US Army Corps
of Engineers

Philadelphia District

DELAWARE COAST PROTECTION
INDIAN RIVER INLET SAND BYPASS PROJECT
NORTH BEACH SUPPLEMENTAL SAND NOURISHMENT
SUSSEX COUNTY, DELAWARE

DRAFT

ENVIRONMENTAL ASSESSMENT (EA)

NEPA Unique ID: EAXX-202-00-E5P-1742316597

MARCH 2025

PREPARED BY:

U.S. ARMY CORPS OF ENGINEERS, PHILADELPHIA DISTRICT

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FINDING OF NO SIGNIFICANT IMPACT
DELAWARE COAST PROTECTION
INDIAN RIVER INLET SAND BYPASS PROJECT
NORTH BEACH SUPPLEMENTAL SAND NOURISHMENT
SUSSEX COUNTY, DELAWARE

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, as amended. The draft Environmental Assessment (EA) dated 17 March 2025 and titled *Delaware Coast Protection – Indian River Inlet Sand Bypass Project- North Beach Supplemental Sand Nourishment* evaluates existing environmental, cultural, and socio-economic conditions and the effects of the project on existing resources at the proposed project site. The EA also evaluates alternative sand sources and the effects on existing resources of no action.

The plan is a combination of the dredging and beachfill plan and sand source alternatives for the restoration of the North Beach shoreline. The Delaware Department of Natural Resources and Environmental Control completed an initial phase of the restoration of the beach by dredging from the interior Indian River Inlet Flood Shoal and placing approximately 480,000 cubic yards of sand on the North Beach shoreline. This phase is identified as "Phase 1", which was constructed to address severe erosion of the North Beach and dune. Phase 1 was completed March 1, 2025. The next phase (Phase 2) is the USACE component, which will complement the Phase 1 portion. For the completion of the Phase 2 berm and dune restoration, approximately 500,000 cubic yards of sand beachfill would be placed along the shoreline of the North Beach extending north from the north Indian River Inlet jetty for approximately 5,000 feet. The construction template will result in a 250-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of 5H:1V. The berm will have a dune on top with an overall dune crest elevation of +16.0 ft NAVD and width of 25 ft with 3H:1V slopes. The installation of dune fencing, crossovers and dune grass plantings would subsequently be conducted by the State of Delaware. A staging area will be needed for the contractor and a site designated approximately 2,300 ft north of the north jetty has been identified and will be used in conjunction with two areas located under the IRI bridge. The Phase 2 sand would be obtained from the hydraulic dredging of the Indian River Inlet Ebb Shoal (IRI-Ebb A).

The selected plan also includes the periodic nourishment of the North Beach on an as needed basis to supplement the Indian River Inlet sand bypass plant operations to maintain the Phase 2 berm and dune template. The required sand quantities may be variable but could be as high as 800,000 cubic yards at the time of need. The sand sources include the Indian River Inlet Ebb Shoal (Ebb-A) and the existing Indian River Inlet Flood Shoal Sand Source. Additionally, the Indian River Inlet Ebb Shoal (Ebb-B) portion including the proposed southern lobe expansion area is considered for future use but requires supplemental environmental compliance approvals upon further investigations for sediment quality, benthic resources, and cultural resources.

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	☒	☐	☐
Soils	☒	☐	☐
Tribal trust resources	☐	☐	☒
Water quality	☒	☐	☐

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 applicable, will be implemented to minimize effects.[1] In consultation with the NOAA Fisheries, pursuant to the Magnuson Stevens Fishery Conservation and Management Act (MSA) for the protection of Essential Fish Habitat (EFH) and federally-managed fish species, USACE will adhere to NOAA Fisheries recommended seasonal restricted period for dredging and placement activities. Pursuant to Section 7 of the Endangered Species Act of 1973, as amended,

[1] 40 CFR 1505.2(C) all practicable means to avoid and minimize environmental harm are adopted.

a determination that the project may affect, but is not likely to adversely affect (NLAA) listed species or critical habitat was submitted to NOAA Fisheries Greater Atlantic Regional Field Office (GARFO) for review. A GARFO concurrence with this determination is being requested. A determination that the action is not likely to adversely affect the piping plover, red knot and seabeach amaranth plant was submitted to the U.S. Fish and Wildlife Service for review. A USFWS concurrence with this determination is being requested. All terms and conditions of the Section 7 consultation with NOAA Fisheries and USFWS shall be implemented in order to minimize take or jeopardizing endangered species.

Public review of the draft EA was initiated 20 February and will be completed on 17 March 2025. All comments submitted during the public review period will be addressed in the Final EA and included in the Correspondence Appendix. Comments from state and federal agency review did not result in any significant changes to the final EA. All state and federally-mandated approvals have been received.

Pursuant to Section 106 of the National Historic Preservation Act of 1966, as amended, USACE determined that no historic properties will be adversely affected by the recommended plan. The Delaware State Historic Preservation Office for review and concurrence.

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 included in the EA.

Water Quality Certification pursuant to Section 401 of the Clean Water Act will be obtained from the Delaware Department of Natural Resources and Environmental Control. All conditions of the Water Quality Certification shall be implemented in order to minimize adverse effects to water quality.

A determination of consistency with the Delaware Coastal Zone Management Program pursuant to the Coastal Zone Management Act of 1972 will be obtained from the Delaware Coastal Management Program. All conditions of the consistency determination shall be implemented in order to minimize adverse effects to the coastal zone.

All applicable environmental laws have been considered and coordination with appropriate agencies and officials has been completed. 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.

____________________	___________________________________
Date	Jeffrey M. Beeman Lieutenant Colonel, Corps of Engineers District Commander

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1.0 INTRODUCTION

This document is being issued pursuant to 33 CFR 230.10(a) and is intended to present and evaluate new information for the Indian River Inlet (Sand Bypass Facility), which is authorized under the Delaware Coast - Cape Henlopen to Fenwick Island Project ("Delaware Coast Protection") to address severe beach erosion along the Atlantic Ocean shoreline of the north side of the Indian River Inlet north jetty (North Beach). In accordance with the National Environmental Policy Act (NEPA) of 1969, this assessment is being conducted in accordance with 33 CFR Part 230, which is the U.S. Army Corps of Engineers procedures for implementing NEPA. This document supplements previous NEPA documents referenced as:

- Final Environmental Impact Statement (USACE, 1971),
- Environmental Impact Statement – Draft Supplement (USACE, 1975a),
- Final Environmental Impact Statement – Indian River Inlet Project Maintenance (USACE, 1975b),
- Environmental Assessment/Finding of No Significant Impact (FONSI) – Indian River Inlet Sand Bypass Plant (USACE, 1984),
- Environmental Assessment/FONSI – Indian River Inlet and Bay Maintenance Dredging and Beneficial Use of Dredged Material Section 104, Navigation (USACE, 2009),
- Environmental Assessment/FONSI – Flood Control and Coastal Emergency Repair – Indian River Inlet North Shore (USACE, 2013).

The proposed work in this assessment is being funded under the Infrastructure Investment and Jobs Act (IIJA) Addendum to supplement repairs of the beach along the North Beach of Indian River Inlet, which are currently being undertaken by the Delaware Department of Natural Resources and Environmental Control. Additionally, this assessment evaluates the use of long-term alternate sand sources to be used for beachfill to supplement the operation of the Indian River Inlet Sand Bypass Plant on an as needed basis. This assessment affects two overlapping Federal projects: the Delaware Coast Protection Project and the Indian River Inlet and Bay Navigation Project.

1.1 Delaware Cost Protection Project

The Delaware Coast Protection project is a Flood and Coastal Storm Damage Reduction project, which is authorized by the Flood Control Act of 1968 and the Water Resources Development Act of 1986 (P.L. 99-662). This project was authorized to address chronic beach erosion along the North Beach of the Indian River inlet caused by the inlet jetties. Here, the jetties interrupt the northward longshore transport of sand resulting in a deficiency of sand on the north side of the inlet. The plan of improvement consists of constructing a sand bypassing plant and operation of said plant for periodic nourishment of a feeder beach (approximately 100,000 cubic yards of sand, annually) to nourish approximately 3,500 feet of feeder beach on the north side of the inlet and protect the Delaware Route 1 highway (Figure 1). Initial construction was completed in 1990, and the sand bypass plant has been subsequently operated and maintained by the non-Federal sponsor, the Delaware Department of Natural

Resources and Environmental Control. In 2013, USACE conducted a major emergency repair of the beach in response to a disaster declaration from Hurricane Sandy under the P.L. 84-99 (Flood Control and Coastal Emergencies) utilizing the interior flood shoal as a sand source where approximately 520,000 cubic yards of sand was used to restore a 5,000-foot segment of beach and dune north of the inlet.

The sand bypass plant is currently being converted from the original diesel motors to an electric system and has been taken temporarily offline. The work also includes the installation of electric motor controls and an enclosed HVAC control room. The bypass plant is expected to resume operations by the fall of 2025.

1.2 Indian River Inlet and Bay Federal Navigation Project

The Indian River Inlet and Bay Navigation Project is in proximity to the Delaware Coast Protection Project and overlaps with it along both jetties. The purpose of this project is to provide a safe navigation channel for commercial, recreational and U.S. Coast Guard use. Indian River Inlet is the only water access point into the Delaware Inland Bay area that includes Indian River Bay and Rehoboth Bay. This project was authorized in 1937 (R&H Doc 41, 75th Cong, 1st Session) and modified in 1945 (HD 330, 76th Cong, 1st Session). The project authorization includes stabilizing the inlet by construction of parallel jetties 500 ft apart; the dredging of a channel generally 200 ft wide and 15 ft deep from the inner ends of the jetties to a point in the Bay substantially 7,000 ft from the ocean shoreline, dredging a channel 9 ft deep, 100 ft wide in the Bay and 80 ft wide in the River, from that depth in the existing channel in Indian River Bay to and including a turning basin 9 ft deep, 175 ft wide and 300 ft long at Old Landing; then about 8,200 ft to highway bridge at Millsboro, 60 ft wide, 4 ft deep (Figure 2).

Maintenance activities have occurred numerous times since the construction of the inlet and navigation channels, which involve maintenance dredging and shoreline stabilization along the interior inlet shorelines and repairs to the jetties. Most recently, USACE awarded a contract to repair a failed bulkhead area along a popular recreational area and sand tighten a portion of the south jetty. This work was funded through the Infrastructure Investment and Jobs Act. Construction began in the Spring 2023 and is expected to be completed in 2025.

1.3 Location

The project is located in Sussex County, Delaware, along the Atlantic Ocean coast at Indian River Inlet (Figure 1). The project area includes a portion of the intertidal beach, supratidal beach and dune, pumphouse, and parking lot along the south Atlantic Ocean Coast shoreline of the Indian River Inlet. The north side (North Beach) of Indian River Inlet consists of the intertidal beach, supratidal beach, and dune areas extending approximately 5,200 feet to the north from the north jetty (Figure 1 thru Figure 3). The North Beach is the location of severe beach erosion and is the focus of this action.

The location also includes the following in-water areas for consideration as alternative sand sources for beachfill: the Indian River Inlet Ebb Shoal located approximately 0.25 miles offshore from the inlet jetties, the Indian River Inlet Flood Shoal located in the interior inlet area immediately west of the Charles W. Cullen Memorial Bridge, and two shoal areas (Burton Island Shoal and Middle Island Shoal) within Indian River Bay (Figure 3).

2.0 PURPOSE AND NEED

The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

The northside Indian River Inlet coastline (North Beach) has a long history of erosion due to the interruption of the northward flow of sand caused by the construction of the inlet jetties. This erosion has made critical infrastructure, such as SR-1 and the Indian River Inlet Bridge (currently the Charles W. Cullen Memorial (Inlet) Bridge), more vulnerable to storm damages. To mitigate risk and provide a consistent source of sand to North Beach, a sand bypass facility was constructed in 1990 by USACE and is operated and maintained by the State of Delaware. The sand bypass system mimics the natural flow of sand from south to north by pumping sand from the southside beach fillet, across the inlet to the North Beach. Sand pumping rates are variable and average 100,000 cy of sand per year.

Prior to the construction of the sand bypass system, sand was periodically obtained from the interior Indian River Inlet flood shoal and placed on the North Beach. From 1957 to 1990, over 2 million cy of sand was dredged from the Inlet interior to maintain the Federal navigation channel and to obtain beach fill for the eroding shoreline north of the Inlet (USACE 2014). Once the sand bypass system was operational in 1990, dredging within the Inlet was only necessary in 2010 to fill scour holes located near the USCG facility. Otherwise, no additional dredging of the interior Inlet was performed to obtain beach fill or maintain the channel until Hurricane Sandy hit in October 2012.

Hurricane Sandy eroded hundreds of thousands of cy of sand from the North Beach, resulting in overwash from the storm surge that flooded SR-1 and the approach to the newly constructed Inlet Bridge. Overwash forced the closure of this critical highway and evacuation route for several days until State crews could remove sand from the roadway and make the necessary repairs. Following Hurricane Sandy, over 500,000 cy of sand was required to rebuild the beach template, which is a far greater volume than the sand bypass system could accommodate. Therefore in 2013 under a coastal emergency action, the USACE dredged the Indian River Inlet flood shoal borrow area and used all dredged material to rebuild the berm and dune system at North Beach.

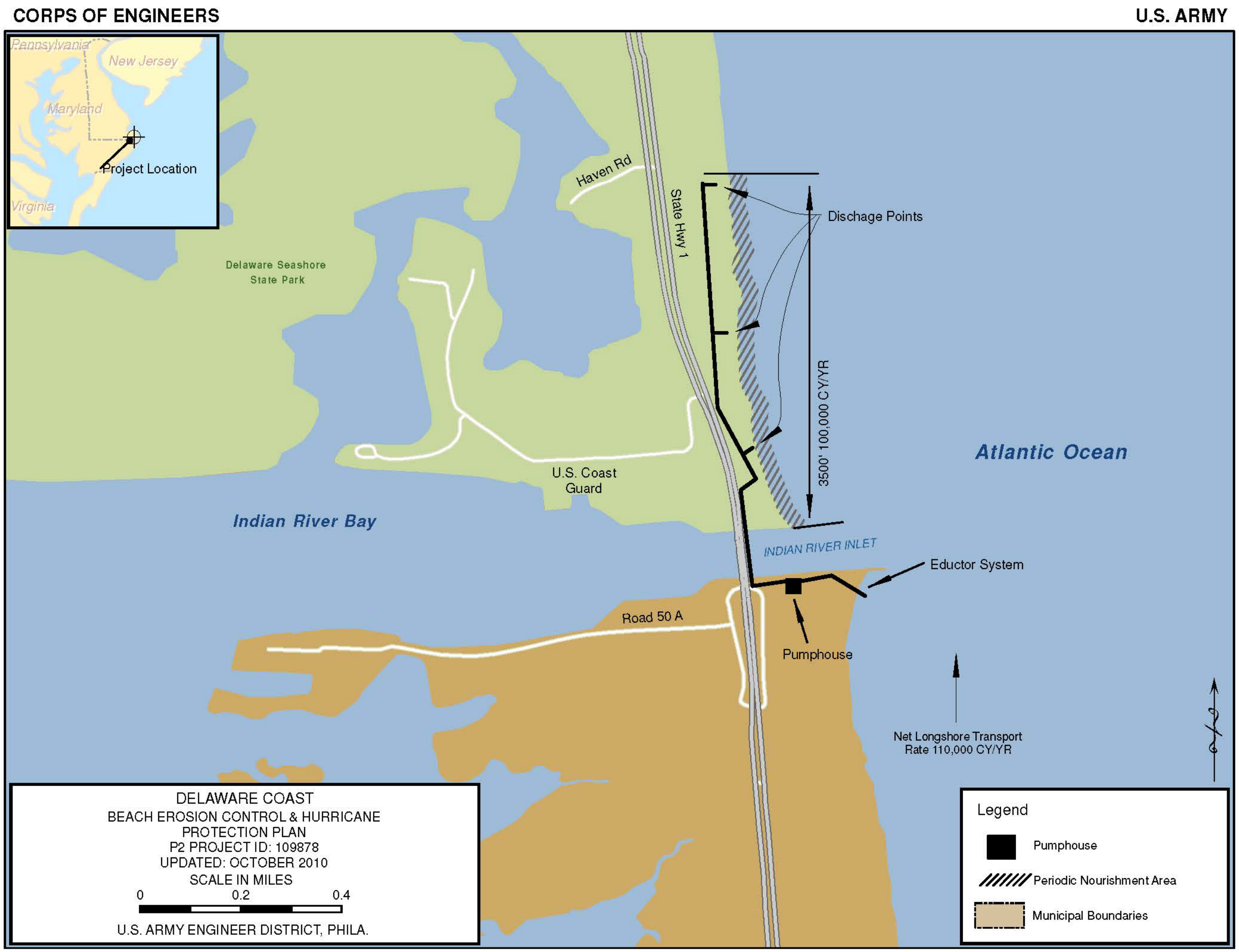
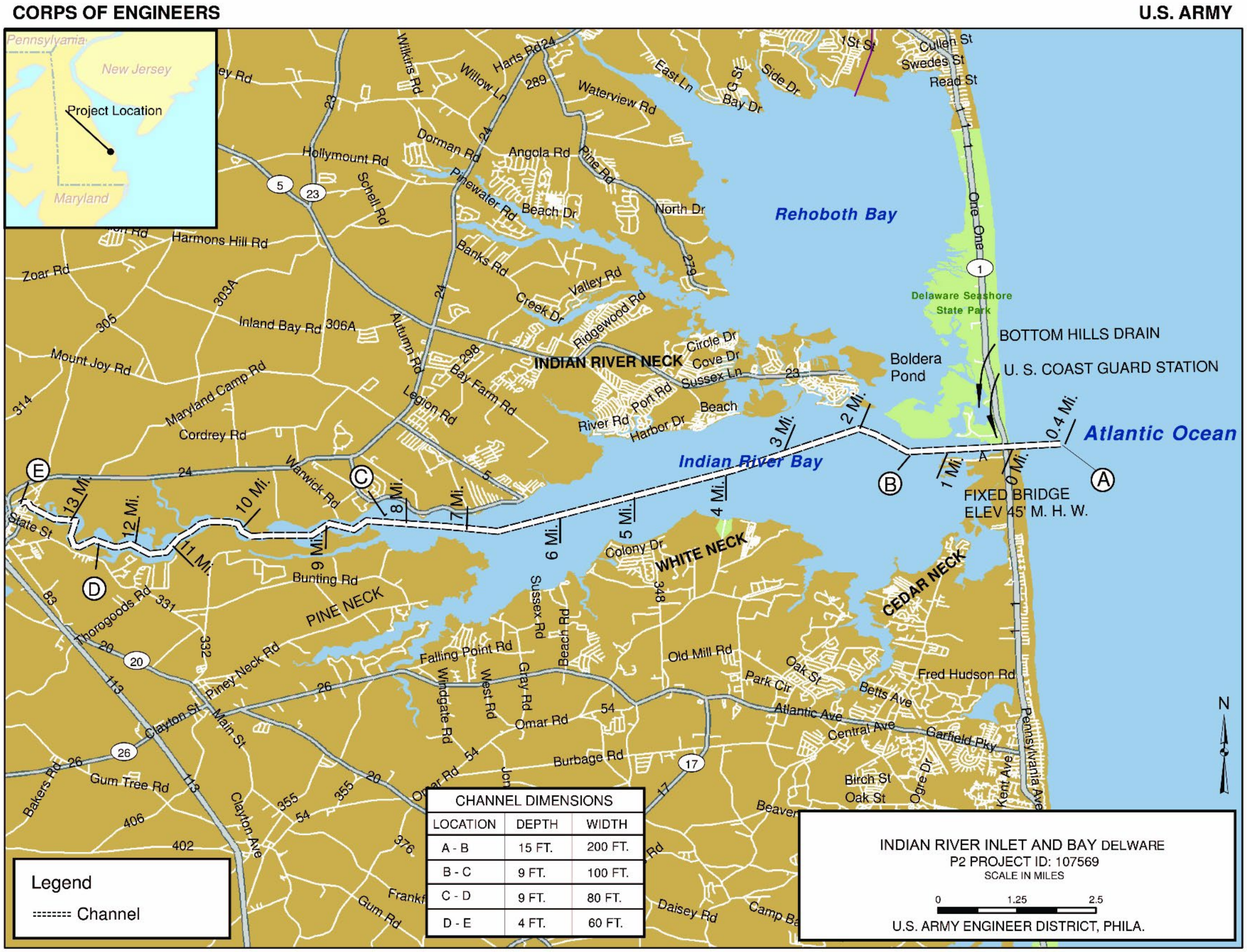


Figure 1. Delaware Coast Protection - Indian River Inlet Sand Bypass Plant and North Beach Beachfill Placement Area



CHANNEL DIMENSIONS

LOCATION	DEPTH	WIDTH
A - B	15 FT.	200 FT.
B - C	9 FT.	100 FT.
C - D	9 FT.	80 FT.
D - E	4 FT.	60 FT.

Figure 2. Indian River Inlet and Bay Federal Navigation Project.

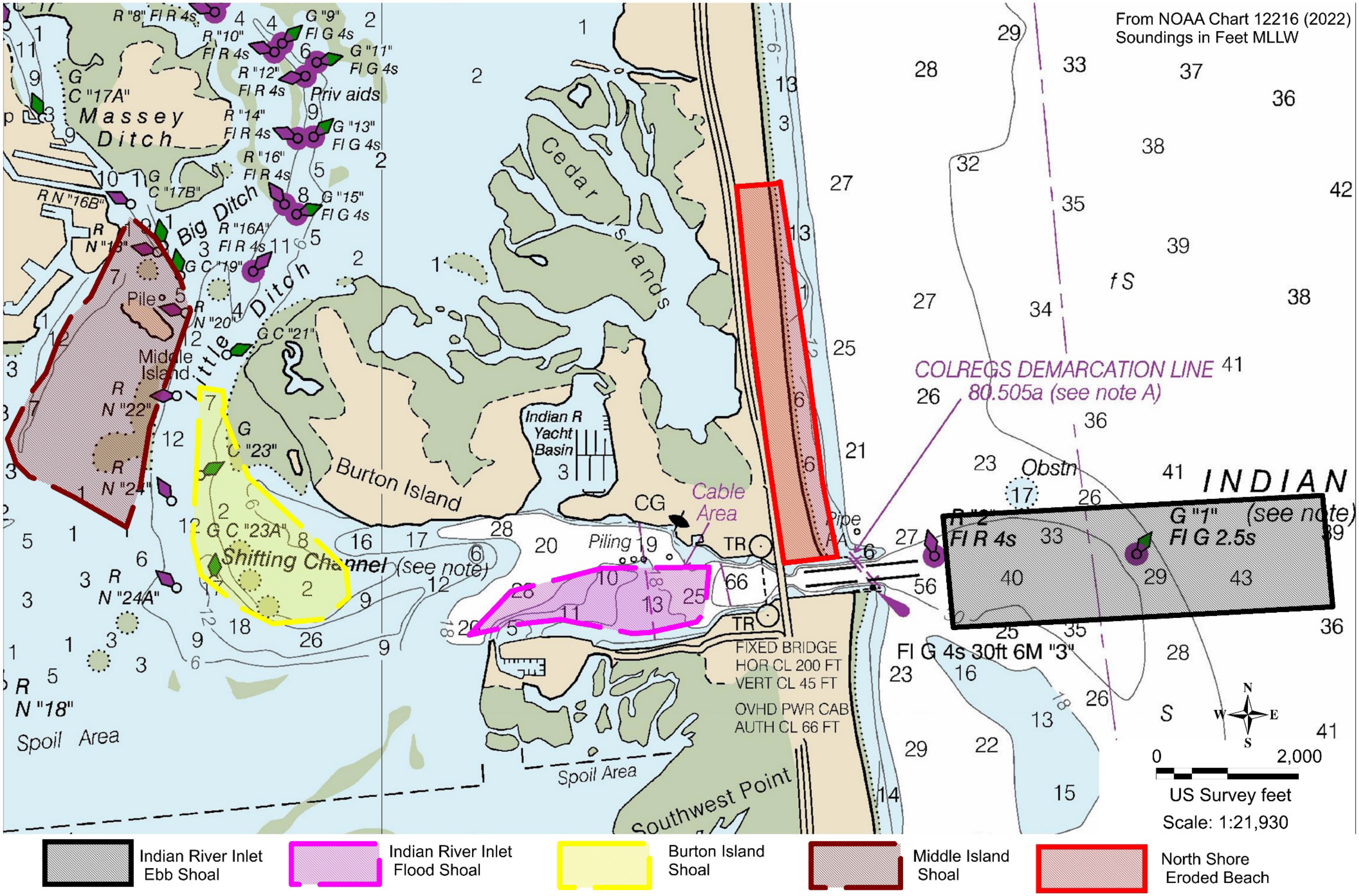


Figure 3. Shoal Areas Considered Initially for Alternative Sand Sources and North Beach Indian River Inlet

For several years the annual pumping of the sand bypass system helped mitigate erosion at North Beach and was the primary maintenance activity; however, in 2020 the system became inoperable. Since then, DNREC Shoreline and Waterway Management Section has judiciously added sand to North Beach via truck haul which has been ineffective for mitigating risk. Due to the inadequate maintenance, the dune system at North Beach is severely eroded and prone to scour from direct wave energy on a regular high tide.

The current condition (as of September 2024) of North Beach is such that a minor storm surge or swell event is very likely to breach the dune. This has the potential to flood Delaware State Route-1 (SR-1), an evacuation route, and erode the existing Inlet Bridge. A dune breach occurred most recently on August 17, 2024, that forced the closure of SR-1 for several hours as ocean water, sand and debris flooded the roadway (Figure 4 and Figure 5).

Severe erosion at North Beach has also exposed hazardous debris from historical roads that had previously washed out (Figure 6). There have been extensive clean-up efforts among DNREC and local volunteers, but as the beach erodes further, additional debris becomes exposed. The debris is now more difficult to remove since the beach elevation has lowered, leaving no dry beach above the intertidal zone during high tide (Figure 7). In response, beachgoers are walking and sitting on the dune face and crest, which is an additional stressor to the dune complex. During low tide at North Beach, beachgoers sit in the intertidal zone among the large pieces of marine debris that are now exposed and washing ashore. In addition, swimmers and waders may be unaware of the hazards posed by debris and the currents driven by wave energy.

Despite repeated attempts to patch the areas of high erosion by truck haul sand, the volume and rate of sand delivery became inadequate such that sand placed on the beach gets washed out within one tidal cycle. Therefore, a truck haul method in this capacity is insufficient to restore and maintain the beach profile.

In response to the urgent need to protect critical infrastructure, DNREC has responded with a project to dredge approximately 480,000 cubic yards of sand to address the immediate severe erosion (this is referred to as “Phase 1”). The Phase 1 work commenced in late November 2024 (under Department of the Army Permit NAP-2024-00438-8) utilizing the interior Indian River Inlet Flood Shoal as the sand source and is expected to be completed in March 2025.

The Phase 1 Project includes the following key components:

- Dredge up to 480,000 cy of sediment from the Indian River Inlet flood shoal, consistent with the authorized elevation of -24 ft NAVD with 1 ft of allowable over-dredge and approximately 640 ft wide.

Figure 4. Aerial view of the dune breach at Delaware Seashore State Park (looking north) on August 17, 2024 (Photo Courtesy of DNREC)

Figure 5. View of the dune breach at Delaware Seashore State Park (looking south) on August 17, 2024 (Photo Courtesy of DNREC).

Figure 6. View (looking south) of Hazardous Debris Exposed on North Beach Due to Erosion (April 2024) (Photo Courtesy of DNREC)

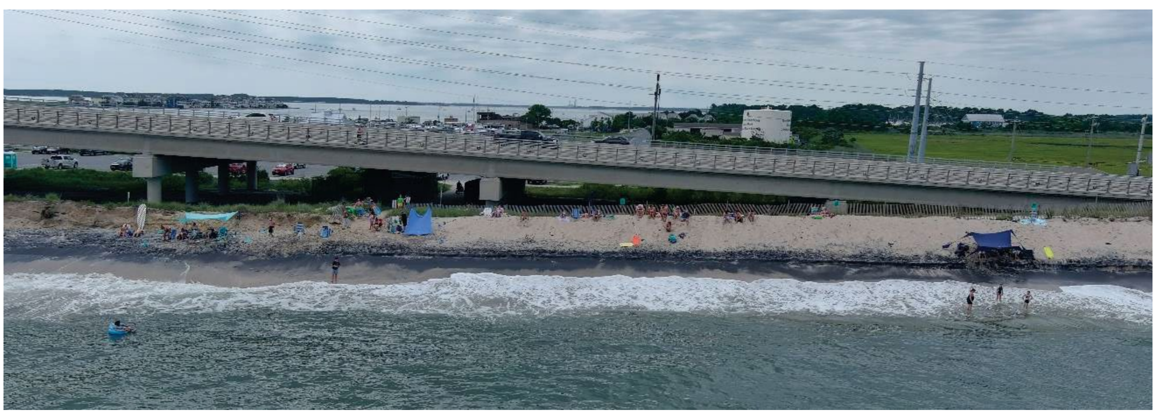


Figure 7. View of North Beach from Atlantic Ocean During Hight Tide. No Observable Dry Beach Above the Intertidal Zone (July 26, 2024) (Photo Courtesy of DNREC)

- Transport dredged material, via pipeline, to the placement site at North Beach.

