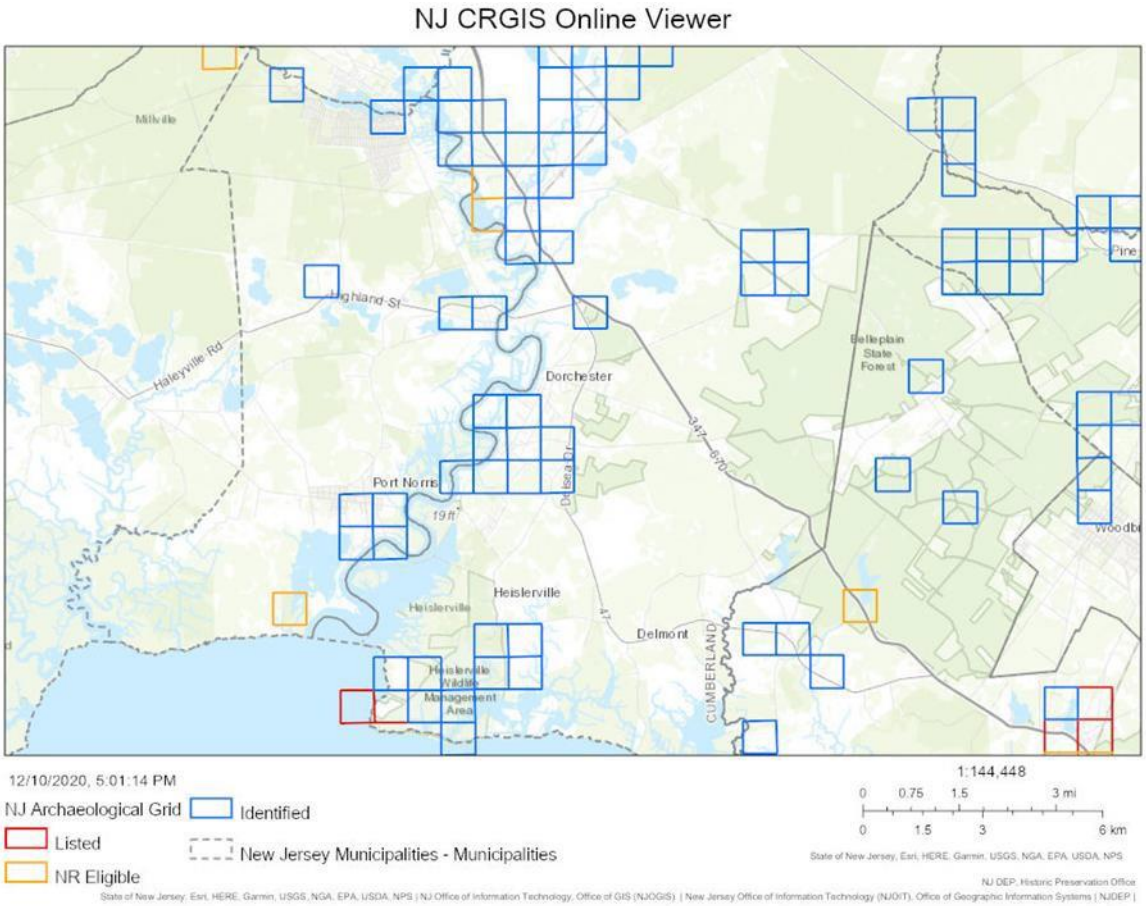



**Figure 36: NJ SHPO LUCY GIS – archaeological grids in the Maurice River APE.**

## State and National Register Listings for Cumberland County, New Jersey

The following State and National Register listings are located within the Maurice River area of potential effect (courtesy of the NJ DEP, Historic Preservation Office, New Jersey and National Registers of Historic Places for Cumberland County, last updated on 9/30/2020 and available at: https://www.nj.gov/dep/hpo/1identify/nrsr_lists/Cumberland.pdf)

**Commercial Township**

*Berry-Gibson Salt Hay Farm (ID#3067)*
Roughly bounded by Route 553 from the north, High Street from the East, Maurice River from the south and Indian Creek from the west, this is an historic salt hay farm determined eligible for the NRHP as an individual property in 1996 during a survey of select salt hay farm sites (Lucy GIS database).

*Bird Island Site (28-Cu-154) (ID#3068)*
This site is the location of Pre-Contact burial remains of two individuals along with Late Woodland pottery fragments collected by an individual on private land known as the Gibson property.

*Bivalve Oyster Packing Houses and Docks (ID#3069)*
Shell Road
(Historic Marine and Architectural Resources of Maurice River Cove MPDF)
This area is an historically significant late 19th and early 20th Century industrial complex associated with the oyster industry and composed of five separate wood frame structures, including oyster packing houses and docks along the waterfront of Shellpile, New Jersey. Shellpile and Bivalve are the names of Port Norris industrial suburbs which developed in the 1870's with the arrival of the Bridgeton and Port Norris Railroad. Although the surviving structures have been significantly altered, they still retain essential elements of their construction (Thomas 1994).

*'Cashier' (ID#5242)*
2800 High Street Bayshore Center at Bivalve
This is an oyster schooner which is a National Register individual property listed under Criteria A and within the boundaries of the Bivalve Oyster Packing Houses and Docks. The period of significance dates from 1849 to 1964.

*Edward Compton House (ID#1034), 1229 Front Street*
Also known as the Elizabeth Compton House, this two-story, wood-framed dwelling was built in 1864 in Folk Victorian and Italianate styles. It is currently the home of the Mauricetown Historical Society; it is in excellent condition and is also a contributing element to the Mauricetown Historic District (Emmons 2017).

Historic Marine and Architectural Resources of Maurice River Cove (MPDF ID#3070) (See individual listings in Cumberland County, Commercial Township)

*Caesar Hoskins Log Cabin (ID#1035),1232 Second Street, Mauricetown*
This is an early timber framed structure (1690's) and an individual National Register property and contributing element to the Mauricetown Historic District. It is the oldest structure in town and is an example of the early architecture of the Swedes who settled in South Jersey. It was also home of the earliest known settler in Mauricetown (Smith 1986).

*Mauricetown Historic District (ID#4701)* Highland, Noble, Bacon, Front, and Stabe Streets, Buckshutem Road and the Village of Mauricetown; from the National Register Nomination Form:

"The Mauricetown Historic District encompasses the entire core of a late-nineteenth century maritime village, and is eligible for listing on the National Register of Historic Places, at the local level, under Criterion A and C. The district is eligible for listing under Criterion A as a well- preserved coastal village representing key maritime-oriented industries in Southern New Jersey—including shipbuilding and coastal trading. Mauricetown is also eligible for listing under Criterion C for its impressive range of nineteenth-century architectural styles, surviving in the form of mansions, worker's housing, and even utilitarian buildings such as summer kitchens and outhouses. Mauricetown's architecture reflects its ascendency and decline over the nineteenth century, including fine examples of Federal, Italianate, Second Empire, and Gothic Revival houses—as well as more vernacular and regional forms such as stack houses, double houses, and saltboxes. The period of significance begins in 1815, when the town was first platted, and ends in 1930, which marks the end of a slow, decades-long decline in Mauricetown's population and economy (Emmons 2017, Section 8, Page 1)."

*A.J. Meerwald Schooner (ID#1039), 22 Miller Avenue*
The A.J. Meerwald is an example of a Delaware Bay oyster schooner built in 1928 and in continuous operation until 1980. It was acquired by the nonprofit preservation organization, the Delaware Bay Schooner Project in 1989; currently it is under restoration on the banks of the Maurice River, a short distance from where it was originally built. Its significance under criterion A is related to the schooner's involvement in New Jersey's regional oyster industry and under criterion C as "a prime representative of a nationally, regionally, and locally significant vessel type," specifically as a Jersey or Delaware Bay oyster schooner built specifically to meet the needs of the local oyster fishery. The Meerwald is representative of the later Jersey schooners built in the 1920's and known as "new style" or "new boats" (Wren 1994).