- Spread and grade dredged material to restore the berm (+9.0 ft NAVD, 100 to 150-ft width) and dune system to an overall elevation of +16.0 ft NAVD and 25-ft wide. Placement will begin at the north jetty and extend northward for approximately 5,200 ft (between 0+00 and 55+0).

The second phase of this effort, “Phase 2”, is the additional placement of sand proposed by USACE. Approximately, 500,000 cubic yards of sand are required to bring the beach and dune back to a fully functional template that provides sufficient protection for the critical infrastructure.

For Phase 2, the additional 500,000 cubic yards would be placed to complement the Phase 1 template where it is most needed to achieve the final dimensions of the berm to a 250 ft. width (construction template) at +9.0 ft. NAVD and dune system to an overall crest elevation of +16.0 ft. NAVD and 25-ft. in width (the Phase 1 component is likely to have completed the dune template prior to Phase 2). The placement locations would be determined based on pre-placement topographical surveys following Phase 1. However, the Indian River Inlet Flood Shoal sand source is expected to become depleted from the Phase 1 dredging and would not have adequate sand quantities to place the additional 500,000 cubic yards required to build the beach back up to its full template. Therefore, a need exists to utilize another (alternate) sand source to supplement the flood shoal sand source during Phase 2.

After Phase 2 is completed, it is expected that the sand bypass plant would become operational in later 2025 and the resumption of sand infusions needed on the North Beach would provide sufficient stability of the beach and dune systems. However, despite the normal sand bypass system operation, there is a need to develop a long-term alternate sand source to supplement the system at times of increased storm activity and/or mechanical shutdowns on an “as needed” basis. Additionally, a long-term alternate sand source is needed to manage sand resources and provide regional sediment management of the Indian River Inlet shoal complex.

3.0 ALTERNATIVES CONSIDERED

Project alternatives were previously evaluated in USACE (1971, 1975a, 1984, and 2013). To meet the purpose and needs as discussed in 2.0, this assessment only focuses on alternate means of delivering sand to the project area (North Beach). Three alternatives are available for consideration: 1) no action; 2) dredging utilizing sand sources and 3) local commercial sand quarry and truck haul delivery.

3.1 No Action

No action assumes the completion of the Phase 1 portion of the dredging and beachfill placement on the North Beach and the expected resumption of the operations of the sand bypass plant later in 2025. The completion of Phase 1 will provide much needed protection by restoring the most vulnerable portions of the beach and dune system on the North Beach. However, no action will not bring the beach on the North Beach back to its full template and the existing beach will remain vulnerable to continued erosion leaving critical infrastructure at risk to damages from storm waves and overwash. Even with the resumption of the sand bypass plant, no action would not satisfy the immediate needs of an additional 300,000 cubic yards of sand, which would allow this segment of beach to remain vulnerable to continued erosion and overwash.

The no action alternative also does not provide a long-term alternate sand source needed to complement the operations of the sand bypass plant on an "as needed" basis. An "as needed" basis would result either from increased erosion on the North Beach such as a significant storm event or a series of storms that erode the beach beyond the capacity of the sand bypass plant. Additionally, unscheduled repairs of the sand bypass plant may be required that can result in delays in placing sand along the North Beach. As is the case with the Phase 1 component, the Indian River Inlet Flood Shoal has periodically been used as a supplemental sand source for the North Beach, but the quantity of sand is limited, and may not supply future needs.

All of these factors combined would increase the vulnerability of the North Beach shoreline and adjacent infrastructure. If no action is taken to fully restore the beach, continued erosion will occur particularly during storm events until such a time that the roadway and newly constructed bridge will be endangered and or impassable. Loss of the inlet crossing is unacceptable as it is the only means of reaching the other side of the inlet versus driving the long way around, which can increase travel times by as much as 20 more minutes. First responders and emergency personnel rely on the bridge and road network in the State Park to access areas in and around the Indian River area by land. Loss of the road during recent storm events led to extended response and travel times involving first responders, complicating patient delivery to medical facilities in a timely manner and economic interruptions.

3.2 Dredging and Beachfill Placement

Hydraulic cutter-suction dredges (CSD's) and trailing suction hopper dredges (TSD's) provide an efficient means of delivering sand to the project location on the North Beach to restore the berm and dune of the beach. The beachfill placement location extends for approximately 5,000 ft. north of the north Indian River Inlet jetty (Figure 3). CSD's and TSD's can move massive quantities of sand from the source to the receiving beach in a short amount of time (up to 10,000 cubic yards/day, depending on dredge size and pumping distance). Cost effectiveness for using dredges for delivering sand as beachfill is realized for large projects. The average cost per cubic yard of sand can be relatively low; however, a significant cost item for dredging is found in mobilization and de-mobilization costs for a dredge. In the case of a 30,000 cubic yard beachfill, the mobilization and demobilization cost can be up to 8 times the cost of the actual dredging and placement costs (cost/cy). However, in a larger scale project, such as 150,000 cubic yards (or greater), the mobilization/de-mobilization costs may be only 2 times the cost of the actual dredging/placement costs.

Cutter suction or hydraulic cutterhead dredges are floating platforms equipped with a rotating cutter that excavates the sea floor, feeding the loosened material into a pipe (generally 30" diameter) and pump system that transports the material and water slurry up to typical distances of five miles by pipeline. Transport distances can be extended by the addition of booster pumps in the pipeline route. Cutter suction dredges will typically be anchored into the bottom with a spud and remain in a fixed spot and will excavate uniform deep pits along the arc of the cutterhead. CSDs can be very efficient dredges that can pump 2,000 cubic yards per hour or greater. The limitations for CSDs are that they require booster pumps for pumping distances greater than five miles, and they typically require calmer sea conditions than what a hopper dredge requires. Problems with clays clogging intake screens have been reported in instances when MEC screens are employed. CSDs are not very mobile and not easy to relocate within a borrow area to find optimal sand if suboptimal sand is encountered. A typical operation of a CSD for a beach nourishment project is provided in Figure 8.

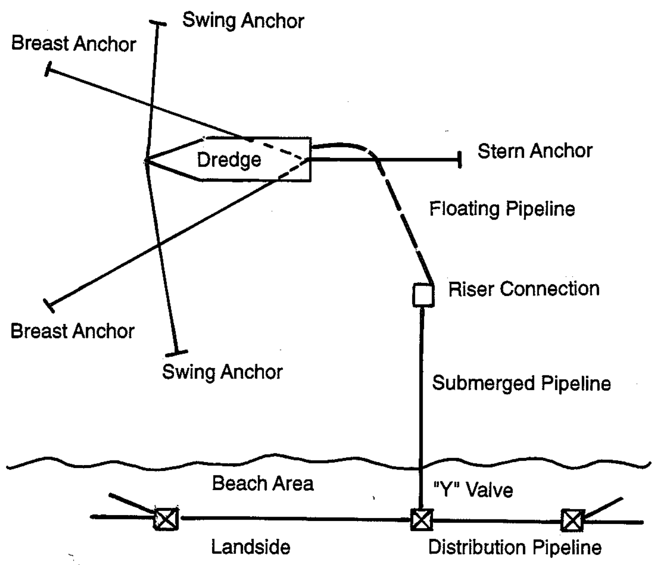


Figure 8. Typical Cutter-Suction Dredge Operation for Beach Nourishment (Source: National Research Council, 1995).

Trailing suction hopper dredges (TSHDs) are designed to vacuum material from the sea floor through drag arms that load the material into the hold (hopper) of the vessel (3,600 CY to 6,500 CY). The cargo of sand is then sailed to a pump-out location within the nearshore zone where the material is pumped ashore by the ship (or the pump-out station). TSHDs have been used for initial construction and periodic nourishments at Rehoboth Beach/Dewey Beach, Bethany Beach/South Bethany, and Fenwick Island. TSHDs are most beneficial for mining sand from sources that are at far distances from the destination beaches where the vessel can transit between sand source and pump-out location. TSHDs are moving vessels during dredging operations, and typically create shallow furrows within the affected portions after each pass within a borrow area. A typical result would be a broader shallow pit with some uneven furrows within it. Because TSHDs are vessels in motion, they have a higher potential for entraining mobile sea life including threatened and endangered sea turtles and Atlantic sturgeon that may be found along the sea floor. A typical operation of a trailing suction hopper dredge for a beach nourishment project is provided in Figure 9.

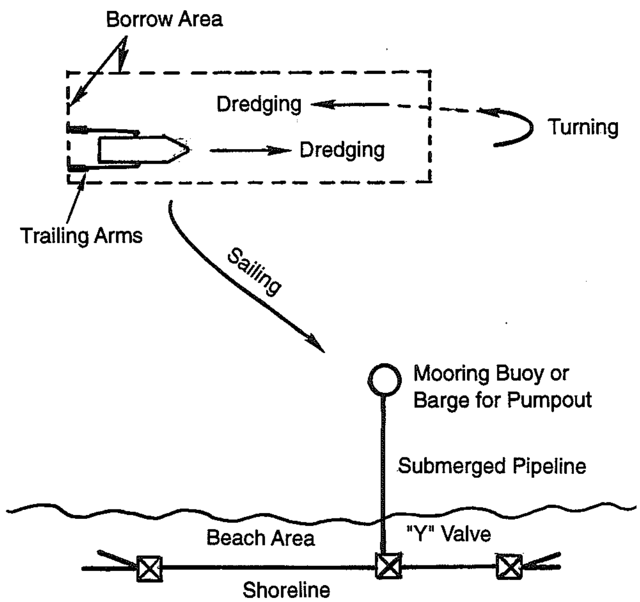


Figure 9. Trailing Suction Hopper Dredge Operation for Beach Nourishment (Source: National Research Council, 1995).

Once the sandy material is dredged from the ocean or bay floor, it is transported/pumped through a submerged pipeline, which rises to the shore typically located in the center of a length of beach to be filled. At this point, sand is delivered via a “Y” valve that distributes the sand along the beach in the preferred direction (see Figure 8, Figure 9 and Figure 10). Pipeline is added as the beachfill progresses along the beach. The sand is pumped on the beach into a basket to screen potential MEC (Munitions and Explosives of Concern) (Figure 11), the excess water runs off, then the sand is moved around with a bulldozer to the shape of the template. This is typically done with a small, temporary "training" berm (not to be confused with the beach berm template) constructed along the beach to direct flow and allow sands to settle out as it is de-watered. The water in the slurry is allowed to flow freely back into the ocean. This operation usually occupies up to about 1,000-foot sections of beach at a time. Public access is prohibited within these segments during ongoing operations, which can usually last from several days to a week depending on work progress.

Figure 10. A Typical Beachfill Operation along the Delaware Atlantic Coast.
(Source: Great Lakes Dredge and Dock Company website accessed at:
http://www.gldd.com/company/projects/coastal-protection/ on 5/7/2015)

Figure 11. Sand Being Pumped Through a 3/4-inch MEC Screen Basket from a Hopper Dredge. Training berms surround pump-out area to allow for sand retention.

Within these segments, the project template is achieved through filling and manipulating the sand with dozers to the required elevations and widths. The design template berm width is the minimum berm width after the filled beach adjusts to wave action. The construction template (including a quantity of advanced (sacrificial) nourishment) will result in a significantly wider berm than the design template berm because the beach will be initially "overbuilt". The advanced nourishment is usually the quantity required for periodic nourishment unless more fill is required to address erosion of the design template berm/dune. The inclusion of the advanced nourishment and construction template enables the economic use of standard earth-moving equipment for the distribution of the fill and minimizes relocation of the discharge point. The result is a beach berm that is initially considerably wider (up to two to three times) than the authorized design width. After the first storm season, the berm is expected to adjust landward becoming considerably smaller as the subaqueous beachfill material moves seaward (USACE, 2003). See Figure 12 for a cross section of a typical beach nourishment construction template.

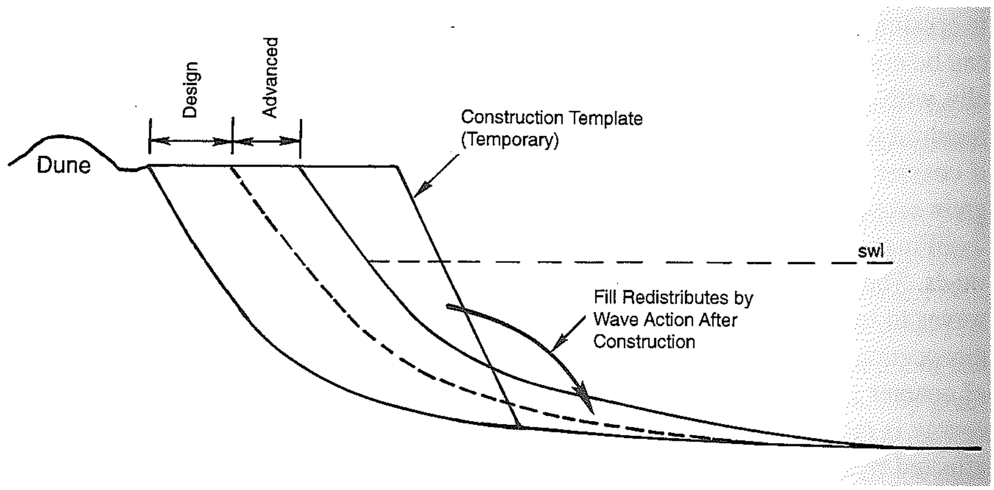


Figure 12. A Typical Profile of a Beachfill Construction Template. (Source: National Research Council, 1995).

The environmental effects of dredging and placement of sand on the beach would result in a temporary removal of the benthic community within the sand source, but re-colonization is expected. The recolonization and recovery of the benthic community is dependent on the regime it is in. High energy areas may have benthic fauna adapted to frequent disturbance whereas, quiescent areas may have more stable benthic communities that are sensitive to disturbance. The benthic community along the nearshore and intertidal beach would experience a temporary adverse impact from fill placement by smothering of the less mobile organisms. Dredging would temporarily increase turbidity in the sand source locations and the beachfill placement areas but would subside upon cessation of dredging due to the coarse nature of the sediments. Effects on fisheries are adverse by impacting benthic food prey items in the borrow area and placement areas. Turbidity could inhibit sight feeding and respiration, but these effects are expected to be minor and temporary.

Five dredging sand sources were considered for Phase 2 and as long-term alternate sources on an "as needed" basis.

3.2.1 Indian River Inlet Flood Shoal

The Indian River Inlet Flood Shoal occurs immediately west of the Charles W. Cullen Bridge (Figure 3, Figure 13, and Figure 14) and has been used several times as a renewable sand source for the North Beach. From 1957 to 1990, over 2 million cy of sand was dredged from this shoal to maintain the Federal navigation channel and to obtain beach fill for the eroding shoreline north of the Inlet (USACE 2013). Once the sand bypass system was operational in 1990, dredging within the Inlet was used in 2010 to fill scour holes located near the USCG facility, to repair the North Beach berm and dune following Hurricane Sandy in 2014, and currently is being used to provide approximately 480,000 cubic yards of sand for the Phase 1 portion of the North Beach restoration (to be completed by the Delaware Department of Natural Resources and Environmental Control in March 2025).

The flood shoal sand source is about 50 acres in size with depths ranging from -5 ft to -28 ft MLLW (-3.2 ft to -26.2 ft NAVD). This alternative is to dredge the flood shoal to a depth of -25.8 ft MLLW (-24 ft. NAVD). This site is the nearest location from the North Beach with an average distance of about 0.6 miles to the north jetty. Dredging the flood shoal has advantages in that it provides advance maintenance of the navigation channel by reducing infilling of adjacent sediments. The material is renewable as this area frequently shoals in with high quality clean sand (>90%). Because this location is interior of the inlet, a smaller dredge plant can be used with easy access to the shorelines.

This site is an important migratory fish passageway to the Indian River Bay estuarine system and to the Atlantic Ocean. Utilization of this site would require a Time of Year restriction from March 1 to June 30th to avoid obstructing fish migrations.

Because the Indian River Inlet Flood Shoal is already being utilized for the Phase 1 beachfill effort for the North Beach, there would be little, or no sand resources left in this area following completion of the Phase I beachfill efforts for the Phase 2 portion until the shoal naturally replenishes. Therefore, this area is not the preferred sand source for Phase 2. This shoal would be considered for future use on an “as needed” basis since it

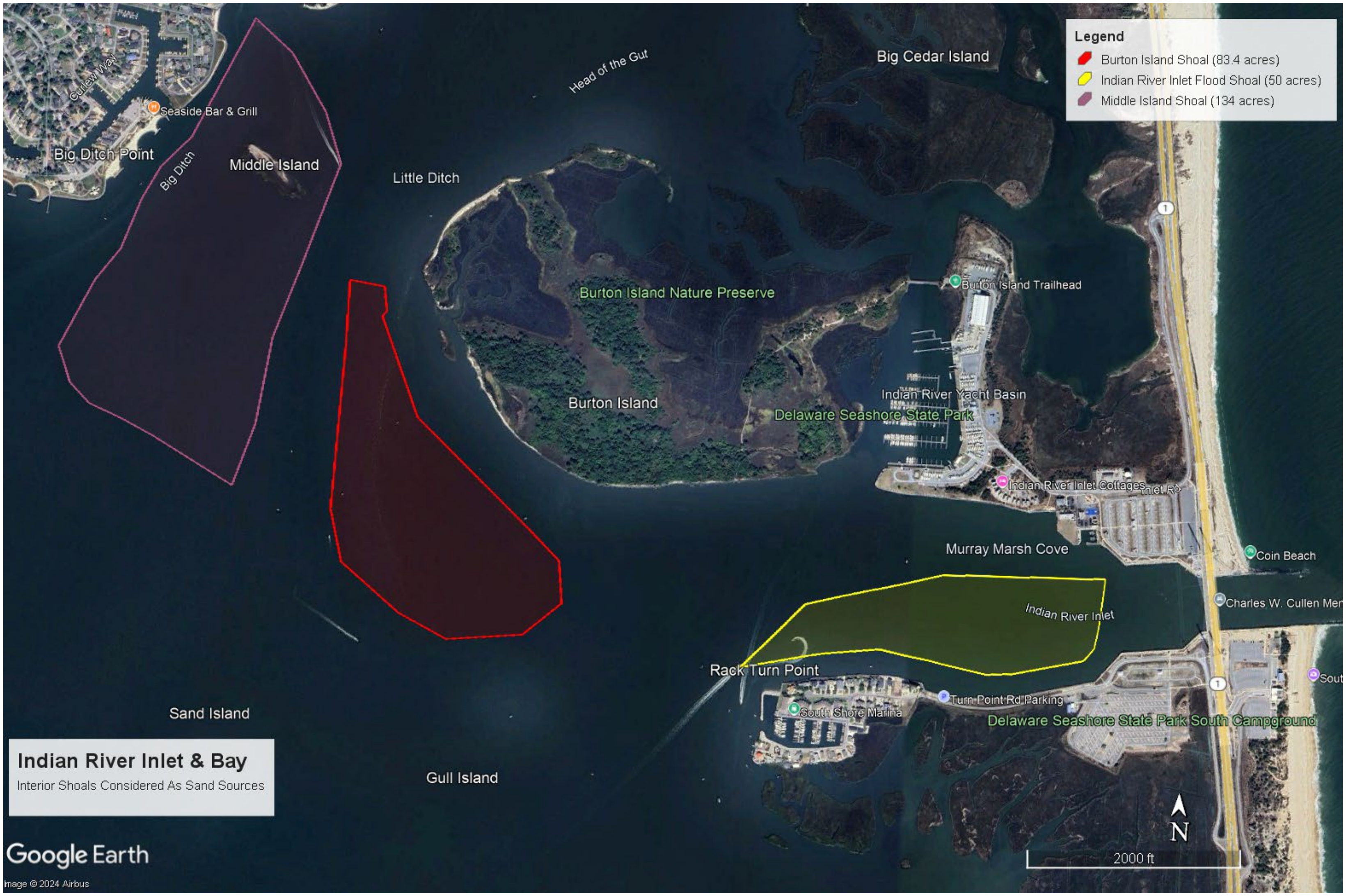


Figure 13. Indian River Inlet and Bay Interior Shoals Considered as Sand Sources

has been demonstrated to provide quality sand resources for the North Beach and can be feasibly used with smaller dredge equipment. Additionally, future shoaling patterns may require maintenance dredging of the Federal navigation channel. The material from this site could be used beneficially as beachfill material.

3.2.2 Burton Island Shoal

The Burton Island Shoal lies southwest of Burton Island adjacent to where the “Little Ditch” confluences with the Indian River Bay (Figure 3 and Figure 13). This site is intermediate in distance from the North Beach with an average distance of about 1.4 miles to the north jetty. This shoal area was initially considered by the Delaware DNREC to supplement the Indian River Inlet Flood Shoal for Phase 1 based on the sand quality (>90% sand). However, subsequent coordination with the Delaware State Historic Preservation Office has revealed concerns that this shoal area is likely part of a prehistoric landform that could potentially contain prehistoric archaeological resources. This is supported by the presence of nearby known sites on Burton Island. Use of this site would require a significant archaeological research effort to clear it for use, and therefore, it was subsequently withdrawn from consideration.

3.2.3 Middle Island Shoal

The Middle Island Shoal area is located at the eastern end of Long Neck at “Big Ditch Point” near the confluence of Massey Ditch, Big Ditch and Little Ditch with Indian River Bay (Figure 3 and Figure 13). This area is a shallow shoal area encompassing Middle Island and has depths ranging from 0 ft to -7 ft MLLW. A sand composite sample was collected, and it was found to contain 31% fine-grained sediments (silts and clays). This site is the furthest location from the North Beach with an average distance of about 2 miles to the north jetty. Like the Burton Island Shoal, this site was withdrawn from further consideration due to the potential for prehistoric archaeological sites and associated submerged landforms. Use of this site would require a significant archaeological research effort to clear it for use, and therefore, it was subsequently withdrawn from consideration. Additionally, further characterization of the sand would be required as the 31% fines would not be optimal beachfill quality sand.

3.2.4 Indian River Inlet Ebb Shoal

The Indian River Inlet Ebb Shoal is a shoal complex formed from outgoing ebb tides exiting through the inlet that deposit sand offshore of the inlet on the Atlantic Ocean side. This shoal is characterized as a high-energy area with heterogenous bathymetry characterized by waves, swift currents and shifting sands. Sand is of excellent quality with >90% sand content. A rectangular shaped 192-acre sized portion (IRI-Ebb A) of the ebb shoal complex is available for use for the Phase 2 restoration of the North Beach based on existing investigations for shipwrecks, benthic macroinvertebrates and sediment quality data (Figure 14).

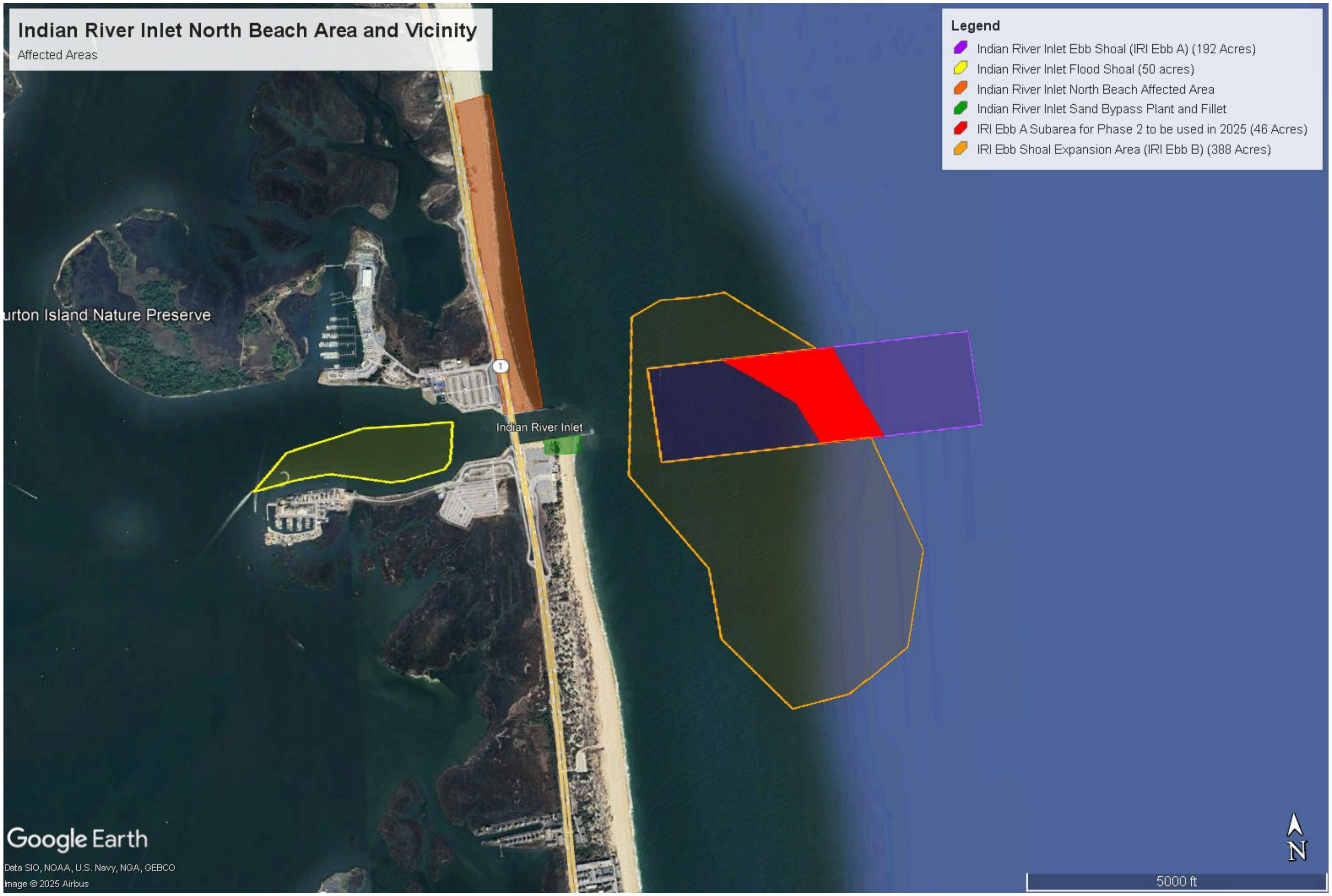


Figure 14. Indian River Inlet Flood and Ebb Shoal Complexes Identified Sand Sources

The existing bathymetry within the rectangular area (IRI-Ebb A) varies from -28 ft. to -41 ft. MLLW. A smaller area (approximately 46 acres) of IRI-Ebb A is needed to complete Phase 2. Because of the high ocean energy in this location, a large hydraulic cutter suction dredge or a trailing suction hopper dredge would be required.

In IRI-Ebb A, investigations for benthic resources reveal a benthic macroinvertebrate community that is adaptable to high energy environments and would be capable of recovering after dredging is completed. Sediment quality data have indicated that the material would meet sediment quality guidelines for ecological and human health, and water quality standards would not be exceeded. A magnetometer investigation did not reveal any potential for submerged cultural resources such as shipwrecks within this area.

Figure 14 also shows a larger area that was identified as an “expansion area” (IRI-Ebb B) for future use based on vibracore data showing extensive sand deposits to the north and south of the 192-acre rectangular area (IRI-Ebb A). Bathymetry is also highly variable with depths ranging from -13 ft. to -30 ft. MLLW. This expansion area would supplement the smaller 192-acre rectangular area (IRI-Ebb A) and provide additional sand resources to be applied as a complete regional sediment management of the Indian River Inlet area of the Delaware Atlantic Coast. This expansion area would require additional investigations for shipwrecks, benthic resources, and sediment quality prior as well as the appropriate environmental approvals prior to its use.

Based on the characteristics of the high-quality sand, high energy nature of the site, and no detectable shipwrecks, the Indian River Inlet Ebb Shoal (IRI-Ebb A) is the preferred sand source for completion of the Phase 2 restoration of the North Beach berm. It is also preferred as an alternate sand source for future needs. The Indian River Inlet Ebb Shoal expansion area (IRI-Ebb B) would supplement the IRI-Ebb A on an as needed basis but requires additional investigations prior to its use.

3.2.5 Beneficial Use of Dredged Material

Beneficial Use of Dredged Material (BUDM) is typically associated with the maintenance dredging of a navigation channel. In this case, the Federal navigation channel occurs within the Indian River Inlet and Bay (Figure 2). Sand that would normally be removed from a shoal and either be disposed of in an upland confined dredged material placement facility (DMPF) or could be used as beachfill either directly on the beach or in the nearshore as an offshore feeder berm. At present, there is no Federal maintenance dredging project in the vicinity of the North Beach requiring disposal or the beneficial use of dredged material. Therefore, BUDM (associated with maintenance dredging) is not considered to complete the Phase 2 efforts along the North Beach. However, there may be future opportunities for BUDM along the North Beach particularly where a split-hull hopper dredge is used to remove smaller spot shoals of sand. In this type of operation, the dredging quantities are typically less than 20,000 cubic yards. A split-hull hopper dredge would remove sand and transport it to a shallow subtidal area (~-8 ft. MLLW) in the nearshore zone of an eroding beach such as the North Beach. Once the hopper is filled with sand, it would exit through the inlet and the material would be placed along the shallow bottom along the North Beach. Figure 15 shows the sequence of a split-hull dredge operation. Once the sand is placed, natural waves and longshore currents would re-distribute the sand along the shoreline. This technique would not replace normal sand bypass operations or other methods described here but would be an effective supplement if this type of dredge is available and there is a need for maintenance dredging.

3.3 Truck Haul Method

The truck haul method would utilize dump trucks to deliver the sand obtained from a local commercial sand quarry. The quarry sand would be delivered along state, county and local roads to the project location on the beach. The specifications require that the delivered sand be de-watered and be composed of predominantly fine to medium sands with no more than 3% fines (silts and clays) and 3% gravels. The sand would also closely match existing sand colors. Delivery routes may be variable due to source location, but the trucks would be required to meet all Delaware Department of Transportation (DelDot) requirements. The trucks would enter the project location through the public parking lot located on the north side (If there is a dune breach, the trucks could enter directly from S.R.1). From there, the trucks would access the upper beach from under the bridge to dump the sand on the upper beach. Dozers and graders would distribute the dumped sand along the beach and across the beach (including the intertidal and nearshore areas) to attain the authorized project berm and dune template. Delivery and construction hours would be limited to weekdays during daylight hours during the construction period. It is estimated that based on the quantities required, there could be as much as 20 truckloads delivered per hour (approximately 240 truckloads per day).

Figure 15. The Dredge *Murden* with a Capacity of 518 Cubic Yards is In-Filling (left), Laden with Sand in Transport (right), and Split-Hull Bottom Dumping (bottom). Photos are from Wilmington District USACE (upper left) and Philadelphia District USACE (right and bottom).

The need to use the truck haul method is based on cost. Beachfill projects that generally require less than 100,000 cubic yards of sand may be more cost effective using a truck fill over dredging. Many variables would need to be considered for the costs; however, a significant variable is that a truck fill avoids the large mobilization costs that a dredge would require.

The truck haul method would avoid adverse effects on the aquatic ecosystem in the Indian River Inlet Ebb and Flood Shoals. However, effects to the terrestrial, intertidal and nearshore placement areas would be similar to dredging as fewer mobile organisms would be buried in the filled areas. Turbidity would be minimal since the material is coarse-grained, and will not require de-watering, as dredged sands would require. The trucks would be required to be Delaware Department of Transportation highway certified and would be operated in accordance with appropriate state and local laws. Adverse effects on the community would be temporary during the daylight hours based on additional traffic on local roads, wear and tear on local roads, noise, and air quality. Additionally, the duration of the overall construction may be considerably longer with a truck haul, which does not deliver sand as efficiently as the dredging method would. These effects are somewhat minimized in that the work would be limited to the tourist offseason (primarily fall and winter months) when there would be less activity and congestion on local roads. The truck haul method is not expected to have adverse effects on cultural resources.

The Delaware DNREC utilized the truck haul method in the summer and fall of 2024 for the North Beach to implement urgent repairs. This method proved to be inefficient for the large volume of sand required to repair the breaches in the berm and dune system that were experienced in August and September. DNREC had reported that oftentimes the truck fill would be washed out within a day after placement. This was due to the prevailing high wind and tides coupled with the depleted condition of the beach template encountered during this time. These conditions exacerbated the loss of the placed truck fill sand, which could not keep pace with the sand losses being experienced.

Based on the quantities of sand (approximately 300,000 cubic yards) required to complete Phase 2, the truck haul method is not recommended due to the inefficiencies associated with the large number of truckloads (approximately 15,000). However, this method is recommended for smaller quantities (100,000 cubic yards or less) if urgent beach and dune repairs are needed following a storm.

3.4 Alternative Selection

Table 1 presents a summary of the alternatives and decision rationales for selecting a plan that restores the beach and dune on the North Beach in 2025 and in the future on an as needed basis. The no action alternative is not preferred because it does not meet the purpose and need of restoring the berm and dune of the North Beach for Phase 2 and it does not provide a long-term sand source to supplement the operation of the sand bypass system on an as needed basis.

The truck haul alternative can be used for limited repairs that require small quantities (<100,000 cubic yards) of sand to make repairs of the beach on an as needed basis, but it does not provide an economical method of delivering a significant quantity of sand (> 100,000 cubic yards) to complete Phase 2 of the restoration of the North Beach. This alternative is preferred for future small repairs or supplements to the sand bypass system on an as needed basis.

Table 1. Decision Rationale for North Beach Berm and Dune Restoration

Alternative	PROS	CONS	Operational Considerations	Environmental Considerations	Selection Status
No Action	None	-Continued North Beach erosion -Increases of dune breaches & over-wash of S.R. 1 -Significant infrastructure losses -Loss of critical emergency evacuation route -Exposure of hazardous debris on beach -Reduced recreational opportunities	None	-Adverse effects on land use -Adverse effects on aesthetics of the beach -Continue loss of beach and dune habitats -No effects on aquatic habitats -No effects on air quality -No effects on cultural resources	This alternative would not fulfill the purpose and need for action and is not preferred or recommended.
Dredging and Beachfill Placement	-Meets purpose and need requirements of restoring the North Beach berm/dune -Protection of critical infrastructure -Fast, efficient method for delivering sand -Cost effective for large sand quantity -Beachfill can mimic a natural beach and dune system -Maintain compatible recreation	-High mobilization and demobilization costs	-Approx. 1,000 ft. beach closure segments -Equipment breakdowns and weather delays -Time of Year Restrictions for migratory fish	-Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish and wildlife habitat in borrow area and beach -Long-term restoration of habitat for beach nesting birds -Time of Year Restrictions for migratory fish -Air quality effects temporary -Short-term loss of recreation during construction -Potential adverse effects on cultural resources can be avoided -Long-term benefit to recreation -Environmentally acceptable	As part of Phase 2, dredging and beachfill placement are the preferred method for restoring the North Beach berm and dune. Once the sand bypass plant is operational, dredging and beachfill placement may be required on an as needed basis and is a preferred method when large quantities of sand are needed. Therefore, this alternative is preferred and recommended.

Alternative	PROS	CONS	Operational Considerations	Environmental Considerations	Selection Status
Truck Haul of Sand	-Can be rapidly deployed -Cost effective for small quantities	-Increased truck traffic on roads -Increased wear and tear on roads -Truck fill would not be as effective in a highly dynamic and erosive environ. -Construction duration would be longer than dredging.	-Requires land-based access -Requires commercial sand pit/quarry	-Water quality effects are avoided or very minimal as sand would be delivered in a de-watered state -Minor, temporary adverse effects on wildlife habitat on beach during placement -Long-term restoration of habitat for beach nesting birds -No Time of Year Restrictions for migratory fish -Air quality effects temporary -Short-term loss of recreation during construction -Truck transport would increase noise in communities of haul routes -Sand color may not match existing beach sand causing adverse effects on aesthetics -No adverse effects on cultural resources -Long-term benefit to recreation -Environmentally acceptable	This alternative is not a preferred method to complete Phase 2 due to the significant quantity of sand required to restore the North Beach berm and dune to full template. However, this method is viable for circumstances where smaller quantities are required to repair the beach/dune on an "as needed" basis.

The dredging sand sources alternative is the preferred method to complete Phase 2 and to provide periodic nourishment of the North Beach on an as needed basis to supplement the sand bypass system or to provide repairs after a significant storm event.

Table 2 provides a comparison of the five sand source alternatives to support the dredging and beachfill restoration alternative. The Burton Island and Middle Island Shoal areas, which were originally considered for the Phase 1 portion of the project, were later withdrawn due to concerns regarding the potential for encountering submerged prehistoric cultural resources. Phase 1A and 1B investigations would be required that would delay the implementation of Phase 2. Therefore, these potential sand sources are not being considered at this time for the Phase 2 and supplemental sand sources for future needs.

The beneficial use of dredged material alternative could provide sand to supplement the operation of the sand bypass facility but is dependent on the availability of future navigation maintenance projects with beachfill quality sand in limited quantities. Therefore, this alternative can be considered only when BUDM is lined up with a navigation maintenance project such as the Indian River Inlet and Indian River Federal navigation project as presented in Figure 2. This alternative is not considered for Phase 2 completion but can be implemented on an as needed basis.

The Indian River Inlet flood shoal has been used in past projects to restore the beach and dune along the North Beach. This area is currently being used for the Phase 1 effort and is expected to be depleted of sand at the completion of Phase 1; therefore, it is not being considered for the Phase 2 completion. This area has been demonstrated to regenerate a sand shoal periodically and can be considered for future use on an as needed basis.

The Indian River Inlet ebb shoal has not been used previously. A 192-acre portion (IRI-Ebb A) of the ebb shoal complex has been surveyed for shipwrecks, aquatic biota, and sediment quality (**Error! Reference source not found.**). Based on the bathymetry of this area, IRI-Ebb A is suitable for use to complete the Phase 2 of the North Beach restoration and is the preferred sand source alternative. A large portion of the ebb shoal to the south and a smaller portion to the north of IRI-Ebb A are designated as an expansion area (IRI-Ebb B). However, prior to the use of IRI-Ebb B, surveys would be required for shipwrecks, aquatic biota, and sediment quality. IRI-Ebb B is proposed for future use on an as needed basis once this information is evaluated for the appropriate environmental approvals.

Table 2. Decision Rationale for Dredging Sand Source Alternatives

Alternative	PROS	CONS	Operational Considerations	Environmental Considerations	Selection Status
Indian River Inlet Flood Shoal	-Contains beachfill quality sand -A sand source that replenishes itself periodically -Close proximity to North Beach -A small or large dredge plant could be used -Beneficial use of dredged material from navigation channel	-Sand quantity limited to approximately 550,000 cy at a time -Cannot be used (depleted) for Phase 2	-Permitted to dredge to -24 ft. NAVD	--Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish and wildlife habitat in borrow area due to disturbance (50 acres shallow estuarine soft bottom) -Time of Year Restrictions for migratory fish (March 1 to June 30) -Air quality effects temporary -Short-term loss of recreation during construction (boat and fishing access) -No effects on cultural resources	This alternative sand source would not fulfill the purpose and need for Phase 2 completion in 2025 because it would be depleted but is proposed as an alternate sand source for future use, as needed. **This site is preferred for future use.**
Burton Island Shoal	-Contains beachfill quality sand -A sand source that replenishes itself periodically	-Greater pumping distance required to beach locations -Only a small dredge plant could be used -Concerns with potential for encountering prehistoric cultural resources	-Dredge depth limited to -10 ft. NAVD	-Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish and wildlife habitat in borrow area (83.4 acres shallow estuarine soft bottom habitat) and nearby wetlands -Time of Year Restrictions for migratory fish -Air quality effects temporary --Short-term loss of recreation during construction (boat and fishing access) -Potential adverse effects on cultural resources	The potential for encountering prehistoric cultural resources is high based on known nearby land-based sites. Utilization of this site would require a significant investigation effort to fully characterize the area to avoid or mitigate potential effects. **This site is not recommended at this time for use.**

Alternative	PROS	CONS	Operational Considerations	Environmental Considerations	Selection Status
Middle Island Shoal	-Contains beachfill quality sand* -A sand source that replenishes itself periodically	-*A composited sample from several cores resulted in approximately 30% fine-grained silts-clays, which is not optimal for beachfill -Greater pumping distance required to beach locations -Only a small dredge plant could be used -Concerns with potential for encountering prehistoric cultural resources	-Dredge depth limited to -10 ft. NAVD -Avoid Middle Island and other intertidal areas	-Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish and wildlife habitat in borrow area (134 acres shallow estuarine soft bottom habitat) and nearby wetlands -Time of Year Restrictions for migratory fish -Air quality effects temporary -Short-term loss of recreation during construction (boat and fishing access) -Potential for adverse effects on cultural resources	The potential for encountering prehistoric cultural resources is high based on known nearby land-based sites. Utilization of this site would require a significant investigation effort to fully characterize the area to avoid or mitigate potential effects. Additional sediment characterization would be required to delineate optimal sand for beachfill. **This site is not recommended at this time for use.**
Indian River Inlet Ebb Shoal	-Contains beachfill quality sand -IRI Ebb A contains adequate quantity of sand for Phase 2 -A sand source that replenishes itself periodically -Site can be expanded (IRI-Ebb B) to accommodate greater sand needs in the future -Close proximity to North Beach	-"IRI-Ebb A" portion has limited sand quantity based on existing deep scour holes and would need expansion to "IRI-Ebb B" for future larger beachfill projects -"IRI-Ebb B" expansion requires additional environmental and cultural resources investigations and approvals -High energy marine environment would require larger ocean-going dredge plants	-Post dredge depths would be variable but would not exceed a cut deeper than 10 feet from existing bottom depth in depth ranging from -20 ft to -40 ft. -areas deeper than -40 feet would need to be avoided	-Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish habitat in borrow area due to disturbance (192 acres marine soft bottom) -High energy area with benthic fauna adapted (less sensitive) to disturbance -Open ocean dredging would not constrict migratory fish passage -Air quality effects temporary -Short-term loss of recreation during construction (boat and fishing access)	The "IRI Ebb A" portion of the shoal complex contains a sufficient quantity of beachfill quality sand to complete Phase 2 of the restoration of the North Beach. **This area is preferred for this purpose.** Future uses may require an expansion ("IRI-Ebb B") for larger quantities of sand needed for large beach restorations.

Alternative	PROS	CONS	Operational Considerations	Environmental Considerations	Selection Status
Beneficial Use of Dredged Material	-Benefits both navigation and CSRM for the North Beach -Supplemental sand source for IRI Sand bypass operation -Will not disturb bottom beyond navigation channel boundaries	-Sand quantities may be limited and may not be sufficient for any significant beach repairs -"Federal standard" may be exceeded -Availability of a split-hull type of dredge may be limited	-Sand placement in nearshore and not directly on beach	-Water quality effects are minor and temporary with sand -Minor, temporary adverse effects on fish habitat in navigation channel due to disturbance -Time of Year Restrictions for migratory fish at dredging location -Placement within a high energy area with benthic fauna adapted (less sensitive) to disturbance -Air quality effects temporary -Short-term loss of recreation during construction (boat and fishing access)	This alternative sand source would not fulfill the purpose and need for Phase 2 completion in 2025 because there are no navigation dredging projects currently proposed in the vicinity of the North Beach and sand quantities would be very limited; but is proposed as an alternate sand source for future use, as needed to supplement the IRI sand bypass operations. **This site is preferred for future use for supplemental sand.**

3.5 Selected Plan (Preferred Alternative)

The selected plan is a combination of the dredging and beachfill plan and sand source alternatives for the restoration of the North Beach shoreline. The Phase 2 portion of the beach berm restoration will complement the Phase I portion, which was completed by DNREC on March 1, 2025. For the completion of the Phase 2 berm restoration, approximately 500,000 cubic yards of sand beachfill would be placed along the shoreline of the North Beach extending north from the north Indian River Inlet jetty for approximately 5,000 feet. The construction template will result in a 200 to 250-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of 10H:1V. The berm will have a dune on top with an overall dune crest elevation of +16.0 ft NAVD and width of 25 ft with 3H:1V slopes (Figure 16 through Figure 19). The installation of dune fencing, crossovers and dune grass plantings would subsequently be conducted. An access and staging area will be needed for the contractor. Access will be gained from the existing Phase 1 construction at Inlet Road along the east side of the parking lot and staging will extend under the SR1 bridge approach through an opening in the dune along the North Beach. The Phase 2 sand would be obtained from the hydraulic dredging of the Indian River Inlet Ebb Shoal (IRI-Ebb A) (Figure 14). The dredging would affect approximately 46 acres of bottom in the IRI-Ebb A borrow area during the Phase 2 construction. Phase 2 is expected to occur over a two to three month period in duration.

The selected plan also includes the periodic nourishment of the North Beach on an as needed basis to supplement the Indian River Inlet sand bypass plant operations to maintain the Phase 2 berm and dune template. The required sand quantities may be variable but could be as high as 800,000 cubic yards. The sand sources include the Indian River Inlet Ebb Shoal (Ebb-A) and the existing Indian River Inlet Flood Shoal Sand Source (Figure 14). Additionally, the portion of the Indian River Inlet Ebb Shoal (Ebb-B) portion including the proposed southern lobe expansion area is considered for future use but requires supplemental environmental compliance approvals upon further investigations for sediment quality, benthic resources, and cultural resources (Figure 14).

4.0 AFFECTED ENVIRONMENT

4.1 Physical Environment

4.1.1 Floodplains

Through Executive Order (EO) 11988, Federal agencies are required to evaluate all proposed actions within the 1% annual exceedance probability (AEP)(100-year) floodplain. Actions include any Federal activity involving 1) acquiring, managing, and disposing of Federal land and facilities, 2) providing Federally undertaken, financed, or assisted construction and improvements, and 3) conducting Federal activities and programs affecting land use, including but not limited to water and related land resources planning, and licensing activities. In addition, the 0.2% AEP (500-year) floodplain should be evaluated for critical actions or facilities, such as storage of hazardous materials or construction of a hospital. The EO provides an eight-step process to evaluate activities in the floodplain that generally includes 1) determine if the proposed action is in the floodplain, 2) provide public review, 3) identify and evaluate practicable alternatives to locating in the 1% AEP floodplain, 4) identify the impacts of the proposed action, 5) minimize threats to life and property and to natural and beneficial

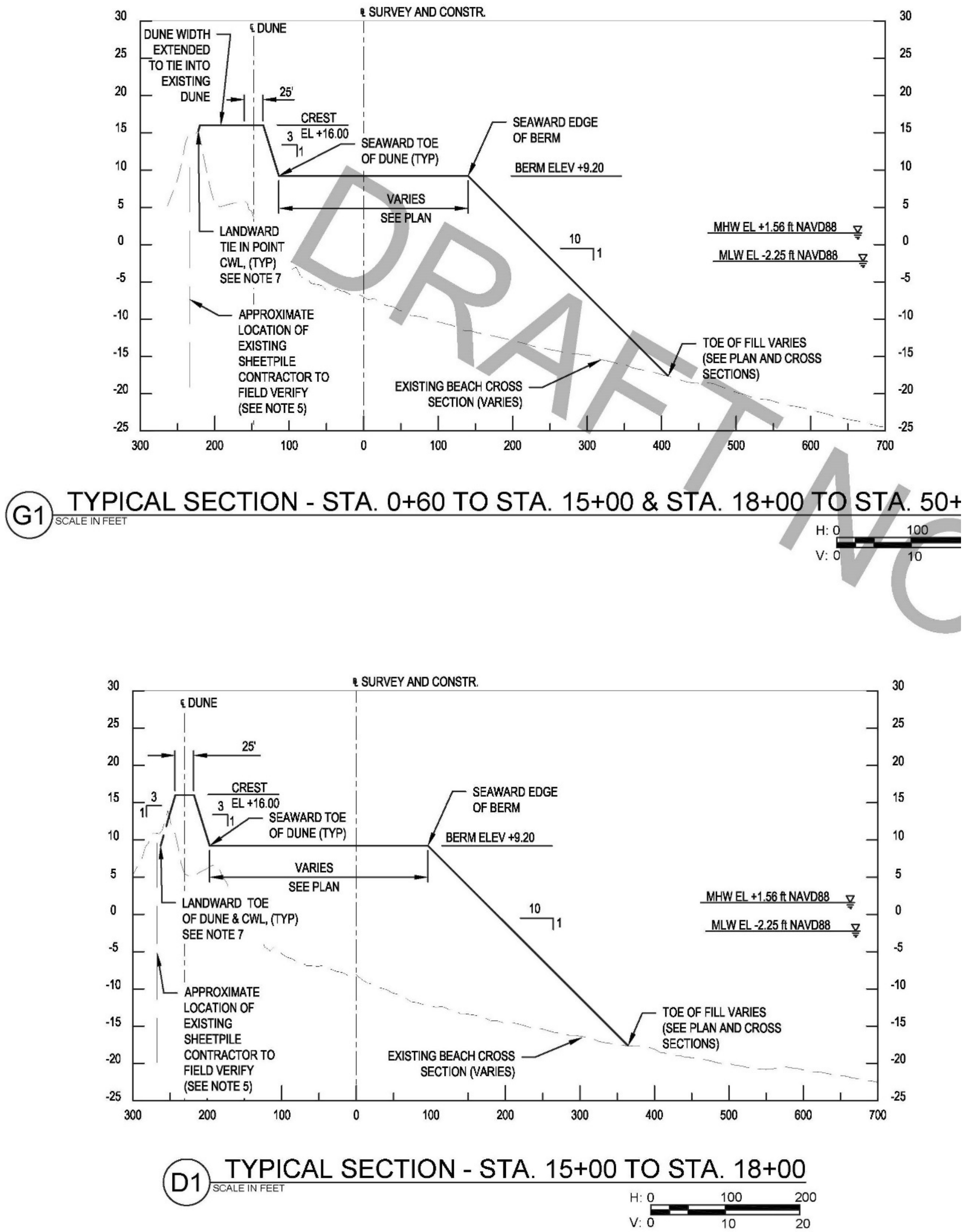


Figure 16. Indian River Inlet North Beach Typical Beachfill Construction Template Cross Sections

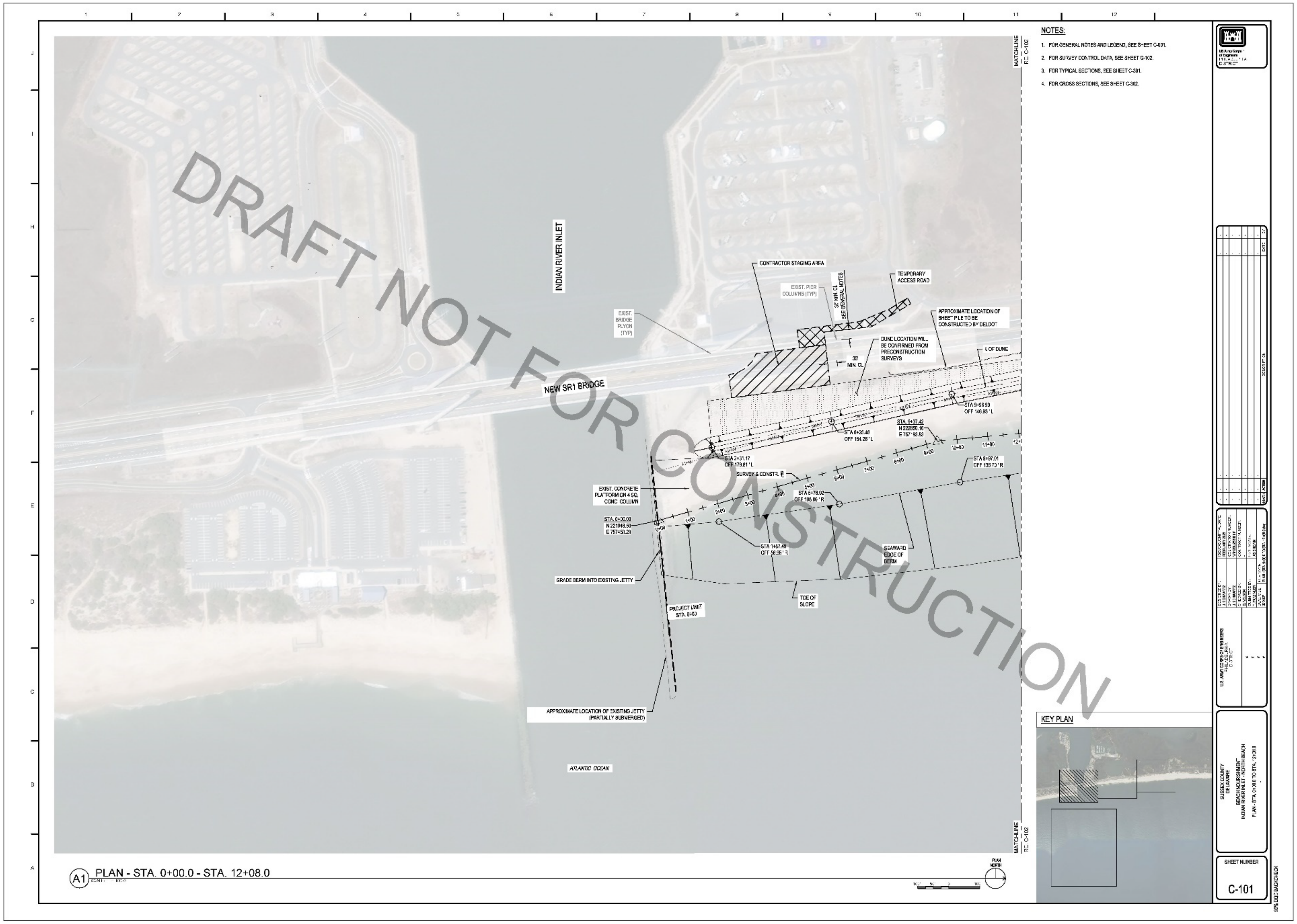


Figure 17. Indian River Inlet North Beach Beachfill Template and Staging and Access Areas

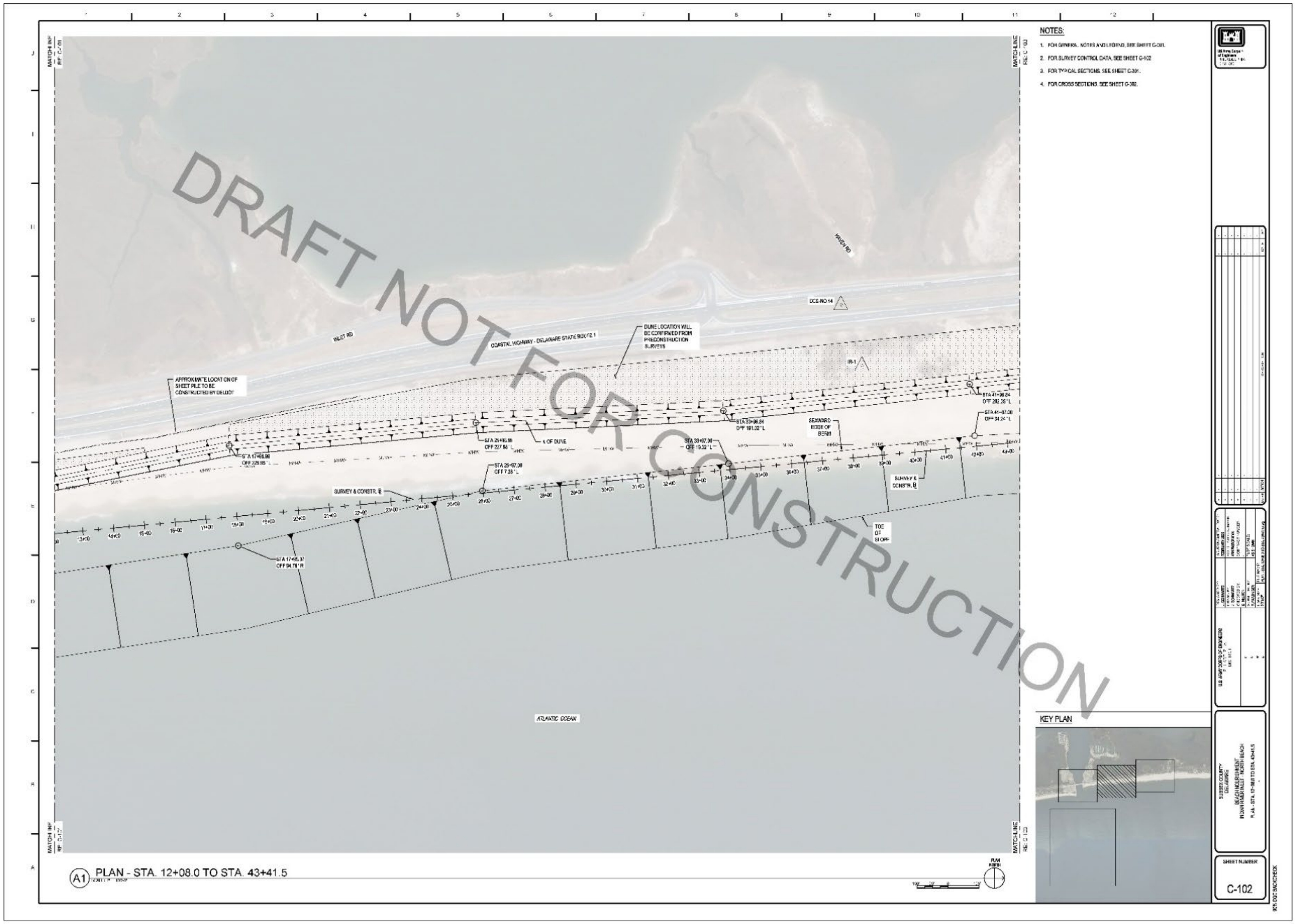


Figure 18. Indian River Inlet North Beach Beachfill Template

Figure 19. Indian River Inlet North Beach Beachfill Template and Northern Terminus of Project

floodplain values and restore and preserve natural and beneficial floodplain values, 6) reevaluate alternatives, 7) issue findings and a public explanation, and 8) implement the action. Proposed actions may have limited effects such that the eight-step process may vary or be reduced in application, which is the case for this project. Federal Emergency Management Agency (FEMA) defined Flood Zones are predominantly high-risk areas, which are within and adjacent to the affected areas. All affected areas and adjacent areas are within the 100-year floodplain and are in zones designated as either "VE" or "AE" (Figure 20). The affected area of the North Beach is predominantly a high-risk coastal area that carry an additional hazard associated with storm waves and is designated by Zone VE. Portions of the dunes and State Route 1 are within the zone designated as "AE", which are high risk areas within the 100-year floodplain adjacent to a body of water, but do not cover the same level of risk as those areas in a VE Zone. The properties adjacent to the interior inlet on both the north and south sides carry an AE designation.