*Port Norris Maritime Historic District*
There is little information available on this area in the Lucy GIS database. The district was surveyed in 1993 as part of an intensive survey of Commercial Township by the National Park Service and was found to be not eligible for the NRHP. However, individual properties within the surveyed district have been found eligible for the NR. It is located on both sides of Main Street in Port Norris west of the Maurice River.

**Maurice River Township**

Fralinger Archaeological Site (28-Cu-008) (ID#5250)
The Fralinger site is a large, multi-component Archaic and Woodland station on the east bank of the Maurice River, upstream from the mouth of the Manumuskin Creek. It was subjected to controlled excavations by Mounier in 1973 and 1974 (PC 0962 site form). According to the Lucy GIS database, a draft National Register nomination was prepared in 1977.

*Maurice River Lighthouse and East Point Archaeological District (Boundary Increase) (ID#5460)*
Maurice River Lighthouse (ID#2801)
East Point by the Maurice River Cove, 3 miles southwest of Heislerville
Built in 1849, the former Maurice River Lighthouse (now known as the East Point Lighthouse) is the oldest of the remaining lighthouses or keeper's dwellings in the Delaware River and Bay area, and the second

oldest in the states of New Jersey and Delaware after the Sandy Hook Lighthouse of 1764. It is the only operating lighthouse still standing on the shores of Delaware Bay (Hunter 2015).

**Previous Surveys in the Study Area**. A bibliography of cultural resources reports for studies conducted in Cumberland County, and within the Maurice River area of potential effect were identified (courtesy of the NJ DEP, Historic Preservation Office, Cultural Resources Reports, last updated on March 16, 2020 and on file at the Historic Preservation Office) and available at: https://www.nj.gov/dep/hpo/1identify/survey_report_bibliographies/CUMBERLAND.pdf.

### 4.7 Visual and Aesthetic Resources

Visual and aesthetic resources refer to the sensory quality of the resources (sight, sound, smell, taste, and touch) of the project area, especially with respect to judgment about their pleasurable qualities (Canter 1993; Smardon *et al*. 1986). The aesthetic quality of the area is influenced by the natural and developed environment. Visual resources include the natural and man-made features that comprise the visual qualities of a given area, or "viewshed." These features form the overall impression that an observer receives of an area or its landscape character. The project area is aesthetically appealing due to its predominant coastal water environment surrounded by natural undeveloped green marshes, wharves, boats, and maritime businesses.

### 4.8 Hazardous, Toxic, and Radioactive Waste

For Civil Works projects, Engineer Regulation (ER) 1165-2-132 provides guidance on evaluating Hazardous, Toxic, and Radioactive Waste (HTRW) and requires that a site investigation be conducted as early as possibly to identify and evaluate potential HTRW problems.

The definition of HTRW according to ER 1165-2-132, page 1, paragraph 4(a) is as follows: "Except for dredged material and sediments beneath navigable waters proposed for dredging, for purposes of this guidance, HTRW includes any material listed as 'hazardous substance' under the Comprehensives Environmental Response, Compensation and Liability Act, 42 U.S.C. 9601 et seq (CERCLA). (See 42 U.S.C. 9601(14).) Hazardous substances regulated under CERCLA include 'hazardous wastes' under Sec. 3001 of the Resource Conservation and Recovery Act, 42 U.S.C. 6921 et seq; 'hazardous substances' identified under Section 311 of the Clean Air Act, 33 U.S.C. 1321, 'toxic pollutants' designated under Section 307 of the Clean Water Act, 33 U.S.C. 1317, 'hazardous air pollutants' designated under Section 112 of the Clean Air Act 42 U.S.C. 7412; and 'imminently hazardous chemical substances or mixtures' on which EPA has taken action under Section 7 of the Toxic Substance Control Act, 15 U.S.C. 2606; these do not include petroleum or natural gas unless already included in the above categories (See 42 U.S.C. 9601(14)."

As noted in 42 U.S.C. 9601(14), the term "hazardous substance" does not include crude oil or any fraction thereof which is not otherwise specifically listed or designated as a hazardous substance, nor does the term include natural gas, natural gas liquids, liquefied natural gas, or synthetic gas usable for fuel. Underground storage tanks (USTs) are federally regulated under 40 CFR Part 280, which includes technical standards and corrective action requirements for owners and operators of USTs.

A Hazardous, Toxic, Radioactive Waste (HTRW) review for locations around the Maurice River Cove area on the Maurice River was conducted in support of the planned dredging within the cove area. The preferred placement area for the dredged material is the flooded marsh area near the Heislerville Dike. A New Jersey Department of Environmental Protection (NJDEP) Site Remediation Profile (SRP) website was queried for various facilities or materials surrounding the dredging area. Searches included:

- Areas of Historic Fill;
- Immediate Environmental Concern Sites;
- Deed Notice Areas;
- Known Contaminated Sites List; and
- Site Remediation Professional (SRP) Preferred Identification (ID) List.

A few sites were found in the search, listed under the SRP ID category.

- US Department of Defense Greenwich Bombing Range
  Commercial Township
  Closed in 2011
  Preferred ID 520804
- Port Norris State Police Station
  Commercial Township
  Closed 2001
  Preferred ID 033058
- Laws and Laws Inc
  Commercial Township
  Closed 2019
  Preferred ID 001442
- 56 Glade Road
  Maurice River Township
  Closed 2006
  Preferred ID 264179
- Hartleys Fuel LLC
  Maurice Township
  Active Underground Storage Tank
  Preferred ID 026580
- Port Norris Express Co
  Commercial Township
  Closed 2019
  Preferred ID 004633

The US Environmental Protection Agency (EPA) website, Clean Ups and Grants Listing Page was queried for the Heislerville Zip Code. The database contains information on several EPA programs, Brownfields,

Resource Conservation and Recovery Act (RCRA), Superfund National Priorities List (NPL), and Response Actions. There were no sites or facilities listed for the search area.

## 5.0 ENVIRONMENTAL EFFECTS

This section evaluates the No Action alternative and the preferred alternative in terms of their potential impacts to natural and socioeconomic resources in the project area. All other placement alternatives evaluated were eliminated from further consideration. As presented in Section 3, the No Action Alternative would entail no longer maintaining the Maurice River channel for navigation through maintenance dredging. The preferred alternative entails dredging shoaled portions of the federal channel in Maurice River to the authorized depth (7 feet MLLW) with up to 2 feet of overdepth dredging (approximately 75,000 cy) using a cutterhead hydraulic pipeline dredge beginning in 2023. The operation entails in-water work for a minimum of 12 weeks. Each successive material placement from maintenance dredging within the flooded marsh adjacent to the Heislerville dike will enrich the existing elevations of the subtidal, intertidal and low marsh habitats. The marsh complex serves to provide protection for the critical Heislerville dike. The Heislerville dike protects valuable habitat in NJDEP's Fish and Wildlife's Heislerville Wildlife Management Area. The project includes pre-, during, and post-placement monitoring to document project development, effects, and lessons learned for adaptive management as well as for EWN applications in similar coastal areas.

### 5.1 Physical Environment

#### 5.1.1 Topography, Physiography, and Geology

The No Action alternative will continue to influence the topography and physiography of the project area. Continued flooding and erosion of the saltmarshes will result in more wetlands becoming inundated, submerged, and converted to shallow water. Normally, tidal wetlands build vertically (accrete) that help to compensate for subsidence and/or sea level rise. This accretion occurs through the accumulation of organic matter (peat) from autochthonous below- ground root production as well as the importation and trapping of suspended sediments washing in with tidal or storm flows by saltmarsh vegetation. The importation and deposition of new sediments is essential to the long-term sustainability of coastal wetlands. Once the vegetation is lost, the mudflat no longer accretes sediments. Geology is not anticipated to be affected under the No Action alternative.