4.1.2 Climate

4.1.2.1 Temperature and Precipitation

The Delaware Bay and Atlantic Ocean coastal region experiences a moderate climate associated with the low elevations of the Coastal Plain and the presence of the large water bodies. A moderate winter season results from winds which are heated by warmer water temperatures of the ocean and bays and blown inland. Summer temperatures are in turn moderated by locally generated winds or sea breezes. The warmest period of the year is normally during late July when maximum afternoon temperatures average 89°F. Temperatures exceeding 90°F occur an average of 31 days per year. The coldest period of the year is during late January and early February when early morning temperatures average 24°F. A minimum temperature of 32°F or lower occurs on an average of 90 days per year. Lewes, Delaware has an average annual temperature of 56°F. Lewes experiences an average temperature of 35°F in January and a July average of 75°F. The average winter frost penetration ranges from 12 to 24 inches. Daily temperature variations along the shore range from 10°F to 20°F throughout the year and are generally much less over the water (Maurer et al. 1974).

4.1.2.2 Wind

Prevailing winds at Breakwater Harbor are from the southwest, however, winds from other direction are nearly as frequent. The average annual wind speed along the Delaware Coast is 14.6 mph. In the 5-degree quadrangle nearest the Delaware Coast, the winds over the offshore areas are distributed with respect to direction as follows: onshore (northeast, east and southeast) 27 percent; (south) 11 percent; offshore (southwest, west and northwest) 44 percent; and (north) 15 percent. Weather data from Atlantic City, New Jersey, which is approximately 50 miles northeast of the study area, but considered valid as a regional source of data, determined that prevailing winds measured at Atlantic City are from the south and of moderate velocities between 14 to 28 mph. Winds from the northeast have the greatest average velocity of approximately 20 mph. The wind data also show that winds in excess of 28 miles per hour occur from the northeast more than twice as frequently as from any other direction. Winds of 50 mph or more may accompany severe thunderstorms, hurricanes, and general winter storms.

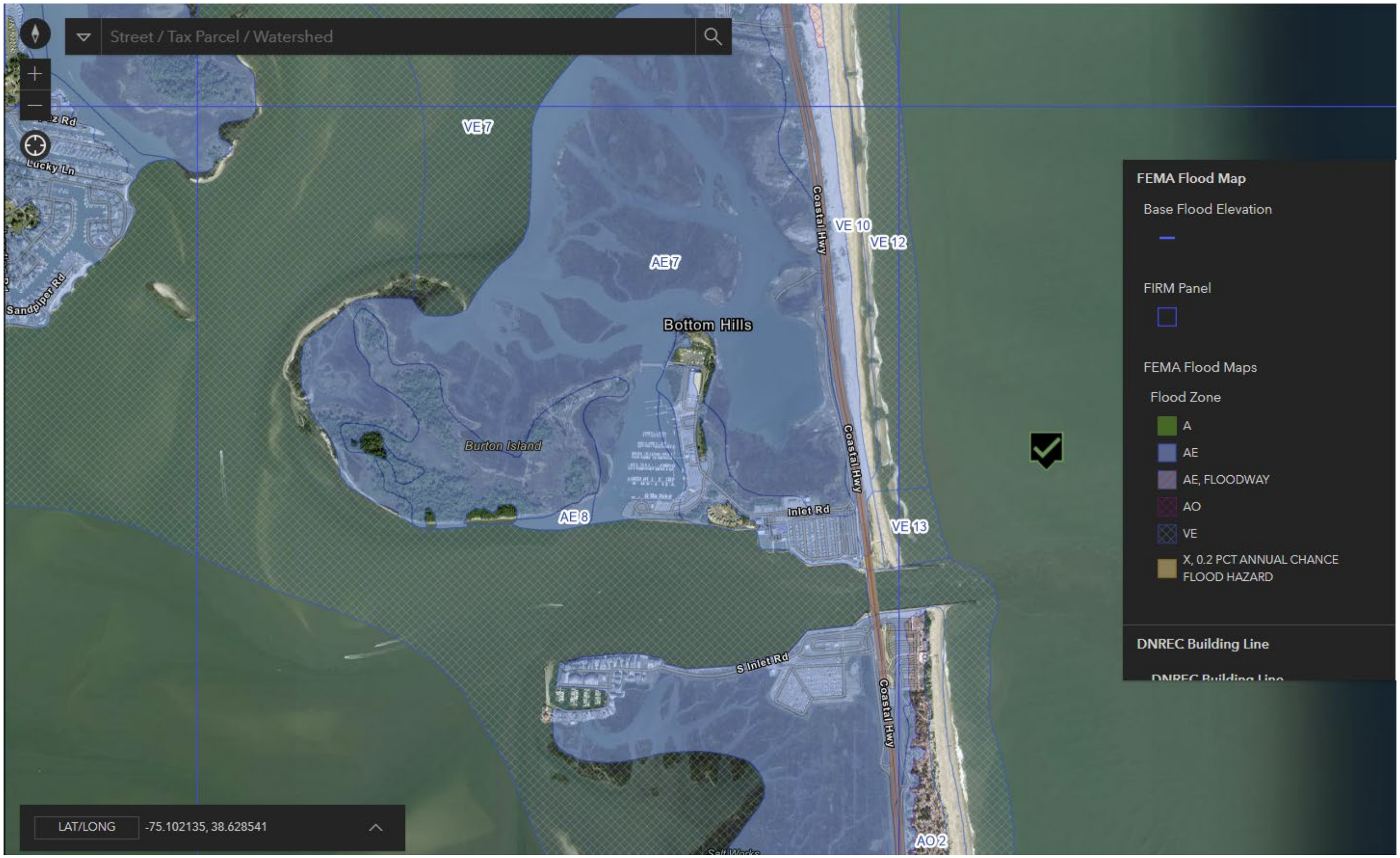


Figure 20. Indian River Inlet Area FEMA Flood Zones (Source: Delaware Flood Planning Tool accessed on 2/7/2025 at https://floodplanning.dnrec.delaware.gov/#pills-details)

4.1.2.3 Storms

There are two major types of damaging storms, which affect the Delaware coast. They are known as “tropical” (hurricanes and tropical storms) and “extra-tropical” (northeasters) storms. Hurricanes usually diminish in intensity by the time they reach the Delaware coast during their usual northward movement. No hurricane has made landfall along the Delaware coast since records have been kept (1871); however, several tropical storms and hurricanes have passed near the Delaware coastline in this period. Recently, the Delaware coast has experienced damages from the Nor’Ida Storm (“Nor’Ida” refers to a coastal nor’easter storm that combined with the elements of Hurricane Ida in November 2009.), Hurricane Irene (in 2011), and Hurricane Sandy (in 2012). Hurricane Sandy was designated an “extraordinary” storm that exhibited a unique combination of elevated ocean water levels (storm surge plus spring astronomical tides); continuous gale force or higher winds; and significant ocean wave heights at NDBC buoys that attained 33 feet). Hurricane Sandy inflicted significant damages to the beaches and communities along the Delaware coast. Of particular note, was the beach erosion and washover on the north side of Indian River Inlet and significant damages sustained to the State Route 1 approach to the Charles W. Cullen Bridge over the Indian River Inlet.

The most damaging storm to affect the project areas in the last 100 years was the northeaster of March 6-8, 1962. Two low-pressure areas joined in the ocean off the Mid-Atlantic coast and remained stationary for several days. The sustained high winds over the long fetch produced large waves and a storm surge which lasted over five consecutive high tides. The storm occurred during a period of unusually high astronomical tides. The combined storm tide elevation of 8.1 feet NGVD was the highest recorded in the period of record at Breakwater Harbor, Delaware (USACE, 1996).

4.1.2.4 Climate Effects and Sea Level Change

According to Delaware’s Climate Action Plan (DNREC, 2021), average temperatures in Delaware have increased approximately 2 °F since 1895, and temperatures are projected to continue increasing. It is projected that Delaware’s average temperatures could be 2.5 to 4.5°F warmer by midcentury and 3.5 to 8°F warmer by 2100. It is also projected that the number of days above 95°F in would increase from an average of 5 to more than 10 days per year over the next two decades. Climate change is also expected to result in increases in precipitation with projected increases by 10% by 2100. Also, the number of very wet days (periods with 2 inches or more of rainfall in 24 hours) is also projected to increase.

The direct and indirect effects of increased temperatures and precipitation are variable and far reaching. Increased temperatures and high heat events can impact human health, natural resources and agriculture by shifting growing seasons, and infrastructure due to heat damage and potential overloading of the electrical grid. Increased precipitation can result in more flooding events, which are further amplified by sea level rise. These effects affect human health due to potential increased mold production, exposure to more waterborne diseases and contamination, and risk of septic failure. Changes in precipitation, including more intense rainstorms, can also affect the quality of water resources, agricultural crop yields and natural habitat for wildlife. Additionally, infrastructure can be impacted due to increased pressure on water control structures and a greater potential for erosion of banks, pavements and structural supports (DNREC, 2021).

Sea level change (SLC) has been predicted to be greater in the Mid-Atlantic Region than points north and south on the eastern seaboard. Since 1900, Delaware has experienced a rise in sea levels of over 1 foot at the Lewes tide gauge since 1900. By midcentury, sea levels are projected to rise another 9 to 23 inches and, by 2100, up to an additional 5 feet (DNREC, 2021).

It is anticipated that the global mean sea level will continue to rise over the next 100 years. To include the direct and indirect physical effects of projected future SLC on design, construction, operation and maintenance of coastal projects, USACE follows guidance provided in the form of Engineering Regulation (ER) 1100-2-8161 (developed with assistance of coastal scientists from the NOAA National Ocean Service and the U.S. Geological Survey) and Engineering Technical Letter (ETL) 1100-2-1 Procedures to Evaluate Sea Level Change: Impacts, Responses and Adaptation. Three estimates are required by the guidance; a Baseline (or "Low") estimate, which is based on historic sea level rise and represents the minimum expected SLC, an intermediate estimate, and a high estimate representing the maximum expected SLC.

4.1.3 Coastal Hydraulics and Hydrodynamics

The Delaware coastal hydraulics are mainly influenced by tides, waves and currents. The tides are semidiurnal with two high tides and two low tides daily with an average tidal period of 24 hours and 50 minutes. The mean tide range at the Lewes tide station is 4.1 feet, and the great diurnal tide range is 4.6 feet.

Waves are measured in significant wave height, wave period, and wave direction. These factors are influenced by the energy of the wave source, wind direction and fetch, bathymetry, shoreline stabilization structures, and tidal currents from the Delaware Bay and Indian River Inlet. Two stations along the Delaware Atlantic Coast have produced wave statistics generated over a 20-year period. Waves approach the coast from NNE, NE, E, SE and S with the most frequent occurrence from the E and SE directions. The highest significant wave heights were recorded during the 1962 Northeaster at 25 feet and 16.5 feet. In 2012, two NOAA buoys recorded the significant wave heights during Hurricane Sandy at 24 feet (Buoy 4409 off of southern DE) and at 33 feet (Buoy 44065 off of northern NJ) (USACE, 2012).

Three types of currents influence the shoreline stability along the Delaware Atlantic Coast: tidal currents, cross shore currents and longshore currents. Tidal currents are generated by hydraulic head differences between water levels in the oceans and back-bay areas (through Indian River Inlet). Cross-shore currents move sand perpendicularly across the shore and offshore on a daily and seasonal basis. Longshore currents are caused by waves breaking at an angle relative to the shore alignment. The turbulence created in the breaker zone suspends the sediments which are transported in the longshore direction. The result is longshore transport of sand along Delaware's beaches. The net longshore transport of sand from Indian River Inlet and north (including Rehoboth Beach and Dewey Beach is in a northward direction. South of Indian River Inlet there is an area where there is no predominant longshore sand transport and is described as a “nodal” zone. This zone includes the Bethany Beach and South Bethany area. Further south (Fenwick Island), the net transport is in a southern direction. Figure 21 provides a map of the longshore transport zones along the Delaware Atlantic Coast (McKenna and Ramsey, 2002).

Indian River Inlet is located approximately half-way between Cape Henlopen at the entrance to Delaware Bay and the state line of Maryland. The inlet is the only opening to the Atlantic for the two - bay system of Indian River Bay and Rehoboth Bay. Both bays are shallow with an average depth of approximately seven feet. The inlet is stabilized by two rubble mound jetties and is spanned by a state highway bridge. These jetties were first constructed by USACE in 1939 for the purpose of 1) improving navigation through the inlet, 2) increasing bay salinity and reducing stagnation (to improve the fishing industry), and 3) increasing the tide range for mosquito control (Anders et. al 1990; Thompson and Dalrymple, 1976). Prior to the Federal jetty project, the inlet was ephemeral, typically breaking through the beach during periods of heavy rainfall and migrating alongshore until closed by littoral processes (Howell 1931).

The currents in Indian River Inlet are important in moving sediment and affecting navigation. The ocean tides generate strong tidal currents in the inlet which frequently exceed six feet/second (3.6 knots). During ebb tide, ocean waves approaching the inlet channel and interact with the strong tidal current. Upon encountering the current between the seaward ends of the jetties, the apparent wave speed decreases and consequently the waves steepen (USACE, 1984b).

The waves can continue to the west, but they may also steepen to the point of breaking. Waves can sometimes be seen propagating westward past the highway bridge, but their heights are greatly reduced after they have broken in the chop. The maximum current recorded in the inlet during a 1975 study was 7.85 feet per second. At the time of the maximum flood current reading, there was a head drop of 1.2 feet from the ocean to the South Shore Marina. The velocity across the inlet throat was found to be nearly constant except near flow constrictions. The vertical velocity profile was not measured, but the study concluded that there was probably little variation except very near the bottom. This was due to the highly turbulent, non-stratified nature of the flow (USACE 1984b).

Current measurements were also made at three locations across the inlet throat over one spring tidal cycle in June 1983. The primary purpose of these measurements was to determine the inlet tidal prism, but the velocities observed were generally in the same range as those recorded in the 1975 study. Maximum flood velocities in 1983 were more than five feet per second and maximum ebb velocities exceeded 6 feet per second (USACE 1984b). In 2004, a comprehensive acoustic doppler current profiler (ADCP) study was completed. This study measured currents throughout the water column along five transects across the inlet over a 26-hour period during spring tide conditions. Maximum velocities in the 2004 study exceeded 9 feet per second for depth-averaged currents and approached 11 feet per second for point measurements in the water column.

The swift ebb and flood currents through the inlet have resulted in erosion on both the interior north and south sides requiring the construction of stone revetments that have propagated westward since the jetties were first constructed. Additionally, as discussed in Anders et. al (1990), deep scour holes have subsequently developed within the inlet near the eastern end of the north jetty and near the abutments of the former Indian River Inlet Bridge. To the west of the scour holes, the inlet widens out where tidal velocities decrease. This area tends to accumulate sediments (particularly from flood tides) and form a shoal interior of the inlet, which is the “flood shoal”.

The ocean currents seaward of Indian River Inlet are influenced by the tidal flows of Delaware Bay, and in turn have a significant effect on sediment transport patterns at Indian River Inlet. The cumulative effect of the interaction of the ocean and inlet tidal currents facilitated by the south jetty is an interruption in the net northerly littoral transport along the ocean shoreline adjacent to Indian River Inlet. The littoral sediments tend to be diverted to the south ocean shoal (ebb shoal) under ebb conditions, and into Indian River Inlet under flood conditions. Thus, natural sand bypassing from south to north across Indian River Inlet does not occur, and the ocean beach north of the inlet experiences a relatively high erosion rate.

As reported in CB&I Coastal Planning & Engineering, Inc (2017), the IRI ebb shoal is classified as a shore detached and asymmetric geomorphic feature that extends approximately 1 mile offshore. It is a dynamic feature that undergoes current-induced scouring at the mouth of the inlet and the deposition of sediments for up to a mile offshore of the inlet. This feature is formed by the influence of the Delaware Bay ebb tide on the “jet” of the inlet that results in an asymmetrically shaped ebb shoal with sediment accreting on the south side of the shoal. Any new sand that is added to the ebb shoal is entrained into the ebb jet and discharged offshore to the seaward limits of the ebb shoal. This process allows for this shoal feature to be detached with no direct (bar) connections to the beach. Also, the redistribution of sediment primarily occurs from within the ebb shoal feature rather than entraining new sand from the adjacent beaches.

4.1.4 Geology

Three types of physiographic regions exist along the Delaware Atlantic Coast: spit complex, headland, and baymouth barrier (Kraft, 1971). Rehoboth Beach is part of a headland-spit complex, which terminates in the north at Cape Henlopen. Dewey Beach primarily consists of a continuous, wide, sandy coastal barrier complex beginning in and extending south of Dewey Beach to the Indian River Inlet area with Rehoboth Bay and Indian River Bay to the west. Bethany Beach is part of another significant headland south of Indian River Inlet. South Bethany and Fenwick Island form another coastal barrier complex with Little Assawoman Bay to the West (Figure 21). The project location is part of the baymouth barrier, lagoon and highland complex, which is characterized by rapid erosion, predominantly coastal washover erosion. The barrier erodes at the beach face and nearshore area and accretes in a landward direction. The beach face is rather steep, and the berm is comprised of horizontally laminated coarse to medium sand. Generalized vertical sequences of sediments found at Dewey Beach and south indicate dune washover sands overlying back barrier marsh sediments (clayey sand and peat), which contain tree stumps from an ancient pine forest.

Below this are tidal delta sands and gravels followed by lagoonal sand and silt, and in some cases a small underlying pocket of beach sand.

Wells in Delaware's coastal communities draw groundwater from the unconfined water-table aquifer (Columbia), the unconfined Columbia-Pocomoke aquifer, the confined Pocomoke aquifer and the confined Manokin aquifer. The Columbia aquifer is the shallowest (occurs from 0 to -19 feet in the IRI area) and resides in the Pleistocene formations of the Sinepuxent, Scotts Corners, Omar and Lynch Heights formations. It also extends into the Pliocene Epoch deposits that contain the Beaverdam formation where it interfaces with the Pokomoke Aquifer. The confined Pokomoke Aquifer is in the deeper Bethany Formation (-100 to -110 ft.), which was formed in the Miocene. Below the Bethany Formation is the Cat Formation Hill (-200 to -249 ft.) that contains the confined Manokin aquifer (also Miocene).

USACE (1995a) and Field et.al. (1979) identify four major physiographic units on the shelf offshore from the Delmarva Peninsula, which are classified: (a) shoreface, (b) linear shoal field, (c) shoal retreat massif (geologic unit containing one or more summits surrounded by depressions), and (d) shelf transverse valleys. The linear shoals have been interpreted as Holocene features that formed in the submarine environment and were consequently stranded as sea level rose and the shore retreated. They consist primarily of sands and gravels and are the most likely to be suitable for beachfill material. These units are presented in Figure 22.

The Indian River Inlet Ebb Shoal complex is described in the "Geologic Map of the Bethany Beach and Assawoman Bay Quadrangles" as "pale-yellow to light-gray, cross-bedded coarse to fine sand with laminae of heavy minerals and granules to pebbles. Shells and shell fragments are a rare constituent of the sands. Ebb tidal delta deposits are found offshore of Indian River Inlet. The sediments are partly disturbed by dredging and influenced by the location of the jetties offshore of the inlet. Ebb tidal delta deposits range from 5 to over 25 ft in thickness. Holocene" (Ramsey and Tomlinson, 2012).

The Flood Shoal complex is described in Ramsey and Tomlinson (2012) as "light gray to gray, clean to silty, very fine to coarse sand. Sedimentary structures range from well-developed crossbedding to structureless where the deposit is completely bioturbated. Flood tidal delta deposits are found adjacent to Indian River Inlet in Indian River Bay and have been greatly modified by dredging. The deposits are up to 25 to 30 ft thick adjacent to the barrier and thin to the west in Indian River Bay (Chrastowski, 1986). Flood tidal delta deposits grade laterally into barrier washover deposits along the coast and into lagoon deposits in Indian River Bay. Holocene".

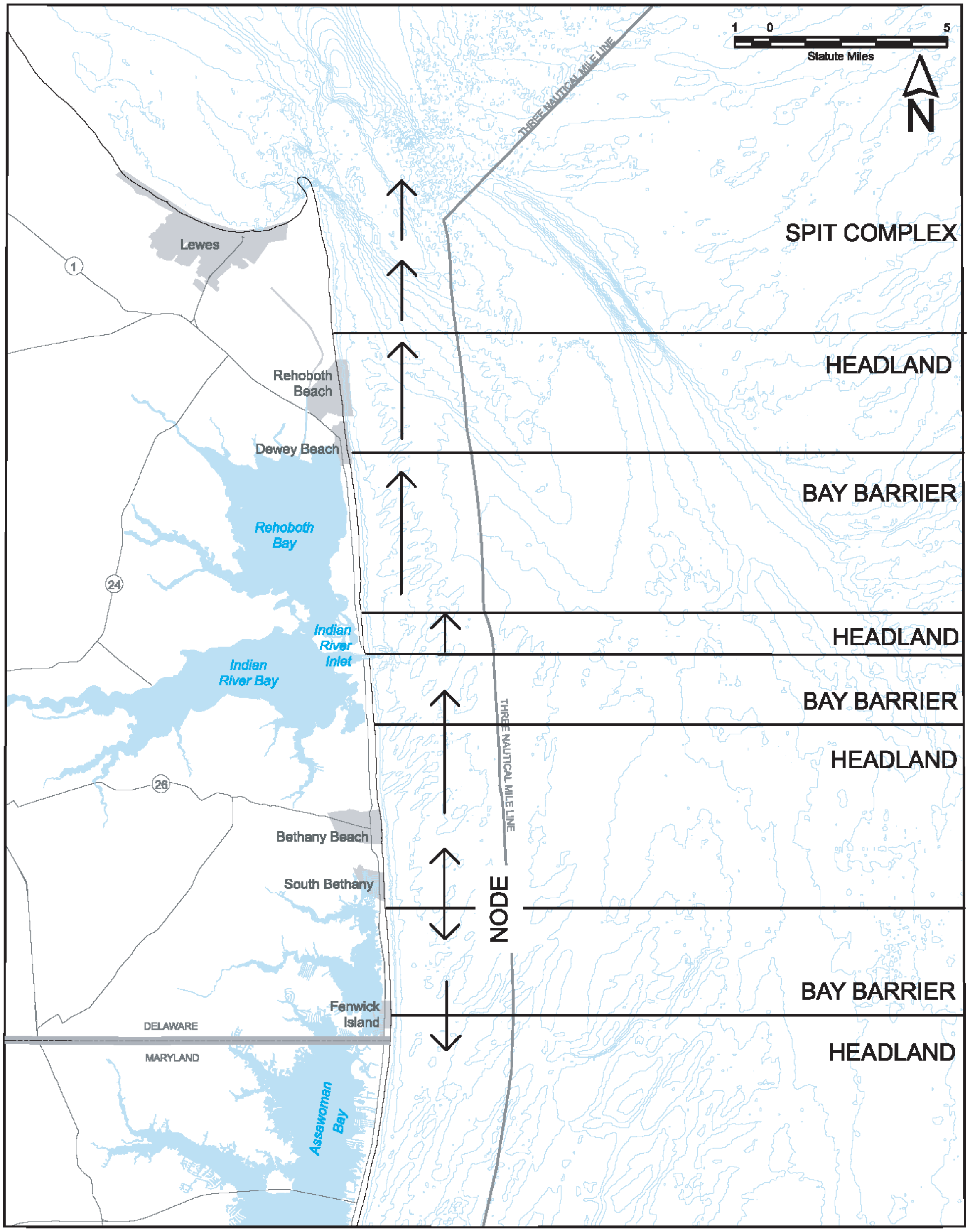


Figure 21. General Longshore Transport Directions and Coastal Physiographic Regions along the Delaware Atlantic Coast. (from McKenna and Ramsey, 2002).

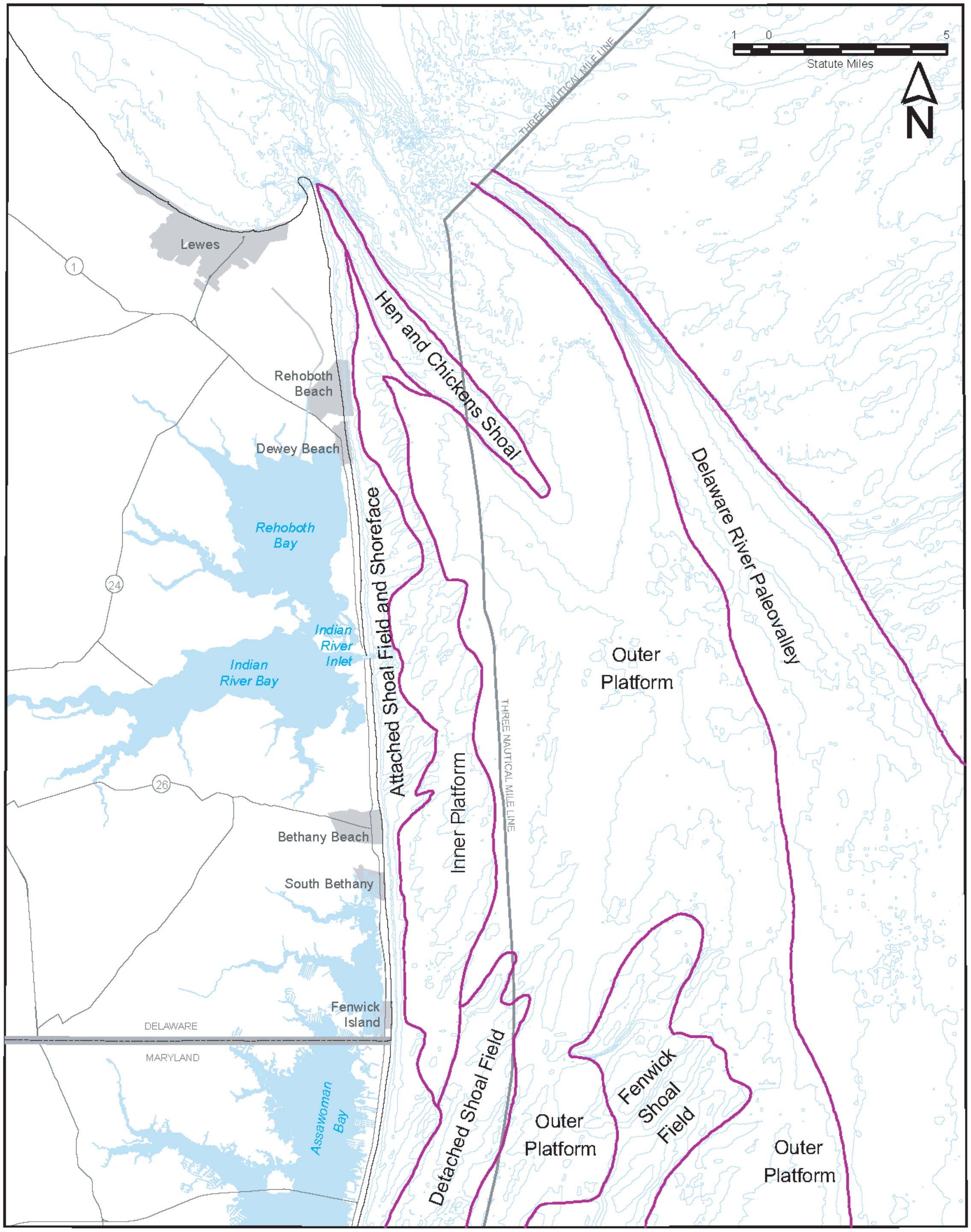


Figure 22. Delaware Atlantic Coast Offshore Geomorphic Regions (from Mckenna and Ramsey, 2002).