The preferred alternative will result in minor positive effects to topography and physiography of the area. Dredging within Maurice River cove will remove shoals within the channel. The selected placement area is comprised of similar sediments (*i.e.* predominantly fines) as those materials that will be dredged from the river channel. The Maurice River will continue to be tidally-influenced and connected to the Delaware Bay. The preferred action alternative is to pump dredged sediments into the flooded salt marsh (*i.e.* sediment enrichment) to add to substrate elevations within two small areas. Coastal wetlands are a critical natural or nature-based feature (NNBF) that provide a suite of ecosystem benefits and can provide flood risk reduction capability (Narayan *et al*., 2016). The advantages of beneficially using dredged sediment to nourish wetlands have been documented in several studies (Ray 2007; Colten *et al*., 2022) and some saltmarsh plants have the capacity for rapid recovery after dredged sediments

are placed in a flooded marsh habitat (Berkowitz *et al*. 2019) to encourage intertidal wetland vegetation to re-establish and reduce erosion effects. The area will require multiple placement operations to achieve elevations resilient to storm impacts and low marsh enhancement. Tidal saltmarsh perennial vegetation contributes persistent below-ground organic matter and greater vertical accretion of sediments (Cahoon *et al*., 2009). The preferred plan is not anticipated to affect area geology in the dredging area nor at the placement area.

### 5.1.2 Climate and Sea Level Rise

Coastal wetlands are particularly vulnerable to sea level rise (Mitchell *et al*., 2017). Under both the No Action alternative as well as the preferred alternative, the Maurice River region will continue to experience a moderate climate due to the area's Coastal Plain low elevation and the presence of the nearby Delaware Bay and Atlantic Ocean. Sea level rise is predicted to continue under both alternative scenarios. The preferred alternative to keep the dredged sediments within the system through BU practices (*i.e.,* by placing the dredged material within a portion of the flooded marsh) will serve to reduce the adverse effects of sea level rise on saltmarsh habitats and adjacent infrastructure in the vicinity of the Heislerville dike.

It is difficult to predict the impact of climate change on species that inhabit the project area. There is significant uncertainty in the rate and timing of climate change as well as the effects that may result. Increased rainfall, as predicted by some climate models, along with SLR may increase water levels, marsh flooding and erosion, thereby exacerbating poor water quality conditions by increasing turbidity and loss of saltmarsh habitat as well as less protection to coastal upland habitats. Warmer water temperatures can impact dissolved oxygen levels, particularly during summer months in shallow waters, decreasing water quality. Rising sea levels are anticipated to continue to affect coastal fish and wildlife habitats, including those utilized by waterfowl, wading birds, and shorebirds. The preferred plan provides a proven conservation strategy to beneficially use dredged channel sediments to address the impacts of climate change and sea level rise.

### 5.1.3 Air Quality

Under the No Action Scenario, air quality would continue in the current regional condition. The CDC National Public Health Tracking Network (2018 data) indicate that Cumberland County residents were not exposed to any days of unhealthy levels of ozone. The national standard for annual particulate matter ($PM_{2.5}$) is 12 micrograms/meter$^3$. When $PM_{2.5}$ levels are above 12, air quality is more likely to adversely affect human health. In 2018, the annual level of $PM_{2.5}$ in Cumberland County was 8.8 micrograms/meter$^3$. The preferred plan would result in maintenance of existing regional air quality conditions. There would be some minor, short-term effects during dredging operations. Air emissions are expected to be below the *de minimus* threshold for a marginal ozone nonattainment area in a high wind area typical of a coastal environment. A General Conformity determination is not required. The project is not considered regionally significant under 40 CFR 93.153(i).

### 5.1.4 Tides and Currents

The No Action alternative will have no impacts on tides and currents. The preferred alternative will not affect tides. Implementation of the preferred alternative is expected to have a direct and long-term positive impact to the area by re-establishing substrate elevations conducive to reduce subtidal water depths along the marsh edge and encourage low marsh vegetative growth that will in turn serve to reduce wave energies coming into the flooded marsh from the Delaware Bay and Maurice River cove. Adding sediments to the marsh platform will contribute to the potential for the marsh to become more resilient and thereby provide additional storm protection to adjacent infrastructure behind the Heislerville dike and potentially re-establish saltmarsh vegetation. The preferred alternative is projected to reduce water velocities by creating more intertidal habitat in an area becoming increasingly inundated by coastal storms.

### 5.1.5 Water Levels, Water and Sediment Quality

Under the No Action alternative, water levels will continue to gradually rise in the project area as more wetlands are flooded and eroded during storm events and SLR. Significant effects to water levels are anticipated from continued loss of wetland acreage. Elevated turbidity levels will result from continued flooding and erosion of marsh sediments. Sediment quality is not anticipated to be affected under the No Action alternative.

Near-marsh, shallow-water strategic placement of sediment dredged from navigation channels is a promising method for increasing marsh accretion rates and providing erosion protection to marsh edges (Fall *et al*., 2022, Chasten *et al.,* 2022). Water and sediment quality laboratory analyses conducted in 2017 and 2022 concluded that dredging and beneficial use placement of shoaled material would not cause any adverse impacts due to existing chemical constituents within the sediments. The conclusions of the sediment and water quality testing reports are as follows:

- There were no exceedances of NJ Soil Residential and Non-Residential Remediation Standards for soil in any of the sediment samples. Sediments were tested for total cyanide, metals, volatile organics, semivolatile organics, pesticides, and PCB aroclors.
- The unfiltered and filtered elutriate sample results were below NJ Surface Water acute criteria for protection of aquatic life. Elutriates were tested for total cyanide, metals, semivolatile organics, pesticides, and PCB aroclors. PCB aroclors were not detected in any of the elutriate samples, and there was one low-level detection for total cyanide.
- Elutriate total and dissolved results for semivolatile organics, specifically PAHs, were compared to final chronic values as presented by DiToro *et al*., 2000. None of the detected PAH concentrations for the elutriates exceeded final chronic values as listed.
- Detections of semivolatile organics, including PAHs, were of low concentration and generally sporadic.
- Background surface water was tested for total cyanide, metals, semivolatile organics, pesticides, and PCB aroclors. The results were below NJ DEP aquatic life acute criteria.
- PCB aroclors and total cyanide were not detected.

- PAH concentrations for the surface water samples were few (four detects) and of low concentration, below final chronic values as listed in DiToro *et al*., 2000.

Under the preferred plan alternative, water quality impacts are anticipated to be minor, temporary, and localized in the form of turbidity from the in-water dredging and placement action. Dredge cutterhead movement can create a turbidity plume in the river. Increased turbidity results from the resuspension of sediments during operations and can impact primary productivity and respiration of organisms in the immediate project area. Increased turbidity can also impact prey species' predator avoidance ability due to decreased clarity in the water column. Turbidity levels decrease exponentially with increasing distance from the dredge due to settling, dispersion and tidal flushing. At the placement site, the dredged sediments are expected to settle out in the immediate area quickly. Fall *et al*. (2022) evaluated strategic BU placement operations under the SMIIL at Gull Island in Great Sound. They observed that turbidity plumes were localized even for predominantly fine-grained material. Monitoring has shown that near-bed turbidities during active placement were temporarily greater than background conditions but were often less than those observed during high wind or storm events. Post-placement monitoring just one week after dredging had ceased and showed that turbidity levels in the area were similar to levels documented for an area where no placement had occurred.

Best Management Practices that are already in place for maintenance dredging would be used to further minimize water quality impacts during dredging and placement operations. The construction operation will be adaptively managed and a combination of a turbidity curtain, earthen berms, hay bales and/or coir logs may be used in the placement area to build elevation as the sediment is pumped onsite. To evaluate the project's intended objective to enhance wetlands and system resilience at the placement site, monitoring will occur before, during, and post-construction. Information gathered will provide opportunities to apply adaptive management to future placements both here and at other estuarine saltmarshes with comparable hydrodynamic and morphologic conditions. No long-term adverse effects are anticipated in this eroding marsh system. Overall, the project will have a positive impact on water quality by furthering re-establishment of elevations suitable for saltmarsh vegetation that in turn, reduces erosion. Vegetative wetlands are highly effective at trapping particulates and removing excess nutrients (*i.e.* nitrogen and phosphorus) from the water through absorption by the plant systems. Sediments within the project area have been tested and determined to be acceptable for beneficial use placement within the local system.

#### 5.1.6 Wind, Wave, and Storm Surge Conditions

The No Action alternative will pose no effects to wind and wave conditions. The preferred alternative will pose no effects to wind conditions in the project area but may contribute to reducing wave conditions and storm surges within the flooded marsh directly adjacent to the Heislerville dike area by reducing water depths and slowing water velocities. Reducing waves in this area is a positive effect as most erosion in the project area is caused by waves generated by local winds, creating storm surges.

### 5.2 Aquatic Resources

#### 5.2.1 Wetlands and Intertidal Mudflats

Under the No Action alternative, tidal wetlands within the project area will continue to be subjected to erosion, subsidence, and flooding and convert to shallow water and unvegetated mudflats. Intertidal flats are valuable habitat to numerous benthic macroinvertebrates, fish, wading birds and migratory shorebirds. However, more than 400 acres of vegetated wetlands in the Heislerville WMA have been converted into shallow water habitat due to excessive inundation. These impacts are direct and long-term in the face of SLR. The preferred alternative would provide a direct positive impact by raising the substrate elevation in a small portion of flooded marsh near the Heislerville dike during the initial placement operation. Future placements may occur in either the primary or secondary placement areas to bolster intertidal mudflats and elevate the substrate to a level suitable for low marsh edge vegetation to expand. Vegetated intertidal wetlands are able to accrete sediments and filter nutrients from the water to increase elevation naturally, reduce erosion and water turbidity while acting as a sponge to absorb flood waters.

### 5.2.2 Benthic Macroinvertebates

Under the No Action alternative there would be no impacts to benthic macroinvertebrates in the channel or in the placement area as no dredging or placement action would occur. There would be a direct but temporary impact to benthic macroinvertebrates in both the channel and in the placement area from the preferred alternative. In both the channel and placement areas, mobile species would likely move from the action area during dredging and placement operations. In the channel, nonmotile infaunal benthic organisms would be directly impacted by the dredging action through removal. The NJDEP Bureau of Shellfisheries noted that although the proposed channel dredging is near known oyster populations, dredging in the vicinity of these beds would cause little to no impact. If any channel dredging fell directly on any oyster lumps, the USACE will work with the NJDEP to have the oysters transplanted from any potential impact area to an alternative area prior to dredging.

In the placement area, macroinvertebrates would likely experience a short-term minor and direct impact due to increased water turbidity, while some species will be subject to smothering. The impact would be expected to subside quickly following completion of placement operations. In similar BU placement operations, monitoring has shown turbidity plumes to be of short-duration and localized. Macrofaunal recovery is usually rapid after placement operations cease. Maurer *et al*. (1981a) found that vertical migration of macroinvertebrates through the newly placed sediments is a viable means to accelerate habitat rehabilitation, particularly since deposition to enhance intertidal habitat within the proposed placement area will not result in significant elevation changes. Recovery may occur within a few months to one or two seasons through larval transport and recruitment from neighboring nondredged areas (Maurer *et al*., 1981a,b; 1982, Maurer *et al.,* 1986; Saloman *et al*., 1982; Van Dolah *et al*., 1984).

### 5.2.3 Fish

Under the No Action alternative, erosion and excessive inundation of the saltmarsh will continue. The erosion increases turbidity in the water column and may degrade water quality. As more saltmarsh acreage is lost due to flooding, less habitat is available for larval and juvenile species of fish.

The Action alternative to dredge the channel and pump the dredged material into an area of the flooded saltmarsh will have limited and short-term impacts on fish. The majority of fish, with the exception of young life stages, are highly mobile and capable of leaving the areas during the dredging and placement operations. Larval and young life stages of fish are not likely to occur in the project area for dredging operations that occur during nonreproductive periods of the year. Dredging within a small section of the navigation channel will result in the loss of benthos that may be prey items for benthic fish species. Some macroinvertebrate benthic organisms in the placement area will be smothered by pumping the dredged material into the area, resulting in a temporary disruption of the food chain within the footprint of the area. Overall, elevating the substrate in a small portion of the flooded marsh is expected to have a positive impact on fish by reducing erosion and adverse impacts to water quality through the establishment of low saltmarsh vegetation habitat. Adverse effects to fish would be minimized since it's anticipated that the maintenance operations will primarily occur during the colder months of the year.

Essential Fish Habitat. An EFH Assessment was prepared and is provided in Appendix A. The No Action alternative will affect essential fish habitat in several ways. Although not significant, the No-Action alternative will result in continued erosion of marshes, converting them to shallow water habitat while increasing total suspended solids concentrations in the water. These conditions currently exist in the project area. Continued erosion will result in an increase in acres of open water but will simultaneously reduce intertidal mudflat and vegetated low marsh habitats that are important as nursery areas for managed fish species. Continued erosion of marshes reduces water quality.

For the preferred alternative to dredge a portion of the navigation channel in Maurice River cove and pump the material into a small area within the flooded marsh, impacts to EFH will be temporary. As with excessive marsh erosion, dredging will cause a temporary elevation of turbidity in the immediate project area during the construction period. Elevated turbidity dissipates quickly once construction operations cease. Adult and juvenile fish are mobile and expected to leave the area of temporary disturbance. In the dredging area, Maurice River cove is expansive and directly connected to the Delaware Bay. Fish would be expected to avoid the dredging area temporarily. Based on the Essential Fish Habitat assessment, many of the designated EFH species, particularly juvenile and adult life stages, may not be found in the immediate placement area due to limited water depths. Most of the fish species known to occur in the area are not estuarine resident species and only utilize the area on a seasonal basis.

As in the channel dredging area, managed fish species as well as mobile EFH fish prey species, would be expected to temporarily leave the dredged material placement area due to elevated water turbidity. The Heislerville WMA's Northwest Reach flooded marsh area constitutes over 400 acres whereas the proposed placement area is a small portion (two 9-acre sites). Mobile species, such as fish and crabs in marine environments, have been shown through video monitoring to leave an area of disturbance and elevated turbidity temporarily, returning shortly after placement operations cease. These impacts would cease once construction is over. Indirect, short-term, and minor negative impacts could result from disruptions to foraging during construction due to increased turbidity and the possibility that infaunal prey may leave the immediate area. As noted, burial of some benthic prey species will occur within the placement site, however, species in highly dynamic areas are typically R-selected species capable of recolonizing their populations rapidly through recruitment from neighboring areas. Many infaunal macroinvertebrates are capable of migrating through the placed sediments (Bolam, 2010; Hinchey *et al*.,

2006; Maurer *et al*., 1981; OSPAR Commission, 2008).

While turbidity will temporarily increase at the placement site during construction, turbidity levels are predominantly elevated in this area due to currents, wave action, and erosive forces. Fall *et al*. (2022) evaluated strategic BU placement operations under the SMIIL at Gull Island in Great Sound. They observed that turbidity plumes were localized for fine-grained sediments. Monitoring has shown that near-bed turbidities during active placement were temporarily greater than background conditions but were often less than those observed during high wind or storm events. Post-placement monitoring just one week after dredging had ceased showed that turbidity levels in the area were similar to levels documented for an area where no placement had occurred.

The NMFS Habitat and Ecosystem Services Department has recommended that dredging be restricted from March 1 to June 30 for migrating anadromous fish; from April 1 to September 30 for horseshoe crabs; and from May 1 to September 15 for sandbar sharks. The USACE has concluded that the preferred plan will have a minimal direct and temporary effect on EFH and will result in an overall long-term benefit to EFH species and EFH habitat by reducing subtidal water depths and encouraging intertidal mudflat and low marsh vegetative development.

### 5.3 Terrestrial Resources

#### 5.3.1 Terrestrial Habitats

Under the No Action alternative, neighboring terrestrial habitats will continue to be subjected to the adverse effects of coastal flooding and sea level rise as more adjacent saltmarshes continue to become excessively inundated by flood waters. No negative impacts are anticipated to terrestrial habitats resulting from implementation of the preferred alternative. Increasing the elevation of submerged mudflats through deposition of dredged sediments will allow for conditions suitable for intertidal saltmarsh vegetation to establish and thereby enhance storm protection to adjacent terrestrial habitat as well as infrastructure. Wetlands provide disaster protection, including surge protection from hurricanes for inland habitats.