4.1.5 Topography and Bathymetry

Beach topography varies seasonally. Winter storms with high energy and high waves tend to deflate the beach profile as sands are eroded from the berm and foreshore resulting in a noticeably lower and narrower beach profile. The sand is typically deposited in the nearshore as sand bars. The spring and summer months tend to build beach elevations and widths as sediments accrete from low waves depositing sand from the nearshore bars that deposit and weld to the beach. The beach berm and foreshores are typically backed by a higher dune. At the North Shore, portions of the dune have been heavily impacted by erosion/breaching and have been flattened. This condition may be changed prior to the Phase 2 implementation where a continuous dune would be constructed with a crest elevation of +16 ft. NAVD (Mean High Water occurs at +1.3 ft. NAVD).

The IRI-Ebb Shoal A has variable bathymetry. The westernmost portion of this area near the inlet jetties has deep scour holes as deep as -60 ft MLLW. The bottom rises up to a depth of -29 feet in the center and then drops off on the eastern end to -43 ft. The IRI-Ebb Shoal B is a lobe of the shoal that extends towards the southern shore. This area is considerably shallower with minimum depths at -13 ft. and maximum depths at -30 ft.

4.1.6 Soils

A review of the web soil survey mapping provided on the Natural Resource Conservation Service (NRCS) website (accessed at https://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx on 1/8/2025) revealed that the affected beach and dune areas along the North Beach are mapped as “Acquango 5-10 percent slopes” (AcC) and “Beaches – very frequently flooded” (Be). These soils are classified as mixed, mesic Typic Udipsamments formed from sandy eolian deposits and/or fluviomarine sediments. These soils are occasionally to frequently flooded beach sands consisting of non-coherent loose sand that has been worked and reworked by waves, tides, and wind, and is still subject to such action (USDA, 1974). Both soils have been modified with the addition of beachfill sand obtained from dredging from the IRI flood shoal, truck haul sand and from the South Beach fillet from the sand bypass facility. Other mapped soil units occurring along the western side of S.R. 1 include the salt marsh soils: “Saltpond mucky sand, very frequently flooded” (Sp) and “Purnell peat, very frequently flooded” (Pu). The “Brockatonorton-Urban land complex, 0 to 2 percent slopes” (BuA) is composed of sand with deeper peat deposits typically occurs along back-barrier beaches and is mapped along the western side of the S.R. 1 bridge approach adjacent to the inlet.

4.1.6.1 Beach Sand Texture

Ramsey (1999) conducted a review of mean beach textures along the Delaware Atlantic Coast (from Cape Henlopen south to the DE/MD state line in Fenwick Island) measured over a 55-year (1929-1984) period prior to any large beach nourishment projects along the coast. The review was broken up into 1-km increments, major geomorphic features, sand transport zones, and inlet locations. The yearly averages did not identify any significant trends through time. Despite some variability among beaches, locations on the beach, seasons and sample years, the sands along the coastal beaches generally fell within the coarse to medium sand size range and were well to moderately well sorted. The overall average sand size for the entire coast was 1.26 phi (± 0.27 phi) (0.4 mm) with an average sorting of 0.46 phi (well sorted). Table 3 provides grain size averages and sorting data (in phi units) from data spanning from 1929 to 1984 along the Delaware Atlantic Coast from Ramsey (1999).

Table 3. Historic Average Grain Sizes (in PHI units) Distribution of Beach Sands along the Delaware Atlantic Coast from 1929 to 1984 (adapted from Ramsey, 1999)

<table>
<tr><th>KM SEGMENT (North to South)</th><th>AVG. GRAIN SIZE (PHI)</th><th>INLET SEGMENT</th><th>LONGSHORE TRANSPORT NODE</th><th>GEOMORPHIC REGION</th><th>FEDERAL PROJECT LOCATION</th></tr>
<tr><td>1</td><td>1.72 (med. sand)</td><td rowspan="22">North of Inlet
1.21 (med. sand)
-0.21</td><td rowspan="30">North Transport Node
1.22 (med. sand)
-0.23</td><td rowspan="7">Cape Henlopen Spit Complex
1.31 (med. sand)
-0.25</td><td rowspan="9"></td></tr>
<tr><td>2</td><td>1.5 (med. sand)</td></tr>
<tr><td>3</td><td>1.38 (med. sand)</td></tr>
<tr><td>4</td><td>1.19 (med. sand)</td></tr>
<tr><td>5</td><td>0.95 (crse. sand)</td></tr>
<tr><td>6</td><td></td></tr>
<tr><td>7</td><td>1.14 (med. sand)</td></tr>
<tr><td>8</td><td>1.17 (med. sand)</td><td rowspan="6">Headland
1.16 (med. sand)
-0.06</td></tr>
<tr><td>9</td><td></td></tr>
<tr><td>10</td><td>1.23 (med. sand)</td><td rowspan="4">Rehoboth Beach
Dewey Beach</td></tr>
<tr><td>11</td><td>1.06 (med. sand)</td></tr>
<tr><td>12</td><td>1.18 (med. sand)</td></tr>
<tr><td>13</td><td></td></tr>
<tr><td>14</td><td>1.07 (med. sand)</td><td rowspan="5">Bay Barrier
1.11(med. sand)
-0.24</td><td rowspan="7"></td></tr>
<tr><td>15</td><td>0.85 (crse. sand)</td></tr>
<tr><td>16</td><td>1 (med.-crse. sand)</td></tr>
<tr><td>17</td><td></td></tr>
<tr><td>18</td><td>1.5 (med. sand)</td></tr>
<tr><td>19</td><td>1.26 (med. sand)</td><td rowspan="4">Headland
1.24 (med. sand)
-0.11</td></tr>
<tr><td>20</td><td></td></tr>
<tr><td>21</td><td>1.1 (med. sand)</td><td rowspan="3">Indian River Inlet Sand Bypass</td></tr>
<tr><td>22</td><td>1.35 (med. sand)</td></tr>
<tr><td>23</td><td>0.81(crse. sand)</td><td rowspan="18">South of Inlet
1.3 (med. sand)
-0.32</td><td rowspan="2">Bay Barrier
1.09 (med. sand)
(0.28)</td></tr>
<tr><td>24</td><td>1.37 (med. sand)</td><td rowspan="5"></td></tr>
<tr><td>25</td><td>1.25 (med. sand)</td><td rowspan="10">Headland
1.27 (med. sand)
-0.32</td></tr>
<tr><td>26</td><td>0.88 (crse. sand)</td></tr>
<tr><td>27</td><td>1.36 (med. sand)</td></tr>
<tr><td>28</td><td>1.28 (med. sand)</td></tr>
<tr><td>29</td><td>1.7 (med. sand)</td><td rowspan="5">Bethany Beach
South Bethany</td></tr>
<tr><td>30</td><td>1.3 (med. sand)</td></tr>
<tr><td>31</td><td>1.39 (med. sand)</td><td rowspan="10">South Transport Node
1.37 (med. sand)
-0.35</td></tr>
<tr><td>32</td><td>1.08 (med. sand)</td></tr>
<tr><td>33</td><td>1.81 (med. sand)</td></tr>
<tr><td>34</td><td>0.71 (crse. sand)</td><td rowspan="4"></td></tr>
<tr><td>35</td><td>1.49 (med. sand)</td><td rowspan="5">Bay Barrier
1.38 (med. sand)
-0.17</td></tr>
<tr><td>36</td><td></td></tr>
<tr><td>37</td><td>1.14 (med. sand)</td></tr>
<tr><td>38</td><td>1.52 (med. sand)</td><td rowspan="3">Fenwick Island</td></tr>
<tr><td>39</td><td></td></tr>
<tr><td>40</td><td>1.82 (med. sand)</td><td>Headland
1.82 (med. sand)
(0.40)</td></tr>
<tr><td colspan="2">Average: 1.26 (med. sand)
Maximum: 1.82 (med. sand)
Std. Dev.:0.27
Minimum: 0.71 (crse. sand)
33 sample Sta.</td><td colspan="4"></td></tr>
</table>

4.1.7 Indian River Inlet Ebb Shoal Sediments

The geotechnical analysis of the proposed Ebb Shoal Borrow Area includes the evaluation of three vibracores (KHV-105, KHV-105EA, and KHV-230) collected within the borrow area. The predominant materials consist of light gray to gray, and tan to brown fine sand, with trace to some medium sand, and trace amounts of silt and clay, extending to a depth of approximately 15.6 feet below the seafloor. Vibracore KHV-230 encountered a seam of dark gray, clayey silt from 15.6 to 16.2 feet, followed by gray, poorly graded sand with silt from 16.2 feet to the termination depth of 19.62 feet. Vibracore KHV-105 encountered a seam of silty clay from 14.7 feet to its termination depth at 18.8 feet.

A maximum dredging depth of 10 feet was determined, and only the material at this depth was considered in the analysis. A statistical analysis of the Particle Size Distribution curves for the vibracores was conducted, and the results show that, on average, the sand content exceeds 98.5%. The fines content (clay and silt) is approximately 1.4%, while the gravel content is 0.07%. The average median diameter (D_{50}) is 0.235 mm, classifying the material as fine sand. A summary of the vibracores is provided in Table 4 below.

Table 4- Ebb Shoal Vibracore Summary

Vibracore ID	Depth (ft.)	% gravel	% sand	% fines	D_{50} (mm)	USCS
KHV-105	0-5'	0	99.4	0.6	0.25	SP
KHV-105	5-7.4'	0	98.4	1.6	0.25	SP
KHV-105	6.9-10'	0	98.4	1.6	0.21	SP
KHV-105EA	0-8.8'	0.4	98.2	1.4	0.25	SP
KHV-230	0-5'	0	99	1	0.261	SP
KHV-230	5-10'	0	98	2	0.191	SP
	Average	0.067	98.567	1.367	0.235	

4.1.8 Hazardous, Toxic, and Radioactive Wastes (HTRW)

A review of the Delaware Environmental Navigator (DEN) (https://den.dnrec.delaware.gov/) was conducted on January 8, 2025, to identify any areas of concern that may contain HTRW. This review identified three SIRS (Site Investigation and Restoration Site) sites, leaking underground storage tanks (LUSTS), underground storage tanks (USTS), above ground storage tanks (ASTS) and an NPDES (National Pollution Discharge Elimination System) discharge.

Three sites are listed in the Delaware's SIRS database that are identified in the general vicinity of the project. One site is the discovery of a chlorine gas cylinder at Delaware Seashore State Park near Indian River Inlet (DE -026) in 1992. In a memo from DNREC dated April 21, 2010, the disposal action was completed in 1992, and the status is now inactive.

A second site, The Indian River Life Saving Station (IRLSS) property (DE-1349), is about 4,000 feet to the north of the beachfill project boundary. The IRLSS is a historical property that was once used by the United States Lifesaving Service, which was later changed to the U.S. Coast Guard. This property was later turned over to the DNREC Division of Soil and Water Conservation for offices and storage of heavy equipment, which vacated the site in the mid-1990's. The site now houses a museum and gift shop. Due to the presence of leaking underground storage tanks (LUSTS), this site was part of a preliminary assessment and site investigation. Remedial activities were conducted in 1998 where three USTs were removed along with 38 tons of petroleum-impacted soils from the site. This action included the backfilling of clean soil. Based on this, the Delaware UST Management Branch issued a "No Further Action Required" letter with a cautionary note requiring that a Contaminated Soil Management Plan be developed in the event of future intrusive activities at the site. Recent sample results show slightly elevated levels of arsenic, iron and some petroleum hydrocarbons within the location of the former USTs, but no widespread areas of contamination. Based on this information, the EPA does not anticipate any further action under the Federal Superfund Program unless new information or conditions change that warrant further Superfund consideration (letter from U.S. EPA Region III to DNREC dated 2/20/2008).

A third site is the North Artillery Range, which is part of the Formerly Used Defense Sites (FUDS) program (C03DE006402), is about 6,000 feet to the north of the beachfill project boundary. This site is approximately 364 acres in size and was used as an automatic weapons firing point for anti-aircraft target practice by the U.S. Army. This site is now part of Delaware Seashore State Park. A Site Inspection Report (USACE, 2010) investigated the potential for munitions and explosives of concern (MEC) and munitions constituents (MC) at the site. The types of munitions identified in this report that were likely used at this range include small arms, 40 mm HE (high explosive) HEI (high explosive incendiary), Mark II and 3.25 –inch target rockets, MK1. After a thorough inspection of the property, which included sampling the soils and sediments for explosives and explosive residues and metals, this investigation concluded that the land portion of this site has no reports of MEC or MD (munitions debris) that are known to exist; and surface soil, subsurface soil and sediment analyses yielded no explosive MC detections. This report further concluded that no Chemicals of Potential Concern (COPC) or Chemicals of Potential Ecological Concern (COPEC) were identified in any of the media at this site.

Two LUSTS were identified in the vicinity by the DEN. One of the LUSTS sites is at the Indian River Life Saving Station (discussed above) where three tanks were removed in 1998. The other LUST was identified at the U.S. Coast Guard Station (N9110231) in Indian River Inlet where an underground storage tank was removed in 1990. A letter from DNREC Division of Air and Waste Management (dated 10/10/91) concluded that residual "low levels of contamination near the tank location pose no threat to human health or the environment, and no further action is required at the present time".

Several existing underground storage tanks (USTs) in the general project vicinity were identified by the DEN at the Coast Guard Station, Indian River Life Saving Station, Old Inlet Bait and Tackle, South Shore Marina, and the DNREC sand bypass facility. Above ground storage tanks (ASTs) were identified at the Indian River Sand Bypass Facility, Indian River Inlet Delaware Seashore State Park, U.S. Coast Guard Station, the Indian River Inlet Bridge Area, and the Indian River Life Saving Station. No further information was available on the DEN for these AST or UST locations.

One historical NPDES wastewater discharge was located in the inlet area and was operated by the Delaware Seashore State Park. This discharge was discontinued in 2000 and is now treated through the Sussex County South Coastal Wastewater Treatment Facility.

Several potential environmental concerns associated with offshore areas were identified relating to HTRW, which may involve unknown hazardous waste sites, sunken ships (possibly with weapons), weaponry from WWII shooting ranges, and rubble piles (used to create artificial reefs). No known hazardous waste sites or major spills were identified within the State and Federal databases within 1 mile of the Delaware Coastline. However, the U.S. Coast Guard National Response Center reported several occurrences of unknown sheens in Delaware Coastal waters or tar-like substances washed up on Delaware beaches where the origin or substance is unknown (National Response Center, 2001). There are no known radioactive sites within three miles of the coast. One experimental stabilized coal waste fish reef lies approximately 1.5 miles southeast of Indian River Inlet. This reef contains 250 tons of stabilized coal waste blocks along with 90 tons of concrete control blocks that were placed within a 75-foot long by 60-foot-wide area (Eklund, 1988).

No known ocean dumpsites were identified within the immediate vicinity of the North Beach or sand borrow areas considered. However, a historic sewage sludge dump area existed approximately 16 miles off of the northern Delaware Coast. This site was used mainly by the City of Philadelphia for the disposal of municipal sewage sludge from 1961 to 1973. Dumping at this site was discontinued because it was determined to be a potential threat to existing commercial surfclam beds and shellfish beds located south and west of the site (Muir, 1983 and Buelow et al. 1968).

4.1.8.1 Munitions and Explosives of Concern (MEC)

Two former artillery-firing ranges have historically occupied tracts of land along the Delaware Atlantic Coast). One range occupied a 275-acre portion of beach area north of Indian River Inlet in the present Delaware Seashore State Park and was known as the North Firing Range. The second range occupied a 108-acre tract of land south of South Bethany in present day Fenwick Island State Park and was known as the South Firing Range. These ranges were associated with the former military installation of Fort Miles, which is now Cape Henlopen State Park. These areas have been the subjects of investigations conducted under the Defense Environmental Restoration Program for Formerly Used Defense Sites (DERP-FUDS). Both ranges were utilized as artillery ranges by the Delaware National Guard from 1950 – 1959. In 1959, control of the Delaware National Guard was transferred from the Department of the Army to the State of Delaware. There were no indications of usage of the North Range after 1959. However, the South Range received continued use as an artillery range by the Delaware National Guard until 1970 and then as a small arms range until at least 1974. The South Firing Range was previously used to conduct surface-to-air firing at radio-controlled aerial targets by self-propelled 40-mm air defense artillery weapons. Also, the area was used for surface-to-surface firing with 40-mm artillery and for practice tests of target detection of high-performance aircraft.

The North Artillery Range, which is part of the Formerly Used Defense Sites (FUDS) program (C03DE006402), is about 6,000 feet to the north of the beachfill project boundary for IRI North Shore. This site is approximately 364 acres in size and was used as an automatic weapon firing point for anti-aircraft target practice by the U.S. Army. This site is now part of Delaware Seashore State Park. A Site Inspection Report (USACE, 2010) investigated the potential for munitions and explosives of concern (MEC) and munitions constituents (MC) at the site. The types of munitions identified in this report that were likely used at this range include small arms, 40 mm HE (high explosive) HEI (high explosive incendiary), Mark II and 3.25 –inch target rockets, MK1. After a thorough inspection of the property, which included sampling the soils and sediments for explosives and explosive residues and metals, this investigation concluded that the land portion of this site has no reports of MEC or MD (munitions debris) that are known to exist; and surface soil, subsurface soil and sediment analyses yielded no explosive MC detections. This report further concluded that no Chemicals of Potential Concern (COPC) or Chemicals of Potential Ecological Concern (COPEC) were identified in any of the media at this site.

The South Firing Range may also have been used as a firing range for M60 Machine guns, M79 Grenade Launchers, and 45 caliber submachine guns. A 1950 memorandum from the Department of the Army to the U.S. Coast and Geodetic Survey indicated that firing was conducted in the South Firing Range utilizing 90-mm and 120-mm projectiles, and the North Firing Range was used as an “Automatic Weapons Area” during the 1950s.

Although the sand sources considered are outside of any known boundary of a firing range, there exists a potential for encountering MEC’s when dredging within the borrow areas considered. Because MECs present a significant hazard to the public and beachfill crew, the Philadelphia District has required that screens be placed on intakes on all dredges and basket screens on the beach pump-out locations to minimize the potential for these items becoming entrained in the dredge and being pumped out on to the beaches. Additionally, crews trained in MEC monitoring and safety protocols provide 24-hour support during dredging operations. This has been the practice since 2005 on all beach nourishment projects along the Delaware Atlantic Coast.

4.1.9 Sediment Quality of Sand Source Areas

Physical and chemical analyses were performed on sediment composite cores and grab samples obtained from the interior shoal areas (IRI Flood Shoal, Burton Island Shoal and Middle Island Shoal) and the ebb shoal area considered as potential sand sources to provide baseline data to screen for any potential contamination of these sites. The interior shoal areas were collected by (under contract with DNREC) in 2024 to characterize the sandy material proposed for the Phase 1 component of the North Beach restoration and a single composite core was collected by USACE for the ebb shoal in 2000. These analyses included grain size, total organic carbon and bulk sediment chemistry analyses that were compared to human health and ecological criteria. Figure 23 provides core locations and their composite groupings.

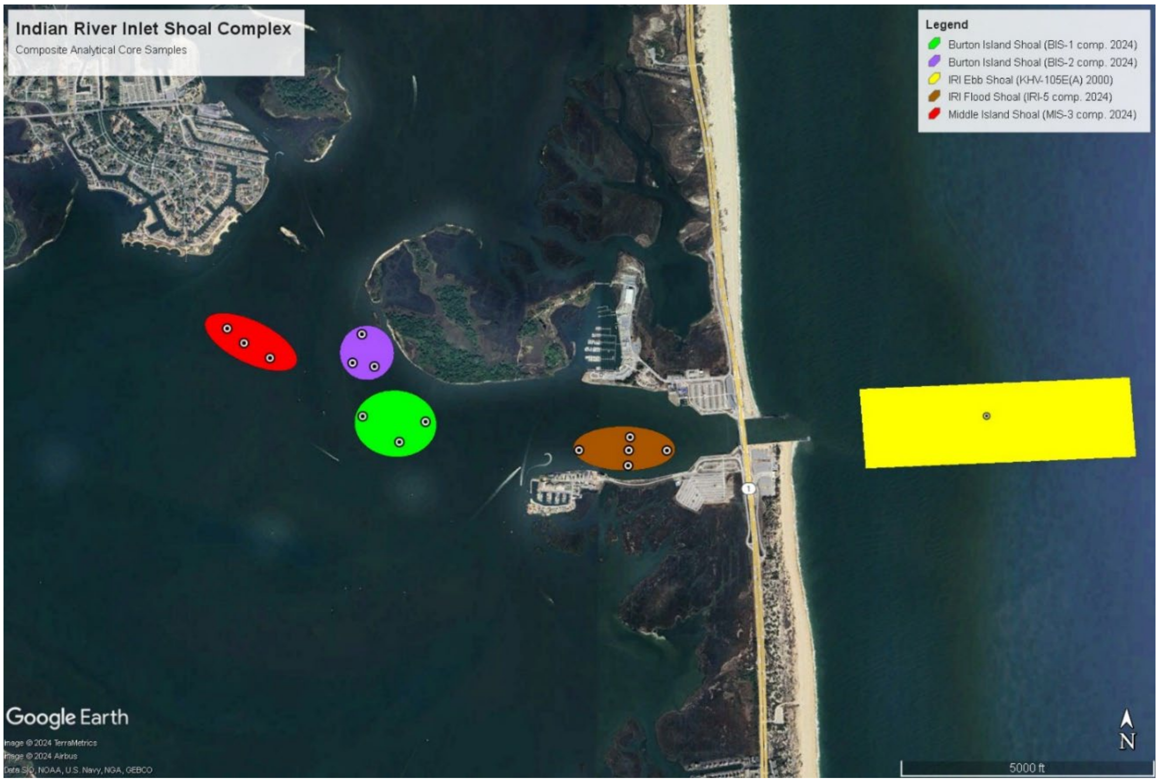


Figure 23. Indian River Inlet Shoal Complexes Analytical Composite Sample Locations.

4.1.9.1 Physical Sediment Quality

Sediment grain size distribution analyses and total organic carbon (Table 5) were conducted along with chemical analyses in cores obtained from the four shoal areas in the region that resulted in the analysis of 5 composites. With the exception of one of the composites (Middle Island Shoal – MIS-3), the sand content was greater than 90% for all composites. The Burton Island Composites, BIS-1 and BIS-2 had 100% and 90.1% sand content, respectively. These composites were dominated by fine to medium sands. The Indian River Inlet Flood Shoal (IRI-5) composite contained 98.1% fine to medium sands. The Indian River Inlet ebb shoal core (KHV-105E(A)) had a sand content of 98.6% and was predominantly fine sand with some medium sand. The total organic carbon (TOC) content of the cores were very low (two were undetectable) with the highest at the Middle Island Shoal containing 0.39%.

Table 5. Results of Grain Size and Total Organic Carbon (TOC) Analyses

SOIL CLASSIFICATION ASTM D422	COMPOSITES				
	BIS-1	BIS-2	MIS-3	IRI-5	KHV-105E(A)
Gravel (%)	0	2.3	0	1.9	0.4
Coarse Sand (%)	0	1.6	0.5	3.1	0
Medium Sand (%)	21.2	46.9	18.5	39.9	13.7
Fine Sand (%)	78.8	39.4	50.3	53.2	84.5
Fines (%)	0	9.9	30.7	1.9	1.4
TOC (%) (Lloyd Kahn)	0.01	0.091	0.39	0.01	0.021
TOC (mg/kg)	<120	910	3,900	<120	208

Values in red =1/2 MDL

4.1.9.2 Inorganic and Organic Chemistry of Sediments

Metals: The five composites collected by DNREC and USACE analyzed 23 target analyte list (TAL) metals (Table 6), and were compared to the Delaware Hazardous Substances Clean Up Act (HSCA) screening levels for soils and the sediment effects levels on the concentrations effects on benthic organisms (Long et al 1995). The HSCA Screening Level Table combines background, risk-based and regulatory values for soil used to determine the contaminants of potential concern (COPCs) in the risk assessment process. Table 6 identified a number of detected TAL metals at trace levels. None of the detections exceeded either the HSCA screening levels or the NOAA ecological sediment effects levels.

Pesticides: Twenty-one target compound list (TCL) pesticides were analyzed among the five composite samples in the area (Table 7). Only one pesticide (Heptachlor) was detected in one of the samples (BIS-1) and was well below the HSCA soil level. No corresponding NOAA ecological sediment effects level is available.

Polynuclear Aromatic Hydrocarbons (PAHs) and SVOCs: Twenty PAHs were analyzed, and eleven detections were reported (Table 8). These detections were only in the Burton Island Shoal and Middle Island Shoal samples. No PAHs were detected in the IRI Flood or Ebb Shoal samples. The eleven detections did not exceed any corresponding HSCA soil screening or sediment effects levels. Additionally, a target compound list of SVOCs (Semivolatile Organic Compounds) including the PAHs in Table 8 were all non-detectable in the IRI Ebb Shoal Sample (KHV-105E(A)).

Polychlorinated Biphenyls (PCBs): The interior shoals that include the IRI Flood Shoal, Burton Island Shoal and Middle Island Shoal analyzed PCBs via EPA Method 680, which measures PCB mono-deca homolog groups. The IRI Ebb Shoal utilized EPA Method 1668 analyzed 75 different targeted congeners. The interior shoal areas did not report any detections of PCB homologs. Therefore, an estimate was provided that utilized ½ of the method detection limit. These values were summed to provide a total PCB value to compare to the corresponding HSCA soil and ecological sediment screening and NOAA ecological sediment levels. The estimated concentrations were far below any of the corresponding screening levels. The same was done for the IRI Ebb Shoal sample for the 75 congeners. The total (including ½ of non-detected congener method detection levels) were far below the corresponding HSCA screening and NOAA sediment effects levels (Table 9).

Dioxins and Furans: Dioxins and furans were sampled for all composites using EPA Method 1613B in the parts per trillion range (ng/kg). Table 10 provides the data. Only a few detections were recorded. To evaluate the toxicity of the sediments, a relative toxicity was developed for each individual dioxin and furan analyzed relative to 2,3,7,8-TCDD dioxin as a toxicity equivalent (TEQ). 2,3,7,8-TCDD dioxins considered to have the greatest potential for adverse health effects and a toxicity equivalent factor (TEF) is assigned as a value of 1 for this compound. The other compounds were assigned TEF coefficients based on their physiochemical and toxicological properties relative to 2,3,7,8-TCDD dioxin. The TEQ was computed for compounds that were detected in the samples and compared to the HSCA screening level for 2,3,7,8-TCDD dioxin, which has been established at a concentration of 4.8 ng/kg. All of the samples had summed values below this screening level. There are no ecological NOAA sediment effects levels or HSCA screening levels for marine sediment to compare the TEFs.

Volatile Organic Compounds (VOCs): No volatile organic compounds were sampled in the interior shoal areas. Two VOCs were detected in the IRI-Ebb Shoal sample taken in 2000 (Duffield Associates, 2000). Acetone, a common laboratory solvent, was detected at a concentration of 240 ug/kg but was below the HSCA soil screening level of 6,100 ug/kg. The likelihood of acetone's presence in marine sediments is improbable due to the fact that it is almost completely miscible in water and evaporates readily when exposed to air. The other VOC detected in the analyses was perchloroethylene (PCE) (also known as tetrachloroethene), was detected at a concentration 0f 7 ug/kg, which is below the HSCA soil screening level of 8,100 ug/kg. PCE is a common solvent associated with dry-cleaning facilities and commercial or industrial de-greasing operations. It has a density that is greater than water and is not very soluble in water. If released to a body of water in significant volume, PCE may settle to the bottom and pool as a separate liquid. There are no known likely sources of this compound, however, it is possible that vapors from dry cleaned garments of laboratory personnel could be a source (Duffield Associates, 2000a). Given the fact that these compounds were found in a sample obtained from the high-energy ocean floor, actual sediment contamination is less likely.