#### 5.3.2 Avifauna and Other Wildlife

Under the No Action scenario, avifauna and other wildlife species would continue to incur further losses in habitat quality and quantity in the project area due to ongoing flooding within the lower Maurice River area. All species are mobile and will leave as water depths render more saltmarsh and open water areas inaccessible for foraging.

With the preferred alternative, dredging is not expected to pose any adverse effect on avifauna and other wildlife. At the placement areas within subtidal and intertidal low marsh, avifauna and other wildlife are expected to leave the vicinity temporarily during construction but will return once operations cease. Species utilize intertidal low marsh for food resources. Foraging microbenthic prey species will be temporarily impacted, as noted above, by elevated turbidity and removal and smothering of nonmotile food organisms. These species will recolonize intertidal areas once operations cease. Recovery may occur within a few months to one or two seasons through larval transport and recruitment from

neighboring nondredged areas (Maurer *et al*., 1981a, b; 1982, Maurer *et al.,* 1986; Saloman *et al*., 1982; Van Dolah *et al*., 1984). The objective of the preferred plan is to restore elevations suitable for enhanced resilience for subtidal marsh edge areas, intertidal mudflats and re-establishment of former low marsh habitat that provides a benefit to birds and other wildlife species that occur in the area.

### 5.4 Rare, Threatened and Endangered Species

Under the No Action alternative, Federally-listed species may be adversely affected by the continued loss of saltmarsh habitat through erosion, flooding, and SLR. Minimal impacts to listed marine species would result from elevated turbidity due to existing conditions of erosion and flooding of the surrounding salt marshes. Sea turtles and large marine mammals will not occur in the placement areas where water depths are insufficient. The Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is unlikely to be present in the project area.

With the preferred alternative, dredging and placement operations within the shallow waters of Maurice River cove and the flooded subtidal marsh in the northwest portion of the Heislerville WMA can pose a temporary, minor effect on wildlife in the area. Piping plover (*Charadrius melodus*) and roseate tern (*Sterna dougallii dougallii*) are unlikely to occur in the project area. The eastern black rail (*Laterallus jamaicensis*), and the rufa red knot (*Calidris canutus*) are known to occur in the vicinity. Four species of listed sea turtles (Kemp's ridley turtle (*Lepidochelys kempii*), leatherback turtle (*Dermochelys coriacea*), green (*Chelonia mydas*) and loggerhead *(Caretta caretta*) turtle) may occur in the dredging vicinity and will avoid the dredge during the period of operation. As noted, macroinvertebrate prey species will be impacted by the operation but recovery is usually rapid after dredging and placement operations cease.

Migratory shorebirds and wading birds will not be in the dredging area but may occur in the general vicinity of the project placement areas. As noted in Section 4.4, several of these avian species are state-listed in New Jersey as threatened, endangered or species of concern. While there may be some temporary disturbance to bird species in foraging areas of the placement site during construction activities, it is anticipated that they will move away from the area temporarily. The proposed placement area is a flooded marsh and unlikely to offer suitable habitat for the nest birds such as the saltmarsh sparrow. The resulting project is expected to be beneficial to these listed avian species by reducing storm impacts and potentially establishing increased elevations for foraging habitat. Dredged material placed on the northwestern side of the Heislerville dike avoids adverse effects to valuable bird nesting habitat in the southeastern section of the WMA and will take place during the nonreproductive period of the year.

Although no longer protected under the Federal Threatened and Endangered Species Act, bald eagles occur year-round in large-wooded areas associated with the marshes of the Maurice River. The species is still protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. The osprey, a State-listed species, also occurs in adjacent wooded areas seasonally. Both osprey and the bald eagle prey on fish and are expected to temporarily leave the immediate vicinity of the dredging and placement operation.

Sea turtles may be in the Maurice River cove area from May through November in the vicinity where

dredging will take place, but likewise, are expected to migrate out of the area prior to dredging and placement operations. Generally, implementation of the preferred plan to dredge a lower section of the channel may impact listed species due to a minor temporary elevation of water turbidity and loss of potential benthic prey species. Dredging will be conducted by a hydraulic cutterhead dredge which poses a low probability of impingement or entrainment of sea turtles or sturgeon. These species are unlikely to occur in the shallow water habitat of the proposed placement area adjacent to the Heislerville dike due to insufficient water depths and decreasing water temperatures. Sea turtles do not nest in the state of New Jersey and sturgeon do not spawn in the project area so no young (*i.e.* less mobile life stages) of any of these species will be present during construction. Due to currents and tidal action, turbidity will dissipate quickly once dredging and placement operations cease. Although foraging capacity within the immediate placement area will be temporarily impacted, the project is expected to improve the wetland habitat in a relatively short period of time as elevated intertidal mudflat becomes recolonized by prey species and eventual saltmarsh vegetation re-establishes along the low marsh edges. The higher substrate elevations will serve to reduce the potential for future flood and wave damages and other storm-related impacts.

Based on the available information, the proposed project is unlikely to adversely affect the continued existence of the above-listed threatened and endangered species. This determination was coordinated with the NMFS Protected Resources Department and the New Jersey Field Office of the USFWS. In addition, the project is expected to have no significant adverse effects on state-listed species of birds. The project is intended to protect and restore important resting, feeding and nesting habitat for these species. To adhere to the USFWS' recommended time-of-year restriction periods for eastern black rail breeding and *rufa* red knot spring migration, the USACE will restrict construction activities within the primary BU placement area from April 1 to August 31 and from April 1 to September 15 in the secondary BU placement area. At the primary BU placement site, a USFWS biologist will conduct a site assessment within 6 hours prior to the start of mobilization activities (*e.g*. pipe placement) if initiated prior to September 15. Dredging activities will not impact low marsh prior to September 15.

### 5.5 Land Use and Socioeconomic Conditions

With the No Action alternative, the Maurice River navigation channel would continue to shoal. This would result in an indirect negative effect on socioeconomic resources such as commercial and recreational fisheries and ship repair businesses. These are not only economically important to the local region, but to the economy of the State of New Jersey.

With the proposed alternative, maintenance dredging practices would not adversely affect socioeconomic resources, land use, infrastructure, or utilities. Dredging a portion of the lower Maurice River channel is needed to provide a safe, reliable navigation channel for waterborne commercial and recreational users. The preferred alternative provides socioeconomic benefits by utilizing the dredged material beneficially by restoring intertidal wetland habitat within a wildlife management area that has been lost to erosion, flooding, and storm damage. Saltmarshes not only provide valuable habitat for water birds and other wildlife but also serve as a frontline defense for infrastructure along the Maurice River.

Environmental Justice. In accordance with Executive Order (Environmental Justice in Minority Populations) 12989 dated 11 February 1994, a review was conducted of the populations within the affected area. The Executive Order requires that "each Federal agency make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health and environmental effects of its programs, policies, and activities on minority populations and low-income populations." The U.S. Environmental Protection Agency definition for Environmental Justice is: "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."

The No Action alternative provides no benefits to the area's population regardless of race, color, national origin or income levels. Flooding is anticipated to continue to occur from significant storm events. The proposed project is not expected to result in disproportionately high or adverse human health or environmental effects on minority or low-income populations. The project goal to beneficially use dredged material to restore natural infrastructure by increasing substrate elevations within a flooded marsh area adjacent to the Heislerville dike. The project is anticipated to provide a direct benefit not only to wetland habitat but also to area infrastructure and communities once wetland vegetation re-establishes, thereby providing additional storm protection and reduced erosion.

### 5.6 Cultural and Historic Resources

The Maurice River Federal Navigation Channel has been authorized to a depth of 7 ft MLLW with 2 ft allowable overdepth. This portion of the APE has been previously dredged and will not impact historic properties since it will not be impacting any previously undisturbed areas. The two areas selected for sediment placement have been eroding steadily since the 1950s. Although these two areas are close to the archaeology sensitivity grid, there are no recorded historic properties. The deposition of sediment in this area would only serve to stabilize, cover, and protect if any archaeological resources are within these areas. Therefore, the USACE has determined that the proposed dredging and sediment deposition will have *No Effect* on historic properties eligible for or listed on the National Register of Historic Places.

### 5.7 Visual and Aesthetic Resources

The natural areas and small maritime communities of the lower Maurice River are considered to have high aesthetic value. Low levels of development, low topographic relief, extensive open water features, wetlands with natural vegetation, and diverse wildlife make this area of the Delaware Bay coast visually pleasing and attractive to the public. There is easy access to the area via state road 47 and county road 616. The Haskin Shellfish Research Lab of Rutgers University and New Jersey's tall ship, the Meerwald, are located in Commercial Township on the river. Local businesses offer typical small fishing village amenities such as marinas, ship repairs, and seafood processing.

The area's undeveloped natural lands and community infrastructure would continue to be vulnerable to flooding and wetland losses under the No Action alternative. However, more open water is not considered an adverse visual impact. Under the preferred alternative, there would be short-term negative impacts to aesthetics during construction with an increase in water turbidity. Over time, and

with the development of wetland vegetation, the aesthetics would improve. Implementation of the preferred alternative would have a direct positive impact on the aesthetic value and viewshed by increasing the acreage of intertidal mudflats and vegetated wetlands utilized by water birds, migratory shorebirds, and other wildlife.

### 5.8 Hazardous, Toxic, and Radioactive Wastes

The No Action Alternative will pose no impacts from HTRW. For the preferred plan, both the NJDEP SRP website and the US EPA website were queried for various facilities or materials in the area surrounding the proposed dredging and placement areas. All noted SRP sites are land-based and not within the proposed action area and pose no concern. It is unlikely that releases would have significantly impacted the cove environment. There may have been some unnoted releases due to boats, ships or other vessels in, or transiting the project area that may result in sediment contamination. In addition to fuels and oils, flaking bottom paint from vessels may have released metals such as copper or zinc.

The dredging contractor would be responsible for proper storage and disposal of any hazardous material such as oils and fuels used during dredging. The US EPA and U.S. Coast Guard regulations required the treatment of waste (*e.g.* sewage, gray water) from dredge plants and tender/service vessels and prohibit the disposal of debris into the marine environment. The dredge contractor will be required to implement a marine pollution control plan to minimize any direct impacts to water quality from construction activity.

### 5.9 Cumulative Effects

The natural resources of the lower Maurice River have been lauded as being of national and international significance and have been documented through the inclusion of the area in federal designations such as the National Estuary Program, the Pinelands National Reserve and upriver, the Wild and Scenic Rivers Program. These factors make it exceedingly important that the proposed solutions and investment of resources sustain the features identified in these designations. The current proposed BU of dredge material and other previously constructed and future projects align behind this common goal to provide erosion and flooding protection to these valuable wetlands and adjacent infrastructure.

The Maurice River Federal navigation channel was last dredged in 1996. Prior to that year, maintenance dredging has only occurred in 1928 and 1932. Previously, the dredged material was not used beneficially. In 1997, the state of New Jersey reconstructed 4,000 feet of the Heislerville dike with dense grade aggregate and recycled concrete rubble within the lower Maurice River are that was damaged due to storms. In 1998, the state of New Jersey positioned barges filled with concrete rubble and 2-4 ton capstones along the point of Basket Flats in the lower Maurice River. The purpose of this effort was to form a breakwater to stem the wave energy encroaching from the bay into the flooded marsh area of the Heislerville WMA and adjacent infrastructure. Stone-filled gabion baskets were placed on either side of this breakwater for erosion protection.

Currently, USACE is conducting a study under the Continuing Authorities Program (CAP) to examine potential solutions to reducing frequent flooding problems in the Cumberland County, New Jersey

coastal region which encompass the communities of Matt's Landing and Heislerville (Section 103 of the Rivers and Harbors Act of 1962, Public Law 87-874, as amended). The study is evaluating the feasibility of providing flood risk management improvements such as storm surge barriers, natural and nature-based features (NNBF) such as living shorelines, artificial reefs, and submerged aquatic vegetation restoration. Non-structural solutions are also being evaluated, including building retrofitting, acquisition/relocation, and undeveloped land preservation.

The proposed project evaluated in this EA focuses on the implementation of beneficial use of channel dredged material for sustainable ecological solutions in a coastal area experiencing excessive flooding. The proposed placement plan contributes to the unique wetland substrate restoration needs and conditions specific to the lower Maurice River area. The Maurice River cove's direct connection with the energy of Delaware Bay's waters under SLR conditions necessitates the urgency in keeping the sediments within the aquatic system rather than disposing of dredged sediments in upland CDFs. The placement plan addresses the area's imminent need, the benefits to living resources, future sustainability (*i.e*. channel maintenance), projections of SLR and other climate change impacts (*e.g*. increasing frequency and intensity of storms).

The enhancement of inundated intertidal marshes and mudflat habitats will serve a diverse assemblage of species including nesting and foraging birds and finfish that utilize the tidal waters and wetlands. The placement of dredged sediments to raise the substrate elevation within the flooded marsh will be conducted in a manner that will not impact other shoreline protection or wetland restoration projects in the vicinity. The proposed project will potentially establish added storm protection to communities and infrastructure from storm surge and nuisance flooding, and aid in their resilience to SLR and climate impacts. The beneficial use of dredge material is a sustainable approach as there is a current and future ready supply of material, as dredging for navigation purposes is ongoing. The implementation of this dredged material placement approach will provide cumulative positive benefits to the area as well as inform future beneficial use projects as a strategy to restore ecosystem function and restore fish and shellfish habitat.

## 6.0 ENVIRONMENTAL COMPLIANCE

Compliance with applicable Federal Statutes, Executive Orders, and Executive Memoranda is summarized in Table 7. This is a complete listing of compliance status relative to environmental quality protection statutes and other environmental review requirements.

The proposed maintenance dredging and beneficial use of dredged material project provides for safe navigation, flood risk reduction, and sediment enrichment to the ecosystem. The project complies with and will be conducted in a manner consistent with New Jersey's requirements with regards to Section 401 of the Clean Water Act and the Coastal Zone Management Act. Water Quality Certification and concurrence with a Federal Coastal Zone Consistency Determination have been received from the New Jersey Department of Environmental Protection (NJDEP) with the circulation of this EA. Concurrence with the Federal Coastal Zone Consistency Determination has also been received from the Delaware Department of Natural Resources and Environmental Control (DNREC) Coastal Management Program under the interstate consistency authority.

The proposed plan has been coordinated with the U.S. Fish & Wildlife Service (USFWS) and the National Marine Fisheries Service (NMFS) pursuant to the Fish and Wildlife Coordination Act, the Threatened and Endangered Species Act, and the Magnuson Stevens Fishery Conservation and Management Act. The dredging and placement operations described in this document are not expected to have significant changes in air quality impacts and complies with Section 176(c)(1) of the Clean Air Act amendments of 1990.

**Table 7: Compliance with environmental quality protection statutes and other environmental review requirements.**

| FEDERAL STATUTES | COMPLIANCE STATUS |
|---|---|
| Archeological - Resources Protection Act of 1979, as amended | Full |
| Bald and Golden Eagle Protection Act | Full |
| Clean Air Act, as amended | Full |
| Clean Water Act of 1977 | Full |
| Coastal Barrier Resources Act | N/A |
| Coastal Zone Management Act of 1972, as amended | Full |
| Endangered Species Act of 1973, as amended | Full |
| Estuary Protection Act | Full |
| Federal Water Project Recreation Act, as amended | N/A |
| Fish and Wildlife Coordination Act | Full |
| Land and Water Conservation Fund Act, as amended | N/A |
| Marine Protection, Research and Sanctuaries Act | Full |
| Magnuson-Stevens Fishery Conservation and Management Act | Full |
| Migratory Bird Treaty Act | Full |
| National Historic Preservation Act of 1966, as amended | Full |
| National Environmental Policy Act, as amended | Full |
| Rivers and Harbors Act | Full |
| Watershed Protection and Flood Prevention Act | N/A |
| **FEDERAL STATUTES** | **COMPLIANCE STATUS** |
| Wild and Scenic River Act | Full |
| **Executive Orders, Memorandums, etc.** | |
| EO 11990, Protection of Wetlands | Full |
| EO12114, Environmental Effects of Major Federal Actions | Full |
| EO 12989, Environmental Justice in Minority Populations and Low-Income Populations | Full |
| EO 13045, Protection of Children from Environmental Health Risks and Safety Risks | Full |
| County Land Use Plan | Full |

**Full Compliance -** Requirements of the statute, EO, or other environmental requirements are met for the current stage of review.