Table 6. Target Analyte Metals Analyzed in the Potential Sand Sources

	NOAA Sediment Effects Levels		HSCA Screen Level for Soil	Burton Island Shoal						Middle Island Shoal			IRI Flood Shoal			IRI Ebb Shoal		
	ER-L	ER-M		BIS-1			BIS-2			MIS-3			IRI-5			KHV-105E(A)		
Units	*mg/kg*	*mg/kg*	*mg/kg*		*mg/kg*			*mg/kg*			*mg/kg*			*mg/kg*			*mg/kg*	
Aluminum			51,200		1600			19000			8900			900			543	
Antimony			3.1	<	0.081		<	0.07		<	0.081		<	0.1		<	1.5	
Arsenic	8.3	70	11		0.53			0.75			3.0			0.82			0.34	J
Barium			1,500		4.9			24			16			4.7			1.51	J
Beryllium			16		0.051	J		0.20			0.32			0.035	J	<	0.13	
Cadmium	1.2	9.6	0.71	<	0.041		<	0.03			0.058	J	<	0.05		<	0.2	
Calcium			---		1500			440	^2		1200	^2		1400			1050	
Chromium	81	370	214		2.1			7.9			14			1.1			1.56	J
Cobalt			34		0.35			1.3			6.9			0.32		<	0.62	
Copper	34	270	310		0.35	J		1.3			2.8		<	0.22			0.49	J
Iron			74,767		910			2200			8400			630			619	
Lead	46.7	218	400		1.3			4.0			3.6			0.79			1.08	J
Magnesium			---		330			480	^2		2100	^2		260			378	
Manganese			2,100		10			10			66			8.8			6.0	
Mercury	0.15	0.7	0.94	<	0.022		<	0.02		<	0.026		<	0.02		<	0.015	
Nickel	20.9	51.6	15		0.84			5.7			7.5			0.50		<	1.7	
Potassium			---		200			450			1200			210			150	
Selenium			39	<	0.1		<	0.08			0.12	J	<	0.12		<	0.46	
Silver	1	3.7	39	<	0.041		<	0.03		<	0.041		<	0.05		<	0.23	
Sodium			---		1500			1700			3300			1500			2160	
Thallium			0.078	<	0.04			0.038	J		0.075	J	<	0.05		<	0.62	
Zinc	124	410	2,300	<	4.1			8.7	J		19	J	<	4.9			4.7	J
Vanadium			134		2.5			11			16			1.7			1.65	J

Table 7. Target Compound List of Pesticides Analyzed in Potential Sand Sources Considered

	NOAA Sediment Effects Levels		HSCA Screen Level for Soil	Burton Island Shoal						Middle Island Shoal			IRI Flood Shoal			IRI Ebb Shoal		
	ER-L	ER-M		BIS-1			BIS-2			MIS-3			IRI-5			KHV-105E(A)		
Units	*ug/kg*	*ug/kg*	*ug/kg*		*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*	
Aldrin	---	---	39	<	0.41		<	0.44		<	0.47		<	0.44		<	0.067	
alpha-BHC	---	---	86	<	0.43		<	0.47		<	0.5		<	0.47		<	0.067	
alpha-Chlordane	---	---	36000	<	0.19		<	0.21		<	0.22		<	0.21		<	0.067	
beta-BHC	---	---	300	<	0.5		<	0.54		<	0.58		<	0.54		<	0.067	
delta-BHC	---	---	---	<	0.51		<	0.56		<	0.59		<	0.55			0.6	
Dieldrin	---	---	34	<	0.37		<	0.41		<	0.43		<	0.4		<	0.13	
Endosulfan I	---	---	47000	<	0.25		<	0.27		<	0.29		<	0.27		<	0.067	
Endosulfan II	---	---	47000	<	1.2		<	1.4		<	1.4		<	1.3		<	0.13	
Endosulfan sulfate	---	---	38000	<	0.45		<	0.49		<	0.52		<	0.48		<	0.13	
Endrin	---	---	1900	<	0.77		<	0.84		<	0.89		<	0.83		<	0.13	
Endrin aldehyde	---	---	---	<	0.44		<	0.47		<	0.5		<	0.47		<	0.13	
Endrin ketone	---	---	---	<	0.68		<	0.74		<	0.79		<	0.74		<	0.13	
gamma-BHC (Lindane)	---	---	570	<	0.94	p	<	0.26		<	0.28		<	0.26		<	0.067	
gamma-Chlordane	---	---	36000	<	0.28		<	0.31		<	0.33		<	0.31		<	0.067	
Heptachlor	---	---	130		0.65	J	<	0.38		<	0.41		<	0.38		<	0.067	
Heptachlor epoxide	---	---	70	<	0.4		<	0.43		<	0.46		<	0.43		<	0.067	
Methoxychlor	---	---	32000	<	2.9		<	3.2		<	3.4		<	3.1		<	0.67	
Toxaphene	---	---	490	<	16		<	17		<	18		<	17		<	6.7	
p,p'-DDD	---	---	190	<	0.91		<	0.99		<	1		<	0.98		<	0.13	
p,p'-DDE	2.2	27	2000	<	0.79		<	0.86		<	0.92		<	0.86		<	0.13	

	NOAA Sediment Effects Levels		HSCA Screen Level for Soil	Burton Island Shoal						Middle Island Shoal			IRI Flood Shoal			IRI Ebb Shoal		
	ER-L	ER-M		BIS-1			BIS-2			MIS-3			IRI-5			KHV-105E(A)		
Units	*ug/kg*	*ug/kg*	*ug/kg*		*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*	
p,p'-DDT	1.58	46.1	1900	<	0.9		<	0.98		<	1		<	0.97		<	0.13	

Table 8. Polynuclear Aromatic Hydrocarbon Analyses for Potential Sand Sources Considered

	NOAA Sediment Effects Levels		HSCA Screen Level for Soil	Burton Island Shoal						Middle Island Shoal			IRI Flood Shoal			IRI Ebb Shoal	
	ER-L	ER-M		BIS-1			BIS-2			MIS-3			IRI-5			KHV-105E(A)	
Units	*ug/kg*	*ug/kg*	*ug/kg*		*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*
Anthracene	85.3	1100	1,800,000		0.47	J	<	0.41			1.5	J	<	0.41		<	33
Pyrene	665	2600	180,000	<	0.76		<	0.81			1.4	J	<	0.82		<	33
Dibenzofuran	---	---	7,800	<	0.76		<	0.81		<	0.86	F1	<	0.82		<	33
Benzo[g,h,i]perylene	---	---	---	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Benzo[e]pyrene			570	<	0.76		<	0.81		<	0.86		<	0.82			NS
Indeno[1,2,3-cd]pyrene	---	---	1,300	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Perylene			540		0.82	J	<	0.81			11		<	0.82			NS
Benzo[b]fluoranthene	---	---	1,100	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Fluoranthene	600	5100	240,000	<	0.76	*+ cn		0.82	J		2.1	J	<	0.82	*+	<	33
Benzo[k]fluoranthene	---	---	11,000	<	0.76	*+	<	0.81	F1	<	0.86		<	0.82	*+	<	33
Acenaphthylene	44	640	---	<	0.38		<	0.41			1.9	J	<	0.41		<	33
Chrysene	384	2800	110,000	<	0.38		<	0.41			0.73	J	<	0.41		<	33
Benzo[a]pyrene	430	1600	240	<	0.76		<	0.81		<	0.86		<	0.82		<	33

	NOAA Sediment Effects Levels		HSCA Screen Level for Soil	Burton Island Shoal						Middle Island Shoal			IRI Flood Shoal			IRI Ebb Shoal	
	ER-L	ER-M		BIS-1			BIS-2			MIS-3			IRI-5			KHV-105E(A)	
Units	*ug/kg*	*ug/kg*	*ug/kg*		*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*			*ug/kg*
Dibenz(a,h)anthracene	63.4	260	170	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Benzo[a]anthracene	261	1600	1,100	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Acenaphthene	16	500	360,000	<	0.76		<	0.81		<	0.86		<	0.82		<	33
Phenanthrene	240	1500	180,000	<	0.76			0.94	J		2.0	J	<	0.82		<	33
Fluorene	19	540	240,000	<	0.76	cn	<	0.81		<	0.86		<	0.82	cn	<	33
Naphthalene	160	2100	2,000	<	1.5		<	1.6		<	1.7		<	1.6		<	33
2-Methylnaphthalne	70	670	24,000	<	1.1		<	1.2		<	1.3	cn	<	1.2		<	33

Table 9. Polychlorinated Biphenyls Analyzed in the Potential Sand Sources Considered

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.	Result		Est.	Result		Est.	Result		Est.	Result		Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Total Monochlorobiphenyls							NM		NM	<	0.37	0.185	<	0.34	0.17	<	0.37	0.185	<	0.39	0.195
Di-CB	8	2,4'					72.8	B	0.0728												
Total Dichlorobiphenyls									0.0728	<	0.37	0.185	<	0.34	0.17	<	0.37	0.185	<	0.39	0.195
Tri-CB	18	2,2',5					55.8	B	0.0558												
Tri-CB	28	2,4,4'					47.4	B	0.0474												

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.		Result	Est.		Result	Est.		Result	Est.		Result	Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Tri-CB	37	3,4,4'					17.7	B	0.0177												
Total Trichlorobiphenyls									0.1209	<	0.24	0.12	<	0.23	0.115	<	0.25	0.125	<	0.26	0.13
Tetra-CB	42	2,2',3,4'					15.9	B	0.0159												
Tetra-CB	44	2,2',3,5'					45.0	B	0.045												
Tetra-CB	47	2,2',4,4'					16.4	B	0.0164												
Tetra-CB	49	2,2',4,5'					42.5	B	0.0425												
Tetra-CB	52	2,2',5,5'					56.0	B	0.056												
Tetra-CB	60	2,3,4,4'					0.99	U	0.0004945												
Tetra-CB	64	2,3,4',6					26.0	B	0.026												
Tetra-CB	66	2,3',4,4'					29.9	B	0.0299												
Tetra-CB	70	2,3',4',5					0.98	U	0.0004905												
Tetra-CB	74	2,4,4',5					1.12	U	0.00056												
Tetra-CB	78	3,3′,4,5					1.36	U	0.00068												
Tetra-CB	79	3,3′,4,5′					1.39	U	0.000695												
Tetra-CB	80	3,3',5,5'					19.7		0.0197												
Tetra-CB	81	3,4,4',5					1.23	U	0.000615												
Tetra-CB	77	3,3',4,4'	38				7.65	B	0.00765												
Tetra-CB	81	3,4,4′,5	12				1.2	B	0.0012												
Total Tetrachlorobiphenyls									0.263785	<	0.49	0.245	<	0.46	0.23	<	0.49	0.245	<	0.52	0.26
Penta-CB	82	2,2',3,3',4					5.38	B	0.00538												

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.		Result	Est.		Result	Est.		Result	Est.		Result	Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Penta-CB	84/101	2,2',3,3',6					24.1	B	0.0241												
Penta-CB	86	2,2',3,4,5					0.37	U	0.0001865												
Penta-CB	87	2,2',3,4,5'					12.6	B	0.0126												
Penta-CB	91	2,2',3,4',6					6.35	B	0.00635												
Penta-CB	92	2,2',3,5,5'					6.23	B	0.00623												
Penta-CB	95	2,2',3,5',6					28.7	B	0.0287												
Penta-CB	97	2,2',3',4,5					8.71	B	0.00871												
Penta-CB	99	2,2',4,4',5					22.9	B	0.0229												
Penta-CB	105	2,3,3',4,4'	120				3.84	B	0.00384												
Penta-CB	110	2,3,3',4',6					28.6	B	0.0286												
Penta-CB	114	2,3,4,4',5	120				0.42	U	0.000211												
Penta-CB	118	2,3',4,4',5	120				29.8	B	0.0298												
Penta-CB	119	2,3',4,4',6					1.36	B	0.00136												
Penta-CB	120	2,3',4,5,5'					0.27	U	0.000135												
Penta-CB	123	2',3,4,4',5	120				0.38	U	0.000188												
Penta-CB	126	3,3',4,4',5	0.036				0.33		0.000329												
Total Pentachlorobiphenyls									0.1796195	<	0.98	0.49	<	0.92	0.46	<	0.99	0.495	<	1	0.5
Hexa-CB	128/167	2,2',3,3',4,4'	120				2.37		0.00237												

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.		Result	Est.		Result	Est.		Result	Est.		Result	Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Hexa-CB	137	2,2',3,4,4',5					1.10	B	0.0011												
Hexa-CB	138	2,2',3,4,4',5'					29.2	B	0.0292												
Hexa-CB	141	2,2',3,4,5,5'					5.49	B	0.00549												
Hexa-CB	146	2,2',3,4',5,5'					8.22	B	0.0082												
Hexa-CB	149	2,2',3,4',5',6					34.6	B	0.0346												
Hexa-CB	151	2,2',3,5,5',6					12.5	B	0.0125												
Hexa-CB	153	2,2',4,4',5,5'					44.0	B	0.044												
Hexa-CB	156	2,3,3',4,4',5	120				2.42	B	0.0024												
Hexa-CB	157	2,3,3',4,4',5'	120				0.55		0.0005												
Hexa-CB	158	2,3,3',4,4',6					1.88	B	0.0018												
Hexa-CB	166	2,3,4,4',5,6					0.53	U	0.0002												
Hexa-CB	168	2,3',4,4',5',6					6.88	B	0.0068												
Hexa-CB	169	3,3',4,4',5,5'	0.12				0.17	U	0.0001												
Total Hexachlorobiphenyls									0.1496	<	0.49	0.245	<	0.46	0.23	<	0.49	0.245	<	0.52	0.26

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.	Result		Est.	Result		Est.	Result		Est.	Result		Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Hepta-CB	170/190	2,2',3,3',4,4',5					7.19	B	0.0072												
Hepta-CB	171	2,2',3,3',4,4',6					2.77		0.0028												
Hepta-CB	174	2,2',3,3',4,5,6'					15.7	B	0.0157												
Hepta-CB	177	2,2',3,3',4',5,6					7.96	B	0.0080												
Hepta-CB	179	2,2',3,3',5,6,6'					13.7	B	0.0137												
Hepta-CB	180	2,2',3,4,4',5,5'					1.69	U	0.0008												
Hepta-CB	183	2,2',3,4,4',5',6					9.90	B	0.0099												
Hepta-CB	185	2,2',3,4,5,5',6					2.89		0.0029												
Hepta-CB	187	2,2',3,4',5,5',6					28.8	B	0.0288												
Hepta-CB	189	2,3,3',4,4',5,5'	130				0.27	U/EMPC	0.0001												
Hepta-CB	191	2,3,3',4,4',5',6					0.34		0.0003												
Total Heptachlorobiphenyls									0.0902	<	0.61	0.305	<	0.57	0.285	<	0.62	0.31	<	0.65	0.325
Octa-CB	194	2,2',3,3',4,4',5,5'					11.0	B	0.011												

			Delaware HSCA Screening Levels		NOAA Sediment Effects		IRI Ebb Shoal (2000)			IRI Flood Shoal Composite (2024)			Burton Island Shoal Composites (2024)						Middle Island Shoal Composite (2024)		
Sample ID:							KHV-105E(A)			IRI-5			BIS-1			BIS-2			MIS-3		
EPA METHOD:							EPA 1668			EPA 680			EPA 680			EPA 680			EPA 680		
Sample Date:			Soil	Ecological Sediment (marine)	ER-L	ER-M	Result	FLAG	Est.	Result		Est.	Result		Est.	Result		Est.	Result		Est.
PCB Homolog Group	PCB Congeners IUPAC	Isomer																			
Units			*ug/kg*	*ug/kg*	*ug/kg*	*ug/kg*	*pg/g*		*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*		*ug/kg*	*ug/kg*
Octa-CB	195	2,2',3,3',4,4',5,6					2.76	B	0.00276												
Octa-CB	196/203	2,2',3,3',4,4',5',6					9.77	B	0.00977												
Octa-CB	198	2,2',3,3',4,5,5',6					0.88	U/EMPC	0.0004												
Octa-CB	200	2,2',3,3',4,5',6,6'					3.86	B	0.0039												
Octa-CB	201	2,2',3,3',4',5,5',6					20.0	B	0.02												
Octa-CB	205	2,3,3',4,4',5,5',6					0.52	U/EMPC	0.0003												
Total Octachlorobiphenyls									0.0481	<	0.61	0.305	<	0.57	0.285	<	0.62	0.31	<	0.65	0.325
Nona-CB	206	2,2',3,3',4,4',5,5',6					7.64		0.0076												
Nona-CB	207	2,2',3,3',4,4',5,6,6'					1.01	B	0.0010												
Nona-CB	208	2,2',3,3',4,5,5',6,6'					4.42	B	0.0044												
Total Nonachlorobiphenyls									0.0130	<	0.61	0.305	<	0.57	0.285	<	0.62	0.31	<	0.65	0.325
Deca-CB	209	2,2',3,3',4,4',5,5',6,6'					8.19		0.0082												
DCB Decachlorobiphenyl									0.0082	<	0.61	0.305	<	0.57	0.285	<	0.62	0.31	<	0.65	0.325
Total PCB (Inclusive of blank masked values)			230	40	22.7	180	940		0.946			2.51			2.35			2.54			2.65
Total PCBs (Excluding blank masked values)							44.8														

Notes:
B = Substance detected at less than three times the concentration detected in the method blank analyzed by MRI. MRI dismissed these concentrations as "analytic background," meaning that MRI's analysis does not believe that the substance is present in the sample.
MDL = Method Detection Limit - Lower limit of detection for the analysis.
U= Undetected with a noise based detection limit given
EMPC= A peak was detected that did not meet ion ration criteria. The peaks were summed to calculate an Estimated Maximum Possible Concentration given as the detection limit in pg/g.
NM = Not Measured
pg/g= picograms per gram or parts per trillion
ug/kg= micrograms per kilogram or parts per billion
*Values in Red= were undetected with an assumed value of 1/2 of the MDL
Yellow Highlight = Represents coplanar PCBs
Est.= Estimated based on sums including ½ the value of the MDL for undetected PCBs

Table 10. Dioxins and Furans Analyses for the Sand Sources Considered

		Delaware HSCA Screening Levels (soil)	Burton Island Shoal				Middle Island Shoal		IRI Flood Shoal		IRI Ebb Shoal	
			BIS-1		BIS-2		MIS-3		IRI-5		KHV-105E(A)	
EPA Method: 1613B												
	TEF		Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ
Units		*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*
DIOXINS												
2,3,7,8-TCDD	1	4.8	<2.3	0	<0.24	0	<0.26	0	<2.4	0	<0.255	0.000
1,2,3,7,8-PeCDD	0.5		<23	0	<2.4	0	<2.6	0	<24	0	<0.306	0.000
1,2,3,4,7,8-HxCDD	0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.299	0.000
1,2,3,6,7,8-HxCDD	0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.159	0.000
1,2,3,7,8,9-HxCDD	0.1		<23	0	3.8	0.38	<2.6	0	<24	0	<0.187	0.000
1,2,3,4,6,7,8-HpCDD	0.01		<23	0	40	0.4	56	0.56	<24	0	2.22	0.022
OCDD	0.001		57	0.057	1900	1.9	1100	1.1	<24	0	31.1	0.031
FURANS												
2,3,7,8-TCDF	0.1		<2.3	0	<0.24	0	<0.26	0	<2.4	0	<0.272	0.000
1,2,3,7,8-PeCDF	0.05		<23	0	<2.4	0	<2.6	0	<24	0	<0.223	0.000
2,3,4,7,8-PeCDF	0.5		<23	0	<2.4	0	<2.6	0	<24	0	<0.192	0.000
1,2,3,4,7,8-HxCDF	0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.188	0.000

			Delaware HSCA Screening Levels (soil)	Burton Island Shoal				Middle Island Shoal		IRI Flood Shoal		IRI Ebb Shoal	
				BIS-1		BIS-2		MIS-3		IRI-5		KHV-105E(A)	
EPA Method: 1613B													
		TEF		Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ	Result	TEQ
	Units		*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*	*ng/kg*
1,2,3,6,7,8-HxCDF		0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.187	0.000
1,2,3,7,8,9-HxCDF		0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.499	0.000
2,3,4,6,7,8-HxCDF		0.1		<23	0	<2.4	0	<2.6	0	<24	0	<0.18	0.000
1,2,3,4,6,7,8-HpCDF		0.01		<23	0	<2.4	0	<2.6	0	<24	0	0.431	0.004
1,2,3,4,7,8,9-HpCDF		0.01		<23	0	<2.4	0	<2.6	0	<24	0	<0.241	0.000
OCDF		0.001		<23	0	<2.4	0	<2.6	0	<24	0	<1.03	0.000
Toxicity Equivalent (Dioxins+Furans)			4.8		0.057		2.68		1.66		0		0.05761

4.1.10 Water Quality

The Delaware Department of Natural Resources and Environmental Control conducts beach water quality monitoring of recreational waters to ensure their quality for swimming. Point sources of pollution, and rainfall-driven runoff from the land (nonpoint source pollution), may introduce disease-causing organisms into swimming waters. However, because of improvements in wastewater treatment and the elimination of some discharges, Delaware's guarded beaches are no longer impacted by point sources of pollution. DNREC reports that efforts are also underway to control nonpoint source pollution by installing central wastewater collection and treatment systems to eliminate septic systems and by better managing agricultural, commercial and residential lands.

Bacteriological water quality can be affected by a number of factors, including human-induced contamination and a number of natural factors. For example, windy conditions create water turbulence. Naturally occurring bacteria that live on the bottom can be churned up into the water column by wind-induced waves. This will result in elevated levels of Enterococcus bacteria. If elevated levels are the result of natural conditions, and are presenting no threat to the public's health, an advisory will not be issued (source DNREC website: http://apps.dnrec.state.de.us/recwater/MoreInfo.aspx accessed on 5/4/2015).

Along Delaware's Atlantic coast, stormwater discharges are the primary sources of pollutants in recreational water. Rehoboth Beach currently has 6 stormwater ocean outfalls at Lake Avenue, Grenoble Place, Laurel Avenue, Maryland Avenue, Rehoboth Avenue and Delaware Avenue. DNREC monitors 19 water quality monitoring locations along Delaware's Atlantic Coast, which includes all of the guarded beaches in the State parks, and municipalities. Recreational water samples are analyzed to determine the levels of Enterococci bacteria. Enterococcus is one of several indicator organisms that signal the presence of potentially harmful bacteria and viruses. Currently, Delaware uses the following Enterococcus standards (colonies per 100 milliliters):

Table 11. Delaware Enterococcus Standards

Water Type	Geometric Mean (# colonies)	Instantaneous Value (# colonies)	Resample Value (# colonies)
Fresh	100	185	
Salt	35	104	104

The geometric mean is calculated to determine the long-term safety of a recreational beach for swimming. The instantaneous value allows DNREC to assess current water quality conditions. Results are available 24 hours after the sample is delivered to the laboratory. Standards that are exceeded are used (in addition to other factors) to make a decision as to the safety of the waterbody for swimming, which could result in the issuance of a "no swimming" advisory. (DNREC internet website http://apps.dnrec.state.de.us/RecWater/MoreInfo.aspx accessed on 5/4/2015).

Delaware's Atlantic Coast recreational beaches from Cape Henlopen to Fenwick Island historically have excellent water quality based on long term testing for enterococcus indicator bacteria conducted by the Delaware Shellfish and Recreational Water Programs. Bacterial sampling occurs annually from the first Monday in May through the third Monday in September to coincide with the summer swimming season. Bacterial results are available on the State's website, which is updated as new results are received.

In 2024, two water quality advisories for the Indian River Inlet North Shore were issued for bacterial contamination in July and August. Additionally, beach closings occurred along the entire Atlantic Coast of Delaware in mid-September of 2024 due to instances of medical waste washing ashore that triggered an emergency response from DNREC (Source: https://data.delaware.gov/Energy-and-Environment/Recreational-Water-Advisories/ever-58ni/data_preview retrieved on 1/17/2025).

For the Inland Bays, a permanent caution regarding swimming due to nutrient and bacterial pollutions that come from failing septic systems, fertilizers, and other sources. The slow flushing of the Indian River Bay, Rehoboth Bay and Little Assawoman Bay is a major factor that allows the pollutants to linger.

A review of the Draft State of Delaware 2024 Combined Watershed Assessment Report (305(b)) and Determination for the 303(d) List of Waters Needing TMDLs places the Indian River Assessment Unit (DE140-E01) on the 303(d) List of impaired waters for copper. However, the water quality monitoring station within the Indian River Inlet (Coast Guard Station – 306321) has met water quality thresholds and criteria for dissolved oxygen, nitrogen, total phosphorous, dissolved organic nitrogen, total suspended solids, zinc, marine copper, arsenic, lead, and enterococcus. The only parameter that did not meet the water quality criteria at this location was dissolved inorganic phosphorous.

Shellfish harvesting designations are based on water quality monitoring by DNREC and other factors. Within the affected area, there are two areas shellfish harvest prohibitions: 1) The Indian River Inlet from the eastern end of the jetties to Burton Island, and 2) The Atlantic Ocean from the northern most point at Cape Henlopen to the Delaware/Maryland State line and due east 3 nautical miles in the State of Delaware's jurisdictional waters (a "prohibited/unclassified growing area").

DNREC regularly monitors for harmful algal blooms. In 2007, a red tide was experienced along the Atlantic coast of Delaware. The red tide was caused by a dinoflagellate organism, *Karenia brevis*, which is normally found along the Gulf Coast of Florida. It was believed that this organism was brought to near shore waters by an eddy from the Gulf Stream. K. brevis produces a brevetoxin, which may become aerosolized when the organism is broke up in the surface. Its effects can cause respiratory irritation to the general public (DNREC internet website https://dnrec.delaware.gov/watershed-stewardship/assessment/recreational-water-monitoring/red-tide/ accessed on 1/17/2025).

4.1.11 Air Quality

The Environmental Protection Agency (EPA) adopts National Ambient Air Quality Standards (NAAQS) for the common air pollutants, and the states have the primary responsibility to attain and maintain those standards. Through the State Implementation Plan (SIP), The Delaware Department of Natural Resources and Environmental Control – Division of Air Quality manages and monitors air quality in the state. The goal of the SIP is to meet and enforce the primary and secondary national ambient air quality standards for pollutants. Criteria pollutants have primary ambient air quality standards designed to protect public health, including an adequate margin of safety to protect sensitive populations such as children and asthmatics. The criteria pollutants being monitored in Delaware are: ozone (O3), carbon monoxide (CO), nitrogen dioxide (NO2), sulfur dioxide (SO2), particulate matter (PM – PM2.5/PM10) and lead (DNREC, 2014). Delaware reports criteria pollutant concentrations from the statewide monitoring network on an hourly basis to the EPA AirNow website. AirNow uses Delaware's data to calculate an Air Quality Index (AQI) for each pollutant. The pollutant with the highest AQI determines the AQI category for the day. In 2019, only New Castle County had days in the Unhealthy for Sensitive Groups category, due to high ozone (DNREC, 2019).

Ground-level ozone is created when nitrogen oxides (NOx) and volatile organic compounds (VOC's) react in the presence of sunlight. NOx is primarily emitted by motor vehicles, power plants, and other sources of combustion. VOC's are emitted from sources such as motor vehicles, chemical plants, factories, consumer and commercial products, and even natural sources such as trees. Ozone and the pollutants that form ozone (precursor pollutants) can also be transported into an area from sources hundreds of miles upwind (DNREC, 2014).

The Clean Air Act requires that all areas of the country be evaluated and then classified as attainment or non-attainment areas for each of the National Ambient Air Quality Standards. Areas can also be found to be "unclassifiable" under certain circumstances. The 1990 amendments to the act required that areas be further classified based on the severity of non-attainment. The classifications range from "Marginal" to "Extreme" and are based on "design values". The design value is the value that actually determines whether an area meets the standard. In 2015, the U.S. Environmental Protection Agency (EPA) promulgated a revised National Ambient Air Quality Standard (NAAQS) for ground level ozone at a concentration of 0.071 ppm averaged over eight hours. The new standard supersedes the previous 8-hour ozone standard of 0.075 ppm. New Castle County exceeded the new 0.071 ppm and has been downgraded to "serious" non-attainment. However, Sussex County was not included and remains as "marginal" non-attainment for the 2008 NAAQS (https://www.epa.gov/green-book/ozone-designation-and-classification-information accessed on 1/17/2024) .