**Partial Compliance** - Some requirements and permits of the statute, E.O., or other policy and related regulations remain to be met and coordination is ongoing.

**Noncompliance** - None of the requirements of the statute, E.O., or other policy and related regulations have been met.

**N/A** - Statute, E.O. or other policy and related regulations are not applicable.

Pertinent public laws applicable to the Maurice River Maintenance Dredging and Beneficial Use of Dredged Material are presented below:

**National Environmental Policy Act of 1970, As Amended, 42 U.S.C. 4321, *et seq*.**
NEPA requires that all federal agencies use a systematic, interdisciplinary approach to protect the human environment. NEPA requires the preparation of an EIS for any major federal action that could have a significant impact on quality of the human environment and the preparation of an EA for those federal actions that do not cause a significant impact but do not qualify for a categorical exclusion. Section 102 of the Act authorized and directed that, to the fullest extent possible, the policies, regulations and public law of the United States shall be interpreted and administered in accordance with the policies of the Act. This EA was prepared as a full-disclosure document in accordance with NEPA and a Public Notice was issued for public review. Comments are provided in Appendix D.

**Clean Air Act, as amended, 42 U.S.C. 7401, *et seq.***
The Clean Air Act regulates air emissions from stationary and mobile sources. The law authorizes USEPA to establish NAAQS to protect public health and public welfare and to regulate emissions of hazardous air pollutants. Based on ambient levels of a pollutant compared with the established national standards for that pollutant, regions are designated as either being in attainment or non-attainment. Cumberland County is in attainment for all priority pollutants. The draft EA was forwarded to the USEPA and NJDEP for their review to confirm compliance with Section 309 of the Clean Air Act.

**Clean Water Act, 33 U.S.C. 1251, et seq.**
Coordination has been completed to ensure the preferred alternative is in compliance with the Clean Water Act of 1977 and subsequent amendments. A 404(b)1 Assessment is included as Appendix C. A Section 401 Water Quality Certification is required for the project. Implementation of the preferred alternative would not result in permanent negative changes in water quality. Following construction activities, intertidal wetland habitat in the placement area is expected to be more resilient in the face of sea level rise and potentially establish additional low marsh vegetation. The project is expected to provide long-term positive impacts to water quality in the area. All state water quality standards will be met.

**Coastal Zone Management Act of 1972**
The proposed project is within the coastal zone, which is managed under NJDEP's Coastal Zone Management Program (CZMP). Although dredging and dredged material placement impact shallow water habitat, which is protected under the Coastal Zone program, beneficial effects from the proposed action are consistent with other goals of the CZMP. The CZMP includes goals to protect coastal land and water habitat. Construction of the project would beneficially use dredged material removed from the navigation channel to retain it in the local natural system and improve the resiliency of adjacent saltmarsh that has been inundated with flood waters and protection from erosion. A Federal consistency determination in accordance with 15 CFR 930 Subpart C has been made stating that the preferred alternative is consistent with the enforceable policies of the State of New Jersey's federally-approved coastal management program. NJDEP, and under the interstate consistency authority the Delaware Administrative Code 2201, the DNREC have reviewed USACE's determination of consistency with their CZMP enforceable policies and concur. The draft EA was made available to the public within both states

for review. USACE received concurrence from the NJDEP and DNREC.

**Endangered Species Act of 1973**

The preferred alternative has been determined to be in compliance with the Endangered Species Act of 1973 (ESA) after completion of consultation with the natural resource regulatory agencies. The preferred alternative is not anticipated to adversely affect rare, threatened, or endangered species and is expected to provide a positive impact through the development of additional valuable habitat used by threatened and endangered species.

**Fish and Wildlife Coordination Act**

The Fish and Wildlife Coordination Act (FWCA) requires Federal agencies to consult with the USFWS, NMFS, and the fish and wildlife agencies of States where the "waters of any stream or other body of water are proposed or authorized, permitted or licensed to be impounded, diverted or otherwise controlled or modified" by any agency under a Federal permit or license. Consultation is to be undertaken for the purpose of "preventing loss of and damage to wildlife resources." The intent is to give fish and wildlife conservation equal consideration with other purposes of water resources development projects. USFWS and NMFS were provided the draft EA for review, pursuant to the Fish and Wildlife Coordination Act in fulfillment of Section 2(b) of the FWCA (48 Stat.401, as amended, 16 U.S.C. 661 *et seq.*). Additionally, the NMFS also received an independent EFH Assessment report pursuant to both the Magnuson Stevens Fishery Conservation and Management Act and the FWCA. Coordination with USFWS and NMFS will be ongoing through construction and post-construction monitoring.

**Magnuson-Stevens Fishery Conservation and Management Act**

The Magnuson-Stevens Fishery Conservation & Management Act (MSA) is the primary law governing marine fisheries management in U.S. federal waters. Pursuant to Section 305 (b)(2) of this act, the USACE is required to prepare an Essential Fish Habitat (EFH) Assessment for the proposed maintenance dredging and BU placement operation in the Maurice River cove. The draft EA and an EFH Assessment were submitted to NMFS for their review. Compliance with the MSA has been met. Coordination with NMFS for EFH is ongoing through construction and monitoring.

**Migratory Bird Treaty Act, 16 U.S.C. 715-715s and Executive Order 13186 Responsibilities of Federal Agencies to Protect Migratory Birds**

The Migratory Bird Treaty Act (MBTA) prohibits the taking or harming of any migratory bird, its eggs, nests, or young without an appropriate federal permit. Almost all native birds, including any bird listed in wildlife treaties between the United States and several other countries are covered by this Act. A “migratory bird” includes the living bird, any parts of the bird, its nest, or eggs. The take of migratory birds is governed by the MBTA’s regulation of taking migratory birds for educational, scientific, and recreation purposes and requiring harvest to be limited to levels that prevent over-utilization. Section 704 of the MBTA states that the Secretary of the Interior is authorized and directed to determine if, and by what means, the take of migratory birds should be allowed and to adopt suitable regulations permitting and governing take. Disturbance of the nest of a migratory bird requires a permit issued by the USFWS pursuant to Title 50 of the CFR. The proposed dredging and placement operation is not expected to adversely impact migratory birds or their nests and eggs as the work will occur in subtidal and intertidal areas. The proposed project is expected to enhance areas of intertidal and low marsh

habitat which are utilized by some species of wading birds for foraging. The preferred alternative is in compliance with the MBTA and Executive Order 13186.

**Section 106 of the National Historic Preservation Act of 1966, as amended**

The National Historic Preservation Act (NHPA) of 1966, as amended (54 U.S.C. § 306108) requires federal agencies to take into account the effects of its actions on historic properties by identifying historic properties, assessing effects and resolving those adverse effects. The process is initiated by the federal agency and includes comment and input from the State Historic Preservation Officer (SHPO), the Tribes, the Advisory Council on Historic Preservation (ACHP), and other Consulting Parties. The USACE has determined that the proposed undertaking will have No Effect on historic properties eligible for or listed on the National Register of Historic Places. The Deputy State Preservation Officer concurred (March 3, 2023).

**Resource Conservation and Recovery Act, as amended, 43 U.S. C. 6901, *et seq.***

The Resource Conservation and Recovery Act (RCRA) controls the management and disposal of hazardous waste. "Hazardous and/or toxic wastes", classified by RCRA, are materials that may pose a potential hazard to human health or the environment due to quantity, concentration, chemical characteristics, or physical characteristics. This applies to discarded or spent materials that are listed in 40 CFR 261.31-.34 and/or that exhibit one of the following characteristics: ignitable, corrosive, reactive, or toxic. Radioactive wastes are materials contaminated with radioactive isotopes from anthropogenic sources (*e.g*., generated by fission reactions) or naturally occurring radioactive materials (*e.g.,* radon gas, uranium ore). There are no hazardous materials concerns associated with the preferred alternative. The preferred alternative is in compliance with the RCRA.