4.1.12 Noise

Noise is of environmental concern because it can cause annoyance and adverse health effects to humans and animal life. Noise can impact such activities as conversing, reading, recreation, listening to music, working, and sleeping. Wildlife behaviors can be disrupted by noises also, which can disrupt feeding and nesting activities. Because of the developed nature of the municipalities and resorts along the Delaware Atlantic Coast, noises are common and can come in the form of restaurant and entertainment facilities, automobiles, boats, and recreational visitors. The affected areas have little to no development and are not within any areas with noise restrictions.

4.2 Biological Environment

4.2.1 Terrestrial

The entire terrestrial portion of the project impact area contains a high-energy coastal barrier sandy beach within Delaware Seashore State Park. This area includes a narrow beach and a fragmented dune area that has been subject to breaches and overwash. In this segment, back barrier flats are minimal on the east side of State Route 1 because of severe erosion. Here the North Beach dune and beach abut State Route 1. West of the highway, extensive overwash strand thickets and saltmarshes are present that transition into open tidal waters of Bottom Hills Drain and Stockley Gut. Except for the highway and Charles W. Cullen Memorial bridge, no other development occurs along the Atlantic coastline along the 1 mile stretch of the North Beach.

4.2.1.1 Dune and Upper Beach Flora and Fauna

The North Beach dune system has been severely eroded from the north jetty extending approximately 2,000 feet with remnants of the original dunes. The dune system is more robust further north with greater vegetative cover. Typical of mid-Atlantic beaches, the predominant vegetation growing on the primary dune areas consist of American beachgrass (*Ammophila breviligulata*), sea rocket (*Cakile dentata*) and beach clotbur (*Xanthium echinatum*) and seaside goldenrod (*Solidago sempervirens*). The secondary dunes offer more vegetative diversity including: beach heather (*Hudsonia tomentosa*), saltmeadow hay (*Spartina patens*), broom sedge (*Andropogon virginicus*), beach plum (*Prunus matitima*), seabeach evening primrose (*Oenothera humifusa*), sand spur (*Cencrhus tribuloides*), seaside spurge (*Ephorbia polygonifolia*), joint-weed (*Polygonella articulate*), slender-leaved goldenrod (*Solidage tenuifolia*), and prickly pear (*Opuntia humifusa*). Some areas where depressions have formed between dunes have developed freshwater wetlands with bog-like characteristics. None of these wetlands occur within the North Beach affected area. The primary and secondary dunes typically transition into scrub-thicket habitat composed primarily of shrubs and small trees including: wax myrtle (*Myrica cerifera*), bayberry (*M. pensylvanica*), dwarf sumac (*Rhus copallina*), black cherry (*Prunus serotina*), American holly (*Ilex opaca*), groundsel bush (*Baccharis halimifolia*), beach plum, and the non-native Japanese black pine (*Pinus thunbergiana*).

Because most of the dune present within the affected area is a primary dune, fauna inhabiting the dune is scarce, but may include several species of passerine birds, and typical mammalian species such as the eastern cottontail (*Sylvilagus floridanus*). Some of the plants found on the dune may also be found on the upper beach, which transitions into a mostly barren area above the high tide line with little biological activity. Several species of gulls (*Larus* spp.) may be present within the upper and lower beach and may be observed feeding on carrion, plant matter or invertebrates within the beach wrack. One of the most active organisms in the upper beach zone is the ghost crab (*Ocypode quadrata*), which is a scavenger, predator, and deposit sorter that lives in semi-permanent burrows in the upper beach. The lower beach including the intertidal zone is frequently inhabited by shorebirds including sanderling (*Calidris alba*), semipalmated sandpiper (*C. pusilla*), and western sandpiper (*C. mauri*), which utilize these areas to feed on invertebrate infauna.

4.2.2 Aquatic Environment

4.2.2.1 Benthic Environments

Projects that involve dredging and fill placement have direct and indirect effects on the benthic environment principally on the macrofauna inhabiting this environment. Benthic macroinvertebrates refer to those organisms living along the bottom of aquatic environments. They can be classified as those organisms dwelling in the substrate (infauna) or on the substrate (epifauna). Benthic invertebrates are an important link in the aquatic food chain and provide a food source for a variety of bottom feeding fish species and shorebirds in the intertidal zone. Various factors such as hydrography, sediment type, depth, temperature, irregular patterns of recruitment and biotic interactions (predation and competition) may influence species dominance in benthic communities. Benthic assemblages in Delaware coastal waters exhibit seasonal and spatial variability. Generally, coarse sandy sediments are inhabited by filter feeders and areas of soft silt or mud are more utilized by deposit feeders. Benthic communities along the Delaware Atlantic Coast are variable from those dominated by mollusks, polychaete worms or amphipods.

4.2.2.1.1 Benthos of Intertidal Zone and Nearshore Zone

Benthic invertebrates inhabiting the upper marine intertidal zone along the Delaware Atlantic beaches are scarce in a zone characterized by little biological activity. The beach wrack line provides a moist microhabitat inhabited by crustaceans such as the amphipods: *Orchestia spp.* and *Talorchestia spp*., which are also known as beach fleas. Biological activity becomes more intense within the intertidal zone, which is characterized as a high-energy environment due to pounding wave action and shifting sands. Fauna inhabiting the intertidal zone of a high-energy beach have developed special morphological adaptations to allow these organisms to rapidly burrow, relocate, and feed to enable their survival in this extreme environment. Typical benthic organisms that are likely to be found within the intertidal zone of beaches along the Delaware Atlantic Coast include the mole crab (*Emerita talpoida*), the coquina clam (*Donax variabillis*), a haustorid amphipod (*Haustorius canadensis*) and a spionid worm (*Scolelepis squamata*). Within the nearshore zone, diversity increases due to the transition into deeper water. The nearshore may include some of the intertidal species and some of the offshore species.

4.2.2.1.2 Benthos of Offshore Zones

Offshore benthic habitats along the Delaware Atlantic Coast are highly variable depending on depth and substrate type, which influence the benthic community composition. Here, benthic communities generally exhibit greater diversity than those within the intertidal and nearshore areas, which can be attributed to more stable physical environments.

Scott (2001) conducted sampling for benthic infauna of the IRI Ebb Shoal area where five grab samples were collected in June of 2000. The benthic community is indicative of a benthic community in a sandy high energy site. A total of 34 taxa were recorded from these five samples. Bivalves were the most abundant of the taxa and also made up the most biomass in the samples. Principal bivalve taxa in order of their abundance (greatest to lowest) were the coquina clam (*Donax variabilis*), surf clam (*Spisula solidissima*), dwarf tellin (*Tellina agilis*), and the razor clam (*Ensis directus*). Other abundant taxa at this location include oligochaete worms, a shrimp-like crustacean called a "tanaiad" (Tanaissus psammophilus), nemertinean worms (Nemertinea), the polychaete worms (*Paraonis fulgens*, *Hemipodus roseus*, and *Travisia* sp.) and the amphipod (*Protohaustorius wigleyi*). In addition, benthic megafuana were retrieved from fish trawls on the bottom in the ebb shoal by Wirth (2001), and the most abundant taxa included starfishes (Asteroidea), horseshoe crabs (*Limulus polyphemus*), portly spider crab (*Libinia emarginata*), blue crab (*Callinectes sapidus*), knobbed whelk (*Buscyon carica*), channeled whelk (*Busycotypus canaliculatus*), Atlantic rock crab (*Cancer irroratus*), lady crab *(Ovalipes ocellatus*), right-handed hermit crabs (Paguridae), and purple-spined urchin (*Arbacia punctulate*). There was one occurrence of the American lobster (*Homarus americanus*) in one of the winter trawls, which likely originated from the nearby jetty rocks.

USACE (1975) describes the benthic community in Indian River Bay as primarily a soft-bottom community composed of infaunal species such as the dwarf tellin clam, dwarf surfclam (*Mulinia lateralis*), bloodworm (*Glycera dibranchiate*) and the trumpet worm (*Pectinarice gouldi*). Other benthic species occurring large numbers in Rehoboth Bay and Indian River Bay include the hard clam (*Mercenaria mercenaria*), the snails: *Anachis translirata* and *A. avara*, a polychaete worm (*Clumenella torquata*), and the amphipods: *Corophium* sp., *Ampelisca abdita* and *A. vadorum*.

4.2.2.2 Fisheries

The proximity of several embayments allows the coastal waters of Delaware to have a productive fishery. Many species utilize the estuaries of Delaware Bay, Rehoboth Bay and Indian River Bay for forage and nursery grounds. The finfish found along the Delaware Atlantic coast are principally seasonal migrants. Winter is a time of low abundance and diversity as most species leave the area for warmer waters offshore and southward. During the spring, increasing numbers of fish are attracted to the Delaware Atlantic coast because of its proximity to several estuaries, which are utilized by these fish for spawning and nurseries (USACE, 1996).

Surveys conducted in the 1960s in the project area identified 38 species in Indian River Bay. Five of those species accounted for 92% of the catch. These species were striped killifish (*Fundulus majalis*), Atlantic silverside (*Menidia menidia*), mummichog (*Fundulus heteroclitus*), winter flounder (*Pleuronectes americanus*), and bay anchovy (*Anchoa mitchilli*). Although Indian River Bay does not support a commercial fishery, it indirectly contributes by serving as a spawning and nursery area for several economically valuable species. Species known to spawn in the bay include winter flounder, bay anchovy, Atlantic menhaden (*Brevoortia tyrannus*), Atlantic silverside, and hogchoker (*Trinectes maculatus*). Species known to use the upper estuary as a nursery area, include spot (*Leiostomus xanthurus*), weakfish (*Cynoscion regalis*), Atlantic menhaden, and bluefish (*Pomatomus saltatrix*). Recreational fishing in Indian River Bay is popular and sport fishes include winter and summer flounder (*Paralichthys dentatus*), snapper (*Lutjanus campechanus*), blue fish, striped bass (*Morone saxatilis*), and blowfish (*Sphoerides maculatus*). Diadromous species such as alewife (*Alosa pseudoharengus*), blueback herring (*Alosa aestivalis*), striped bass and American eel (*Anguilla rostrata*) use the inlet to reach freshwater tributaries for spawning or growth to maturity (NMFS, 2013).

More recently, a fish survey was performed by Wirth (2001) within the Indian River Inlet Ebb Shoal area (Table 12). Fish collections were accomplished seasonally using commercial and experimental trawls and gill nets. Thirty-four species were captured in the different gear types over the four seasons. The most abundant species overall included the clearnose skate (*Raja eglanteria*), little skate (*Raja erinacea*), windowpane (*Scophthalmus aquosus*), weakfish, summer flounder, bullnose ray (*Myliobatis freminvillei*), spotted hake (*Urophycis regia*), scup (*Stenotomus chrysops*), smallmouth flounder (*Etropus microstomus*), Atlantic butterfish (*Peprilus triacanthus*), Atlantic croaker (*Micropogonias undulatus*), spot, and southern stingray (*Dasyatis americana*).

Table 12. Indian River Inlet Ebb Shoal Area Seasonal Fish Occurrence (Wirth, 2001)

Common Name	Scientific Name	Winter	Spring	Summer	Fall
Shortnose sturgeon	*Acipenser brevirostrum*		R		
Alewife	*Alosa pseudoharengus*				R
Bay anchovy	*Anchoa mitchilli*				O
Silver perch	*Bairdiella chrysoura*				R
Atlantic menhaden	*Brevoortia tyrannus*			R	R
Dusky shark	*Carcharhinus obscurus*		R	O	
Sandbar shark	*Carcharhinus plumbeus*		R		
Black sea bass	*Centropristis striata*		O	O	
Squids*	Cephalopoda	R	R		R
Atlantic herring	*Clupea harengus harengus*	R			
Weakfish	*Cynoscion regalis*		R	A	A
Southern stingray	*Dasyatis americana*		O	A	
Roughtail stingray	*Dasyatis centroura*		R		
Smallmouth flounder	*Etropus microstomus*		A		
Spot	*Leiostomus xanthurus*		R	A	O
Northern kingfish	*Menticirrhus saxatilis*		O		R
Atlantic croaker	*Micropogonias undulatus*		R	A	A
Smooth dogfish	*Mustelus canis*		A	O	O
Bullnose ray	*Myliobatis freminvillei*		A	A	
Summer flounder	*Paralichthys dentatus*	A	O	A	A
Butterfish	*Peprilus triacanthus*		A		O
Winter flounder	*Pleuronectes americanus*	O			
Bluefish	*Pomatomus saltatrix*			R	O

Common Name	Scientific Name	Winter	Spring	Summer	Fall
Northern searobin	*Prionotus carolinus*		R		
Striped searobin	*Prionotus evolans*		O		R
Clearnose skate	*Raja eglanteria*	A	A	A	A
Little skate	*Raja erinacea*	A	A		A
Winter skate	*Raja ocellata*				R
Windowpane	*Scophthalmus aquosus*	A	A	A	A
Northern puffer	*Sphoeroides maculatus*		R	O	R
Spiny dogfish	*Squalus acanthias*	R			
Scup	*Stenotomus chrysops*		A		
Dusky pipefish	*Syngnathus floridae*		R		
Northern pipefish	*Syngnathus fuscus*		R		R
Hogchoker	*Trinectes maculatus*		O	O	O
Spotted hake	*Urophycis regia*		A	R	O
# Taxa		8	26	17	22

*A pelagic invertebrate captured

R=rarely encountered; O=Occurrence, A=Abundant

A small commercial and recreational whelk fishery exists along the Delaware Atlantic Coast. Two species are principal targets: the channeled whelk (*Buscyon canaliculatum*) and the knobbed whelk (*B. carica*). These species (often referred to as “conchs”) are harvested either by pots or dredges.

4.2.2.3 Essential Fish Habitat (EFH)

Under provisions of the reauthorized Magnuson-Stevens Fishery Conservation and Management Act of 1996 (MSA), the entire project area including the borrow areas, nearshore and intertidal beach areas were designated as Essential Fish Habitat (EFH) for species with Fishery Management Plans (FMPs), and their important prey species. EFH is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity under the MSA. The MSA requires Federal agencies to perform an EFH assessment when activities may affect EFH. The EFH mapper was queried for EFH species and their life stages at a representative point to all project features at Latitude 38.608 and Longitude -75.055. This query generated a list identifying 24 species and their respective life stages presented in Table 13.

Table 13. Summary of EFH Designations in Waters Associated with Indian River Inlet and North Beach and their Habitat Requirements Per Associated Life Stage

Managed Species	Eggs	Larvae	Juveniles	Adults
Albacore Tuna (*Thunnus alalunga)*			**Habitat:** Offshore. Highly migratory. Epipelagic. Summer brings in juveniles to the productive waters of the northeastern Atlantic. **Prey:** wide variety of fishes and invertebrates	
Bluefin Tuna (*Thunnus thynnus*)			**Habitat:** Offshore. Coastal and pelagic habitats of the mid-Atlantic Bight and the Gulf of Maine and Cape Lookout, from shore (excluding Delaware Bay) to the continental shelf break; temperatures from 4 to 25 C, water depts range from 40-100m, but typically <20m . **Prey:** zooplanktivorous fish and crustaceans	
Skipjack Tuna (*Katsuwonus pelamis*)				**Habitat:** Offshore/nearshore. epipelagic, occurring in waters ranging in temp. from 14.7 to 30 C. Remain at the surface during the day and may descend to depths of 260m at night. **Prey:** Opportunistic feeders on a variety of fish (eg. herrings), crustaceans, cephalopods, mollusks, and sometimes other skipjack tunas.
Yellowfin Tuna *(Thunnus albacares)*			**Habitat:** Offshore pelagic habitats from Cape Cod to mid-east coast of Florida and the Blake Plateau; **Prey:** Opportunistic including cephalopods, fish and crustaceans	
Red hake *(Urophycis chuss)* (Steimle et al. 1998)	**Habitat:** Surface waters, May – Nov.	**Habitat:** Surface waters, May –Dec. Abundant in mid-and outer continental shelf of Mid-Atl. Bight. **Prey:** copepods and other microcrustaceans under floating eelgrass or algae.	**Habitat:** Pelagic at 25-30 mm and bottom habitat at 35-40 mm. Young inhabit depressions on open seabed. Older juveniles inhabit shelter provided by shells and shell fragments. **Prey:** small benthic and pelagic crustaceans (decapod shrimp, crabs, mysids, euphasiids, and amphipods) and polychaetes).	**Habitat:** Offshore. Demersal. Inhabit bottom habitats in depressions with a substrate of sand and mud in depths of 10 – 130 meters in temperatures below 12°C. **Prey:** small benthic and pelagic crustaceans (decapod shrimp, crabs, mysids, euphasiids, and amphipods) and polychaetes).
Windowpane flounder *(Scopthalmus aquosus)* (Chang, 1998)	**Habitat:** Offshore/nearshore Surface waters <70 m, Feb-July; Sept-Nov.	**Habitat:** Offshore/nearshore Initially in pelagic waters, then bottom <70m,. May-July and Oct-Nov. **Prey:** copepods and other zooplankton	**Habitat:** Offshore/nearshore Demersal. Bottom (fine sands) 5-125m in depth, in nearshore bays and estuaries less than 75 m **Prey**: small crustaceans (mysids and decapod shrimp) polychaetes and various fish larvae	**Habitat:** Offshore/nearshore Demersal. Bottom (fine sands), peak spawning in May , in nearshore bays and estuaries less than 75 m **Prey**: small crustaceans (mysids and decapod shrimp) polychaetes and various fish larvae
Atlantic sea herring *(Clupea harengus)* (Reid et al., 1998)			**Habitat:** Pelagic waters and bottom, < 10 C and 15-130 m depths **Prey:** zooplankton (copepods, decapod larvae, cirriped larvae,	.

Managed Species	Eggs	Larvae	Juveniles	Adults
			cladocerans, and pelecypod larvae)	
Bluefish *(Pomatomus saltatrix)*			**Habitat:** Offshore/nearshore Pelagic waters of cont. shelf and in Mid-Atlantic estuaries from May-Oct. **Prey:** squids, smaller fish	**Habitat:** Offshore/nearshore Pelagic waters; found in Mid-Atlantic estuaries April – Oct. **Prey:** squids, smaller fish
Long finned squid *(Loligo pealei)*	**Habitat:** Offshore/nearshore EFH for pre-recruits is pelagic waters over the Cont. Shelf			
Atlantic butterfish *(Peprilus tricanthus)*			**Habitat:** Offshore/nearshore Pelagic waters in 10 – 360 m	**Habitat:** Offshore/nearshore Pelagic waters **Prey:** jellyfish, crustaceans, worms, and small fishes
Summer flounder *(Paralichthys dentatus)*		**Habitat:** Offshore/nearshore Pelagic waters, nearshore at depths of 10 – 70 m from Nov. – May.	**Habitat:** Offshore/nearshore Demersal waters (mud and sandy substrates) in lower estuaries. **Prey:** mysid shrimp	**Habitat:** Offshore/nearshore Demersal waters (mud and sandy substrates). Shallow coastal areas in warm months, offshore in cold months. **Prey:** fish, shrimp, squid, worms
Scup *(Stenotomus chrysops)*			**Habitat:** Offshore/nearshore Demersal waters	**Habitat:** Offshore/nearshore Demersal waters offshore from Nov – April. **Prey:** small benthic inverts.
Black sea bass *(Centropristus striata)*			**Habitat:** Offshore/nearshore Demersal waters over rough bottom, shellfish and eelgrass beds, man-made structures in sandy-shelly areas	**Habitat:** Offshore/nearshore Demersal waters over structured habitats (natural and man-made), and sand and shell areas. **Prey:** benthic & near bottom inverts., small fish, squid
Spiny dogfish *(Squalus acanthias)*				**Habitat:** Offshore/nearshore Pelagic or demersal in coastal waters in depths from 1-500m. **Prey:** ctenophores, salps, scallops, squid, euphausiids, *Cancer* spp. crabs, herring, bay anchovies, hakes, sand lances, mackerels, butterfish, spot, croaker and weakfish.
Sand tiger shark *(Odontaspis taurus)*		**Habitat** Offshore/nearshore Shallow coastal waters, bottom or demersal. Lower DE Bay and adjacent coastal areas from 19 to 25 C, salinities range from 23 to 30 ppt at depths of 2.8-7.0m in sand and mud areas; migrate from area in the fall.	**Habitat:** Offshore/nearshore Shallow coastal waters, bottom or demersal. Lower DE Bay and adjacent coastal areas from 19 to 25 C, salinities range from 23 to 30 ppt at depths of 2.8-7.0m in sand and mud areas; migrate from area in the fall.	**Habitat:** Offshore/nearshore Shallow coastal waters, bottom or demersal **Prey:** small fishes (including mackerels, menhaden, flounders, skates, sea trout, and porgies), crabs, squids.
Atlantic angel shark *(Squatina dumerili)*		**Habitat:** Offshore/nearshore Shallow coastal waters	**Habitat:** Offshore/nearshore Shallow coastal waters	**Habitat:** Offshore/nearshore Shallow coastal waters, bottom (sand or mud near reefs)
Atl. Sharpnose shark *(Rhizopriondon terraenovae)*				**Habitat:** Shallow coastal waters
Common Thresher Shark (*Alopias vulpinus*)		**Habitat:** Shallow coastal waters	**Habitat:** Shallow coastal waters	**Habitat:** Shallow coastal waters
Dusky shark *(Charcharinus obscurus)*		**Habitat:** Shallow coastal waters		

Managed Species	Eggs	Larvae	Juveniles	Adults
Sandbar shark *(Charcharinus plumbeus)* (Pratt 1999)		**Habitat:** Offshore/nearshore Shallow coastal waters; submerged flats (1-4 m). HAPC is identified within lower DE Bay and possibly HCS Area.	**Habitat:** Offshore/nearshore Shallow coastal waters; submerged flats (1-4 m). HAPC is identified within lower DE Bay and possibly HCS Area..	**Habitat:** Offshore/nearshore. Shallow coastal waters; submerged flats (1-4 m). HAPC is identified within lower DE Bay and possibly HCS Area.
Smoothhound Shark Complex (*Mustelus mustelus*) (Atlantic Stock)		**Habitat:** Shallow coastal waters	**Habitat:** Shallow coastal waters	**Habitat:** Shallow coastal waters
Clearnose skate (*Raja eglanteria*)			**Habitat:** Offshore/nearshore continental shelf waters but will occasionally come into shallow waters and bays during the summer months. Eggs are laid off the coast in spring. **Prey:** Fish, benthic organisms and other macro-invertebrates. .	**Habitat:** Offshore/nearshore continental shelf waters but will occasionally come into shallow waters and bays during the summer months. Eggs are laid off the coast in spring. **Prey:** Fish, benthic organisms and other macro-invertebrates.
Little skate (*Raja erinacea*)			Offshore/nearshore Same as clearnose skate, but they leave shallow water during summer.	Offshore/nearshore
Winter skate (*Raja ocellata*)			Offshore/nearshore Occur in deep continental shelf waters.	Offshore/nearshore

In Wirth (2001), a total of fourteen species with Federal management plans and identified EFH within the borrow areas were collected throughout the year. Some of these species exhibited seasonal and habitat-based preferences. The ebb shoal area exhibited abundant summer flounder, windowpane, and clearnose skate throughout most of the year. The spring exhibited abundance of butterfish. Occurrences of black sea bass and dusky shark were in the spring and summer months.

4.2.2.4 Marine Mammals and Sea Birds

A number of marine mammals are frequent transients along the nearshore and offshore waters of the Delaware Coast. Cetaceans (whales and dolphins) include the right whale (*Eubalaena glacialis*), the humpback whale (*Megaptera novaengliae*), minke whale *(Balaenoptera acutorostrata), fin whale (Balaenoptera physalus), sei whale (Balaenoptera borealis)* and rarely, the blue whale *(Balaenoptera musculus*) are likely to venture into the nearshore waters along the Delaware Atlantic Coast. Bottlenose dolphins (T*ursiops truncates*) are common summertime migrants and can be found in nearshore water along Delaware's beaches. Coastal waters may also be visited by the harbor porpoise (*Phocoena phocoena*). Pinnipeds (seals) are more frequently encountered during the fall, winter and spring months along the coast, and may commonly be observed hauling out on to the beaches. These include the gray seal *(Halichoerus grypus),* harbor Seal *(Phoca vitulina),hooded seal (Cystophora cristata) and* harp Seal *(Pagophilus groenlandicus).*

Many species of birds utilize open water marine habitat for feeding and resting. Birds utilizing this area may include gulls, terns (*Sterna spp*.), razorbills (*Alca torda*), scoters (*Melanitta* spp.), long-tailed duck (*Clangula hyemalis*) and loons (*Gavia* spp.). Open ocean species such as gannet (*Sula bassanus*), blacklegged kittiwake (*Rissa triadctyla*), storm petrel

(*Oceanites oceanicus*), and shearwaters (*Puffinus/Calonectris* spp.) may also be present offshore. Black and surf scoters and long-tailed ducks are common sea ducks in the nearshore during the fall and winter months.

4.2.3 Threatened and Endangered Species

The affected areas that include beaches, nearshore marine habitats, inlet and estuarine habitats could potentially be inhabited with special status species including Federal and State Threatened or endangered species (Table 14).

Table 14. Special Status Species along Delaware's Atlantic Coast Beaches and Coastal Waters

Scientific Name	Common Name	Taxon	Habitat	Federal Status	State Status	State Rank	SGCN Tier
Balaenoptera musculus	Blue whale	Mammal	Marine/pelagic	E	E	*	*
Balaenoptera physalus	Fin whale	Mammal	Marine/pelagic	E	E	*	*
Megaptera novaeangliae	Humpback whale	Mammal	Marine/pelagic	E	E	*	*
Eubalaena glacialis	N. Atlantic Right whale	Mammal	Marine/pelagic	E	E	*	*
Balaenoptera borealis	Sei whale	Mammal	Marine/pelagic	E	E	*	*
Physeter macrocephalus	Sperm whale	Mammal	Marine/pelagic	E	E	*	*
Charadrius melodus	Piping Plover	Bird	Sandy beaches/overwash areas	T	E	S1	1
Calidris canutus	Red Knot	Bird	Sandy beaches/overwash areas	T	E	S1M	1
Laterallus jamaicensis jamaicensis	Eastern Black Rail	Bird	Saltmarshes	T	E		
Sterna dougallii dougallii	Roseate Tern	Bird	Sandy beaches/overwash areas	E			
Sterna antillarum	Least Tern	Bird	Sandy beaches/overwash areas	--	E	S1B	1
Sterna hirundo	Common Tern	Bird	Sandy beaches/overwash areas	--	E	S1B	1
Sterna forsteri	Forster’s Tern	Bird	Sandy beaches/overwash areas	--	E	S1B	1
Rynchops niger	Black Skimmer	Bird	Sandy beaches/overwash areas	--	E	S1B	1

Scientific Name	Common Name	Taxon	Habitat	Federal Status	State Status	State Rank	SGCN Tier
Haematopus palliates	American Oystercatcher	Bird	Sandy beaches/overwash areas	--	E	S1B	1
Dermochelys coriacea	Leatherback sea turtle	Reptile	Marine/pelagic /demersal	E	E	*	*
Lepidochelys kempii	Kemp's Ridley sea turtle	Reptile	Marine/pelagic /demersal	E	E	*	*
Chelonia mydas	Green sea turtle	Reptile	Marine/pelagic /demersal	T	E	*	*
Caretta caretta	Loggerhead	Reptile	Marine/pelagic /demersal	T	E	*	*
Eretmochelys imbricata	Hawksbill sea turtle	Reptile	Marine/pelagic /demersal	E		*	*
Acipenser oxyrinchus oxyrinchus	Atlantic sturgeon	Fish	Marine/pelagic/demersal	E	E	*	*
Danaus plexippus	Monarch Butterfly	Insect	Widespread – dune habitats in affected area with goldenrod flowers	PT			
Photuris bethaniensis	Bethany Beach Firefly	Insect	Interdunal swales (freshwater wetlands)	C	E	S1	1
Amaranthus pumilus	Seabeach Amaranth	Plant	Sandy beaches/overwash areas	T	--	S1	--
Dicanthelium dichotonum	Witch Grass	Plant	Interdunal swales (freshwater wetlands)	--	--	S2	--
Fimbristylis caroliniana	Carolina Fimbry	Plant	Interdunal swales (freshwater wetlands)	--	--	S1	--
Sabatia campnulata	Slender Marsh Pink	Plant	Interdunal swales (freshwater wetlands)	--	--	S1	--
Spiranthes vernalis	Twisted Ladies' Tresses	Plant	Interdunal swales (freshwater wetlands)	--	--	S2	--
E=Endangered Species T=Threatened Species; PT=Proposed Threatened C= Candidate Species *Information on State Rank and SGCN Tier not readily available							

Nesting pairs of the piping plover, which are Federally threatened, and State endangered, normally occur within Cape Henlopen State Park and less frequently at the Delaware Seashore State Park. No known piping plover nesting activity has been recently observed within the Indian River Inlet North Shore affected area. The USFWS Information for Planning and Consultation (IPaC) website was accessed on 2/27/2024. The search inputs were for the Phase 2 affected areas including the ebb shoal and the shoreline along the North

Beach. The IPaC resulted in the identification of three Federally listed threatened and endangered species and/or proposed species within the affected area. This included: the roseate tern (endangered), the monarch butterfly (proposed threatened) and the seabeach amaranth (threatened). The roseate tern is a rare visitor in Delaware, but no breeding is known to occur south of Long Island, New York (with an exception in New Jersey).