**Executive Order 11990, Protection of Wetlands**

This Executive Order directs federal agencies to avoid undertaking or assisting in new construction located in wetlands unless no practicable alternative is available. The preferred alternative is in compliance with Executive Order 11990. Approximately 150,000 cy of dredged material will be placed in two 9-acre areas of inundated (former) marsh to raise the substrate elevation to strengthen the resilience of intertidal mudflats and to allow for potential low marsh vegetation along degraded marsh edges in flooded marsh. The preferred alternative would result in a temporary impact to wetlands during placement operations but would provide sediment enrichment to the subtidal/intertidal mudflat/low marsh complex. The project is in compliance with the E.O.

**Executive Order 11988, Floodplain Management**

Executive Order 11988 directs federal agencies to evaluate the potential effects of proposed actions on floodplains. Such actions should not be undertaken that directly or indirectly induce growth in the floodplain unless there is no practicable alternative. The preferred alternative is in compliance with Executive Order 11988 and would have no effect on development within floodplains.

**Executive Order 12898, Environmental Justice**

This Executive Order directs Federal agencies to determine whether a federal action would have a disproportionate adverse impact on minority or low-income population groups within the project area. See Section 5.5 for a discussion of Environmental Justice considerations for the preferred alternative. The preferred alternative is not expected to result in disproportionately high or adverse human health

or environmental effects on minority or low-income populations.

**Executive Order 13045, Protection of Children from Environmental and Safety Risks**
This Executive Order requires federal agencies to make it a high priority to identify and assess environmental health and safety risks that may disproportionately affect children and to ensure that policies, programs, activities, and standards address these risks. No risks to children are expected from the preferred alternative.

## 7.0 MONITORING AND ADAPTIVE MANAGEMENT

The goal of adaptive management of the BU placement of dredged material within the northwest portion of the Heislerville WMA is to assist in preserving, protecting and restoring the lower Maurice River saltmarsh habitat by raising the substrate elevation (*i.e.* sediment enrichment) to levels more resilient to storms, erosion, and sea level rise and potentially allow for the re-establishment of low marsh edge vegetation and intertidal mudflats in a degraded marsh.

In order to determine how effective the BU placement project is in enhancing habitat resiliency, the placement site will be monitored before, during, and after placement operations. Monitoring will provide information essential to assessing ways in which adaptive management can be applied to future placements both here and other estuarine saltmarsh with comparable hydrodynamic and morphological conditions.

Monitoring efforts and adaptive management are adopted as part of ongoing research being conducted in partnership with the USACE Philadelphia District, USACE's Engineering Research and Development Center (ERDC), and The Wetlands Institute, in conjunction with the University of Penn's Weitzman School of Design (UPENN), the New Jersey Department of Environmental Protection (NJDEP/NJDFW) and other project stakeholders to develop a comprehensive data collection and monitoring plan for the Heislerville Wildlife Management Area (WMA) beneficial use of channel dredged material placement project.

During construction, stabilization of the area may include a combination of a turbidity curtain, earthen berms, hay bales and/or coir logs along the old railroad bed bayward of the Heislerville dike. Dredged material will be placed between the railroad bed and the dike. Two placement locations have been identified. Placement of fine-grained material at the primary site will build intertidal marsh elevation fronting the Heislerville dike. Placement at the secondary site will occur if a longer consolidation period is needed at the primary site. This intertidal mudflat/marsh edge protection will provide a natural infrastructure solution to restoring substrate elevations necessary to provide protection to the vulnerable Heislerville dike and adjacent natural habitat in the Heislverville Wildlife Management Area.

Monitoring of sediment behavior will allow for adaptively managing future placements. The placement of predominantly fine-grained sediment may need time to consolidate and build elevation over several dredging cycles and will be monitored with each successive placement.

Proposed monitoring and data collection plans include:

**Pre-Placement Monitoring**

- Elevation data of the placement areas adjacent to the Heislerville Dike and in the Northwest Reach as well as the federal channel (NAP) (including LiDAR (UAS), DEM from photogrammetry (UAS), tentatively INSAR from satellite, and traditional boat and topo surveys)
- Multispectral imagery pre- and post-dredging using UAS
- Sediment Sampling in Channel and Placement Area; 2017 and July 2022 (NAP)
- Data collection and laboratory analysis of consolidation including additional cores within the channel and then on placement site
- Drone Photography at high and low tides (pre-placement and throughout construction)
- Leverage Seven Mile Island Innovation Lab monitoring, R&D efforts and lessons learned

**During Placement**

- Monitoring of dredged sediments and settling by ERDC, NAP, UPENN
- ERDC will install several time-lapse cameras around the site to monitor surface change, flow velocity (dredging, within tidal creeks, and potentially leaving containment depending on set up) pre, during, and post dredging
- High resolution photography and video footage (NAP, ERDC)
- Documentation of innovative dredging technologies and techniques such as turbidity curtain concept, diffused discharge, use of natural landscape to move sediment and create intertidal or subtidal mudflats.
- Turbidity monitoring (ERDC/NAP) including roving turbidity meter for project area and potential fixed meter as needed

**Post-Placement**

- Surface elevation post placement using LiDAR (UAS), DEM from photogrammetry (UAS), INSAR from satellite (tentative)
- Topographic and Bathymetric Data of Sturgeon and Gull Island Complexes as well as federal channel (NAP) for minimum of 3 years
- Multispectral imagery pre- and post-dredging using UAS
- Aerial monitoring of elevation and topography and design of landscape features for Gull and Sturgeon
- Subsurface imagery with time to monitor evolution of dredged fill (consolidation, sediment mixing, bioturbation) post dredging
- Follow-up sampling on consolidation work (ERDC) including modeling
- Quantification of NNBF benefits for Heislerville Dike
- Leverage SMIIL monitoring, R&D efforts and lessons learned

Building with mixed sediments will create protective natural and nature-based features adjacent to the dike in a varied landscape approach that will include subtidal shallow water, intertidal mudflats and low marsh, and may also lead to the re-establishment of low marsh vegetation in the area. This dredging and BU placement project at Maurice River is based on Regional Sediment Management and Engineering

with Nature principles and practices and employs a science-based approach for creating and optimizing natural infrastructure in the Delaware Bay region experiencing devastating erosion. Keeping sediment in this eroding system is critical to the future of habitats and overall resilience of this important system Past practice of removing channel sediments from this eroding system and placing the sediments in an upland CDF is not a technically or environmentally sensitive option, especially in the face of climate change. The proposed BU placement is considered to be low risk and high yield for creating, protecting, and restoring varied habitats to build a more resilient system. Monitoring before, during, and after placement operations will document the outcome of the BU plan at Maurice River. Monitoring studies at other beneficial use placement locations in SMIIL and other areas within New Jersey as well as nationally are evidence that dredged sediments are a valuable resource for creating natural infrastructure and natural and nature-based features with Engineering with Nature and Regional Sediment Management approaches.

## 8.0 CONCLUSIONS AND RECOMMENDATIONS

The preferred plan supports the beneficial use of dredged material removed from an authorized navigation channel. Approximately 150,000 cy of dredged material will be removed during periodic maintenance dredging of the Maurice River navigation channel and placed within the northwest reach of the Heislerville WMA. Maintenance dredging of a portion of the Maurice River federal navigation channel to authorized depth of 7 ft MLLW with 2 ft allowable overdepth is scheduled to occur initially in 2023 and periodically thereafter, as needed. Dredging will remove critical shoaling in priority areas identified by channel users to maintain a safe and reliable navigation channel for commercial and recreational vessels. As part of the preferred plan, placement operations will be monitored prior, during and after the operation is complete to provide information that will further inform future placements with a continued objective to utilize a valuable source (*i.e.* dredged material) to restore intertidal mudflats and salt marsh habitat in an area that has endured excessive inundation and erosion for many decades. The preferred plan is compliant with all Federal applicable environmental laws (See Table 7).

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