The American oystercatcher, a state endangered bird, nests on sandy beaches, and has nested on the north side of Indian River Inlet. Other potential colonial beach nesting birds that are listed as endangered in Delaware are: black skimmer (*Rynchops niger*), least tern (*Sterna antillarum*), and the breeding populations of common tern (*Sterna hirundo*) and Forster's tern (*Sterna forsteri*). The rufa red knot (*Calidris canutus rufa*), is a Federally threatened and state endangered shorebird that can be found in lower densities during the spring and fall migrations along Atlantic Coast beaches and could occur within the project area. In wintering and migration habitats, red knots may forage on bivalves, gastropods, and crustaceans along the shoreline (USFWS 2013; Harrington 2001).

The monarch butterfly (*Danaus plexippus*) was proposed to be listed as Federally threatened on December 12, 2024. In North America, monarchs are grouped into two long-distance migratory populations: eastern and western populations. The eastern migratory population is the largest and overwinters in the mountains of central Mexico. In the mid-1990s, an estimated 380 million eastern monarchs made the long-distance journey to overwintering grounds in Mexico, completing one of the longest insect migrations in the world.

Today, the eastern migratory population is estimated to have declined by approximately 80%. The probability of extinction for eastern monarch ranges from 56 to 74%, according to the Service's most recent species status assessment. Threats to monarchs include loss and degradation of breeding, migratory and overwintering habitat; exposure to insecticides; and the effects of climate change (USFWS press release December 2024). Monarchs depend on milkweeds (*Asclepias* spp.) and other nectar-producing flowering plants for their breeding and feeding. The seaside goldenrod is one plant that occurs within the dunes of the affected area that provides an important nectar source for migratory monarch butterflies.

The sea beach amaranth or "pigweed" (*Amaranthus pumilus*) is a Federally threatened plant that primarily occurs on overwash flats at accreting ends of barrier islands and lower foredunes and upper strands on non-eroding beaches. This plant has been found within Cape Henlopen State Park, Delaware Seashore State Park, and Fenwick Island State Park. Most recently, seabeach amaranth was observed growing 1.4 miles north of the Indian River Inlet. This species has not been found in any of the municipal Federal project beaches, but did occur within the affected project area of the North Beach area of Indian River Inlet in 2002. However, the severe erosion of the North Beach area in recent years makes this area unlikely to be inhabited by sea beach amaranth.

The State endangered and Federally threatened and endangered sea turtles including the loggerhead sea turtle (*Caretta caretta*), Kemp's ridley sea turtle (*Lepidochelys kempii*), leatherback sea turtle (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and green sea turtle (*Chelonia mydas*) may occur in waters along the Delaware Atlantic Coast from the spring through the fall. Whales protected under the Endangered Species Act or Marine Mammal Protection Act include the humpback whale (*Megaptera novaengliae*), North Atlantic right whale (*Eubalaena glacialis*) minke whale (*Balaenoptera acutorostrata*), fin whale (Balaenoptera physalus), sei whale (*Balaenoptera borealis*) and rarely, the blue whale (*Balaenoptera musculus)* may also be present within Delaware Coastal Waters.

The New York Bight distinct population segment (DPS) of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) was recently listed as endangered by the NMFS. Atlantic sturgeon are anadromous, spending a majority of their adult life phase in marine waters, migrating up rivers to spawn in freshwater then migrating to brackish water in juvenile growth phases. The Atlantic sturgeon are known to spawn within the Delaware River and migrate along the coast of Delaware. Studies have indicated that depth distribution appears seasonal, with sturgeon inhabiting the deepest waters during the winter and the shallowest during summer and early fall. Tagging studies by Fox and Breece (2010) confirm that nearshore waters along the Delaware Atlantic coast are frequently inhabited by Atlantic sturgeon with over 85% of those detected within State waters. Recent telemetry studies suggest that there is a strong seasonal pattern of arrival and departure of Atlantic sturgeon along the Delaware coast. Marine phase Atlantic sturgeon return to Delaware's coastal waters in mid-late March through mid-late May and depart between early September and mid-December. During the summer months, it is reported that these sturgeon may either return to the Delaware River to spawn (mature adults), occupy river/upper estuary foraging areas (mostly sub-adults), or remain in the lower estuary mouth/Cape Henlopen region. Few Atlantic sturgeon have been detected in Delaware's Atlantic coastal waters during the winter months (mid-December through mid-March) (coordination between Dr. Dewayne Fox, Delaware State University and DNREC WSCRP referenced in a WSCRP to USACE letter dated 12/9/2014).

The sand tiger shark and sandbar shark are listed as NOAA species of concern and are frequently in Delaware's coastal waters between April and November. The project areas are also listed as EFH for the sand tiger shark and sandbar shark.

The Bethany Beach firefly (*Photuris bethaniensis*) is a state endangered insect species and Federal candidate species that inhabits freshwater interdunal wetland swale habitats along portions of the Delaware Atlantic coast. Other state species that occur in these types of habitats are the following plants: witchgrass, Carolina fimbry, slender marsh pink, and twisted ladies' tresses. A review of the National Wetlands Inventory mapper indicates that none of these habitats occur within or in close proximity to the affected area along the North Shore Beach.

4.3 Cultural and Social Environment

4.3.1 Cultural Resources

The identification of cultural resources on USACE Civil Works projects is an important part of the overall Federal responsibility. Numerous laws pertaining to identification, evaluation, and protection of cultural resources, Indigenous rights, curation and collections management, and the protection of resources from looting and vandalism establish the importance of cultural resources to our Nation's heritage. With the passage of these laws, the historical intent of Congress has been to ensure that the Federal government protects cultural resources. Guidance is derived from several cultural resources laws and regulations, including but not limited to Sections 106 and 110 of the National Historic Preservation Act (NHPA) of 1966 (as amended); Archaeological Resources Protection Act (ARPA) of 1979; Native American Graves Protection and Repatriation Act (NAGPRA); and 36 CFR Part 79, Curation of Federally Owned and Administered Archeological Collections. Implementing regulations for Section 106 of the NHPA and NAGPRA are 36 CFR Part 800 and 43 CFR Part 10, respectively. All cultural resources laws and regulations should be addressed under the requirements of the National Environmental Policy Act (NEPA) of 1969, as amended. USACE summarizes the guidance provided in these laws in ER 1130-2-540.

4.3.1.1 Area of Potential Effect

For the purposes of this EA, there are four proposed Areas of Potential Effect (APEs). The first three apply to the beach nourishment to be completed in 2025, and a fourth that would apply to future needs.

APE1 – The beach nourishment extent along the North Beach as shown in red on Figure 3.

APE2 – The Indian River Inlet flood shoal located just inside the inlet bay area as shown in pink on Figure 3.

APE3 - called *IRI -Ebb A,* includes the use of the sediments in the Flood Shoal located just inside the bay inlet, and the Indian River Inlet Borrow Area, which was previously surveyed (Cox 2001). It is shown as a rectangle on Figure 14.

APE4 - called *IRI -Ebb B*, includes the larger shoal area surrounding the Indian River Inlet Borrow Area, and has not yet been surveyed for cultural resources. It is shown as an irregular shape surrounding Ebb A on Figure 14.

4.3.1.2 Cultural Context

The Cultural Context presented contains excerpts from the cultural context section of the report titled*, Phase I Submerged and Shoreline Cultural Resources Investigation, Delaware Atlantic Coast, Rehoboth Beach and Dewey Beach, Sussex County, Delaware* (Cox 2001).

4.3.1.3 Prehistoric Context

Evidence recovered from prehistoric sites within the Appalachian Ridge and Valley physiographic province of Pennsylvania indicates successive periods of human occupation dating from at least 12,000 years ago. Three distinct periods are generally used: Paleoindian, Archaic and Woodland. These periods are best understood by viewing them as constructs created by archaeologist's base on changes in technology and environment.

Paleoindian Period

The retreating of the continental glaciers at the end of the Pleistocene period, roughly 17,000 to 15,000 BP, and subsequent climate changes set forth shifts in flora and fauna communities that set the stage for prehistoric occupation in the Project Area (Watts 1979;

Custer 1996). At the maximum advance of the Wisconsin glacial intrusion, the Project Area was a cold, wet, and grassy tundra (Watts 1979). The plant communities on this periglacial landscape consisted of ericaceous shrubs, dwarf birch, and a variety of grasses (Watts 1979:458). This plant profile is based on floral remains recovered from the Longswamp bog in Longswamp, Pennsylvania (Watts 1979), and it is believed that the landscape in the Project Area would have been very similar to Longswamp. The faunal community hosted in this environment included megafauna such as mammoth and mastodon. As the climate warmed after 13,000 BP, floral and faunal communities changed. The environment in eastern Pennsylvania has been described as a "hodgepodge, or mosaic, of different vegetation communities" in this period (Custer 1996:97).

According to Custer, grassland settings were mixed within a larger coniferous spruce-pine forest, and deciduous tree species were present along streams and rivers and near wetlands. Fauna was equally varied. Finds made in York County include small mammals such as moles, shrews, squirrels, lemmings, voles, and mice; carnivores such as wolf, skunk, otter, weasel, and fox; and caribou and white-tailed deer (Custer 1996:98). Kinsey (cited in Custer 1996:98) claimed there had been grazing mammoth and browsing mastodon in Lancaster County, but they were most likely gone by the time of Paleoindian occupation (Custer 1996:99).

Carr and Adovasio (2002:3) date the earliest human occupation in Pennsylvania to 16,000 BP. They sub-divide the Paleoindian period into pre-Clovis (16,000-11,500 BP), Early Paleoindian (11,500-10,000 BP), and Late Paleoindian (10,000-9,000 BP). In general, subsistence strategies are not well understood in any of these periods. The most important data found in Pennsylvania relating to Paleoindian subsistence comes from the Shawnee Minisink site, located in the Delaware River drainage (Gingerich 2007). As noted by Custer (1996:111), "the presence of varied floral and fish remains in a Paleoindian context underscores the view that Paleoindian groups were hunters, gatherers, and fishers who opportunistically used whatever resources were available." This view is supported by Gingerich's (2007:144) analysis of recent excavations at Shawnee Minisink from which he concluded that Paleoindians at that site followed an "opportunistic collection" strategy.

Two lithic procurement patterns have been suggested for Paleoindian settlement in Pennsylvania: the cyclical pattern and the serial pattern (Carr and Adovasio 2002:40). In the cyclical pattern, which Carr and Adovasio hypothesize was followed within the Piedmont of southeastern Pennsylvania (near the Project Area), quarries of high-quality lithic material were the main focus of scheduled movements and the probable location of base camps. According to Gardner (cited in Carr and Adovasio 2002:40), this settlement system depended on a foraging radius of 40 to 150 km. The jasper quarries within the Hardyston district (Anthony and Roberts 1988), Flint Run in Virginia (Carr 1992), and the Iron Hill quarries in northern Delaware (Stanzeski and Hoffman 2006) served as focal points for Paleoindian movements in the Middle Atlantic region. In the serial pattern, several smaller quarry sites would have been exploited. As described by Carr and Adovasio (2002:40), this pattern may have been more dictated by the procurement of food resources than the collection of lithic materials.

Two of the best-known Paleoindian sites in Pennsylvania are the Meadowcroft and Shoop sites. While Meadowcroft is in the far southwestern corner of the state, Shoop is located not very far west of the Project Area in an upland setting within the Susquehanna River drainage. First discovered in the 1930s, this site, and the material recovered from it, have been examined and reexamined by virtually all the major prehistorians working in Pennsylvania (Carr and Adovasio 2002:30). The site produced thousands of lithic artifacts, including at least 100 fluted points, most of them purportedly made of Onondaga chert, an identification that has been questioned by both archeologists and geologists. The closest source of this chert is western New York State, which is a considerable distance from Shoop. Endscrapers (n=600) were the most common tool type found and there were also hundreds of retouched and utilized flakes, sidescrapers, late-stage bifaces, and wedges.

The Archaic Period

Around 10,500 BP, the rapid melting of the glacial remnants far to the north allowed for a broad air mass shift (Custer 1996:33). While in the Late Pleistocene, the glacial air mass interacted with the warm water from the Gulf Stream current to produce cold and very wet weather, dryer and warmer air replaced this (Custer 1996:33). According to Dent (1991:129-131), by 9,200 BP the pine and birch forest of 10,500 BP had shifted to pine-oak, and a boreal forest covered the landscape as a complex mosaic of ecosystems. Although it was warmer and dryer than in previous times, it was roughly 6°F colder with double the precipitation of today (Dent 1991:11). The beginning of the Early Archaic period (~10,000 BP - ~9,000 BP) is marked by a gradual transition from Paleoindian adaptations to adaptations to the changing environment. While the Early Archaic is one of the most poorly understood periods in Middle Atlantic prehistory, archeological evidence for variations in settlement patterns, food procurement strategies, lithic technologies, and population levels have been recognized.

Stylistically, the Early Archaic is marked by the introduction of notched and stemmed bifaces such as the Palmer and Kirk types. Gardner (1974:24) argues that the change to notched biface technology probably signifies changes in hunting technology and the introduction of the Atlatl. Adding to the argument, Stewart has suggested that the extinction of most of the Pleistocene megafauna and the retreat of the glacial ice sheets opened new ecosystems to smaller game animals such as white tailed deer and elk and this, in turn, led to the specialization of Early Archaic hunting adaptations. There is little evidence for plant food processing, or the tools to do so, probably because specialized gathering and processing had not yet become a large part of the food economy (Gardner 1974). The recovery of ground cherry, blackberry, cherry, grape, and pokeberry, as well as pioneer species such as amaranth, chenopodium, and smartweed in Early Archaic contexts from the Shawnee-Minisink site, however, demonstrates that plant foods were utilized to some degree (Dent and Kauffman 1985).

Middle Atlantic settlement models of the Early Archaic are not very different from those of the preceding Paleoindian period. Sites were located on similar landforms, but there is evidence for a greater diversity of site types, intensity of utilization, and increased total population (Gardner 1989). In the Piedmont of the Middle Atlantic, both Paleoindian and Early Archaic components have been identified in poorly drained floodplains and upland bogs (Custer 1996:120). High quality lithic sources continued to be exploited, but new materials such as rhyolite, quartzite, and argillite were also used (Raber et al. 1998:126). Greater group mobility, fostered by moderated climate, hunting and gathering adaptations, and possible population increases, is evident in distinguishable site types in a variety of landscape settings (Raber et al. 1998:126).

The Middle Archaic is generally correlated with the Atlantic climatic phase which roughly dates to about 9,000 – 5,500 BP. The warming and drying of the environment continued in the Project Area with oak and hemlock deciduous forest replacing the pine forests (Carbone 1976:189). Terminal Pleistocene megafauna were gone before this point, and elk and caribou herds were thinning (Kingsley et al. 1990:11). The decreased presence of grazing animals is likely linked to the decrease in open grasslands and similar habitats that supported these species (Custer 1996:100). New ecotones opened and became the focus of shifting animal communities (Custer 1996:100). In the Project Area, the faunal assemblage became essentially modern in this period (Custer 1996:100; Dent 1991:134; Kingsley et al. 1990:11). Middle Archaic roughly coincides with the appearance of distinctive bifurcate base bifaces such as the LeCroy and St. Albans types (Ritchie 1961). These types are considered characteristic of the Middle Archaic, although a diversity of biface morphologies continues well into the Woodland period (Custer 1996; Lewis 1999). Few of the diverse biface styles of the later Middle Archaic are considered diagnostic, and it is likely that many Middle Archaic sites are lumped into the Late Archaic time period based on nondescript stemmed and notched points (Custer 1996). The Middle Archaic, however, represents a recognizable divergence form the preceding Early Archaic/Paleoindian periods (Custer 1996:133).

Changes in land-use practices are evident at the beginning of the period. Instead of focusing on high quality lithic quarries, base camps are found on floodplains and associated special procurement sites are found in a variety of upland settings (Carr 1998). Using the analysis of rhyolite artifact distribution, Stewart and Cavallo (1991) have suggested that the foraging radius of Middle Archaic base camps was reduced in size compared to earlier times and increasingly focused on local resources. Evidence for the exploitation of botanical remains in the form of hazelnuts was found in the Middle Archaic Stratum IX at the Sandts Eddy site on the Delaware River in Northampton County (Bergman et al. 1994:164). Excavations at this and other Middle Archaic sites in the Middle Atlantic during the past two decades have greatly expanded our knowledge of settlement patterns, although very few Middle Archaic components have been identified in the vicinity of the Schuylkill River Valley.
Around 6,000 to 5,000 BP the climate reached a warm and dry maximum called the Sub-Boreal period (Kingsley et al. 1990:11; Stewart 1991:104). This shift is thought to have had drastic effects on the plant, animal, and human populations of the region (Custer 1996:180). Evidence includes an increase in pine, a reduction in oak, negative effects on dry intolerant species, windblown sediment deposition, and an increase of grasses, shrubs, and herbs further south in the Middle Atlantic region (Stewart 1991:106). Importantly, Custer (1996:182) hypothesizes that the increase in oak/hickory forest over oak/hemlock within the Project Area provided a higher carrying capacity than in the Atlantic period (Custer 1996:182), and he considers the adaptations that emerged at the inception of the Late Archaic period (5,000-4,000 BP) to be the most significant changes in all of southeast Pennsylvania prehistory. A degree of sedentism, as well as alternations in settlement and subsistence patterns, appear to coincide with the beginning of the Late Archaic

.

Stylistically, the lithic artifact assemblage does not differ dramatically from the Late-Middle Archaic. A broad range of notched and stemmed bifaces represents most Late Archaic assemblages in the Middle Atlantic region. Although Late Archaic biface morphologies overlap, numerous stylistic types have been identified as representative of various time periods and locations (e.g., Bare Island, Lackawaxen, Schuylkill, Lamoka, and Brewerton). Regional traditions have also been based on biface types and related traits. Traditions such as Maritime Archaic, Shield Archaic, and Laurentian Archaic represent identifiable groups of adaptations covering broad geographic regions across the northeastern United States (Kinsey 1977). The Piedmont Archaic represents the Late Archaic tradition in the Schuylkill River Valley and much of the surrounding area. Narrow stemmed points, hand sized “chopper” bifaces, numerous varieties of ground stone tools, and non-cryptocrystalline lithics, such as argillite, rhyolite, and quartzite, are hallmarks of the Piedmont Archaic (Kinsey 1977:376).

An intensification of resource utilization characterizes the Late and Terminal Archaic (Dent 1995:188, 200-208). Technologically, this intensification is expressed as the expanded use of ground stone tools, the appearance of steatite (soapstone) vessels and, in riverine and coastal areas, fishing implements in the form of notched cobble net sinkers. The presence of storage features has also been noted, although not on the scale seen in the later Woodland period. Such storage features have been viewed as strategies for minimizing risk, reflections of collector forager settlement systems (Binford 1980), and perhaps evidence of incipient social inequality, although reflections of status differentiation are virtually absent in the Archaic in Pennsylvania (Raber et al. 1998:129).

A series of distinctive technologies characterize a period referred to as the Transitional (Terminal) Archaic (4,000–3,000 BP). Although the diagnostic portions of the Transitional Archaic tool kit are distinctive, the underlying settlement pattern is not very different than that of the Late Archaic. As defined by Witthoft (1953), the characteristics of Transitional Archaic cultures are the use of steatite (soapstone) bowls and a distinctive class of biface known as “Broad spears” for their high width/length ratios and high width/thickness ratios. Kinsey (1972) argues for a functional interpretation of the broad spear as more suited to fishing than hunting. Broad spears and Orient Fishtail bifaces are not the only diagnostic Transitional Archaic types, but they are the most visible part of a stemmed and notched point assemblage.
Another addition to the Transitional Archaic toolkit is the use of non-organic cooking containers. The adoption of this technology was gradual, but it likely had an impact on native inhabitants’ production and cooking efficiency (Custer 1996). The earliest ceramics in the Delaware Valley, identified as Marcy Creek Plain (Stewart 1998a:58), appear to be an adaptation in clay to the preexisting soapstone bowl technology (Custer 1996:220). Formed in the same rectangular to ovoid shape with lugged handles and flat bottoms as soapstone bowls, the Marcy Creek Plain pots are constructed of molded clay tempered with crushed chunks of steatite. A series of flat and rounded bottom ceramic types followed Marcy Creek and continued into the Orient Phase and beginnings of Early Woodland.

The Woodland Period

Most scholars consider the Woodland period to have begun at about 3,000 BP, or slightly earlier. As presented by Custer (1982, 1984, 1996), Woodland I is defined by four characteristics: 1) the development of estuarine and riverine adaptations that were stable and intensive enough to produce repeatedly reused base camp sites along the major drainages' floodplains; 2) population growth at single site locations, or more intensive site utilization, which produced sites much larger than Middle Archaic macro-band camps; 3) the appearance of foraging and collecting adaptations in areas less productive than riverine settings; and 4) the participation in exchange networks that moved raw materials as well as finished artifacts across large areas.

Although the Woodland period is generally distinguished among Early, Middle and Late subperiods in the Northeast, the Early and Middle Woodland in the Mid-Atlantic region have been treated together because of fewer temporal and cultural distinctions in the region. In general, the Early Woodland subperiod is signaled by the appearance of new cultural traits, namely the widespread use of ceramics, and intensification of older traits, including mortuary ceremonialism, which were carried over from the Late and Terminal Archaic (Ritchie 1980). Although the beginning the Early Woodland subperiod is generally marked at 3000 BP, there is inevitable overlap of several hundred years with the Terminal Archaic. During the Late Woodland (AD 1000-1600), which lasted up until European contact, the adoption of horticulture had an integral part in population growth and subsistence and settlement systems and saw the establishment of large villages in mostly riverine settings.

The Contact Period

The Indigenous people the Europeans met along the Delaware River during the late 16th and early 17th centuries were descended from the Unami and Munsee speaking people who had populated the Delaware and the Hudson River valleys for centuries.

The name collectively attributed to the descendants of such Unami and Munsee speaking people is Delaware, yet the word Delaware is not of indigenous origin. The term "Delaware" derives from the title given to Sir Thomas West, the third Lord de la Warr, who was appointed as the English governor of Virginia in 1610. European colonists applied the term "Delaware" to reference the Unami and Munsee speaking groups of the River Valley, who called themselves "the People" or Lenape, or the Lenni Lenape, the "True People".
In 1680, although most colonists of the time regarded Indians as subhuman, William Penn was careful to treat the Indians as sovereign nations, entitled to fair play, dignity, and respect. For many decades, Penn was able to enforce the statute forbidding settlers on land prior to negotiated purchase from the Indians. However, after Penn's death, a major wave of German and Scotch-Irish immigration created a population boom in the seaboard areas, increasing the need for additional land.

By this time, the region was controlled by William Penn's heirs, John Penn and Thomas Penn, along with the Penn's family land agent, James Logan, who was already illegally selling Indian land in the Lehigh Valley to the new European immigrants. In order to legitimize the theft of Indian Lands, Penn's heirs hatched a plan to convince the Indians to release the Lehigh Valley to them once and for all.

At dawn on September 19, 1737, three colonists and three Indians set off on the most peculiar "walk" in Pennsylvania's history. Their purpose was to measure out a land purchase that Thomas Penn claimed his father had made from the Indians fifty years earlier. Thomas Penn had in his possession a document that he and James Logan claimed was a deed signed by Unami and Munsee chiefs in 1686, selling the land north of Tohickon Creek to William Penn. According to this document, the amount of land would be measured by a day and a half's walk from an agreed upon starting point (Encyclopedia Britannica, n.d.).

The Indians presented with this document were suspicious and voiced their objections. Nevertheless, Penn and Logan went ahead with their plans and hired three of the fastest colonists to carry out the measurement of the land. The colonists selected for this task trained for months and were assisted by white settlers who cleared paths through the forest, arranged for supplies, and placed boats to ferry them across waterways. Two of the three colonist “walkers” dropped out from exhaustion on the second day, leaving only one to complete the task. In the final tally, he covered approximately 65 miles in eighteen hours.
The Penn family compounded the swindle with creative surveying and boundary setting, using the walk to claim possession of the Lehigh Valley, an area containing the modern cities of Allentown, Bethlehem, and Easton. The fraudulent land claim is now called “the Walking Purchase”. The Walking Purchase and the Revolutionary war marked the beginning of the removal of the Unami and Munsee speakers from the Delaware Valley westward and northward into the frontier.

4.3.1.4 Historic Context

Historic activity in Delaware Bay dates to 1609 when Henry Hudson first located the bay while surveying the northeast coast of North America for the Dutch East India Company. Hudson noted the entrance of Delaware Bay, but did not explore up into the upper bay and river. His observations of Delaware Bay were recorded and eventually stimulated a significant interest in additional exploration, trade, and colonization of the region. In 1614 the State General of Holland granted the merchants of Amsterdam and Hoorn exclusive privileges to trade between 40 and 45 degrees of latitude in an area identified as the territory “new Netherland.” The first Dutch explorers came to Delaware Bay from New Amsterdam (New York City) in October 1614. By decree from the Hague, October 11, 1614, the owners of five Dutch ships were authorized to establish the United Company of Merchants with the exclusive rights to explore the area between New France in the north and Virginia to the south. Captain Cornelius Hendrickson then became one of the first to explore the bay aboard the Onrust. Captain Hendrickson produced the first chart of Delaware Bay and River in 1615. Included in a brief report submitted to the Dutch merchants, Hendrickson claimed to have found “certain lands, a bay and three rivers situated between 38 degrees and 40 degrees (Westlager 1961). Soon the Dutch merchants set up trading stations and settlements at various locations along the banks of Delaware Bay and River. In 1623, the Dutch East India Company constructed the first of several fortifications on the east shore of the bay.

Swedish explorers were also active in the Delaware Bay region. In 1629, the Swedish West Indian Company purchased from the indigenous people, a two-mile wide tract of land on the west side of the bay which extended 32 miles from Cape Henlopen north to a location above present Bowers Beach, Delaware. Although the purchase was ratified in 1630, it was not until Peter Minuit arrived with an expedition in 1638 that the Swedish attempted to settle the region (Hazard 1850). The Swedes eventually settled further upriver at a more suitable landing site on the west shore near present day Wilmington.

For the next three decades the Swedes and Dutch co-existed in the Delaware Valley until 16645 when the British, under the command of Sir Robert Carr, assumed command of the region. When King Charles II made a grant of lands in the Delaware Valley to his brother James, Duke of York, the duke sent a flotilla of warships under Carr's direction to subjugate the Dutch and Swedes and institute British control in the area. After several years of limited interest on the part of the Duke of York, King Charles II deeded a substantial portion of the territory to William Penn in 1682. Penn subsequently established an English colony, Pennsylvania, on the Delaware River with Philadelphia as its capital (Weslager 1961). In 1684, Penn also acquired the "three lower counties", present day Delaware, from the Duke of Yor4k to add to his Pennsylvania holdings. With Penn's involvement the colonization process and economic growth in Delaware became ties more closely to Philadelphia and Pennsylvania. Throughout the colonial period, settlement in the lower Delaware Valley consolidated in regions where solid banks came to Delaware's edge; for most of the waterfront was marshland and unhealthy for habitation. The high land was often some distance up a creek navigable only by shallow-draft vessels. Dover, Delaware and Salem, New Jersey, were examples of this. Some towns which appeared during the colonial period developed because they were stopping points along the 60-mile stretch of river on the much-traveled route from New York to Baltimore. Philadelphia, in the middle of this line of travel, was not merely a stop on the line but developed into a trade and travel center (Tyler 1955).

Wheat, rye, barley and tobacco were the principle colonial products of Delaware Valley inhabitants. After being hauled by wagon to mills established along the banks of the Schuylkill River, Brandywine Creek, and other swift-water tributaries of the Delaware, the flour was places aboard shallops and taken upriver to Philadelphia for consumption or further shipment. For the duration of the colonial period, the Delaware Valley region remained predominantly agricultural. The agricultural landscape that developed in response emphasized the importance of river and coastal transportation routes over roads. The system of agricultural production and transportation routes facilitated the rise of Philadelphia as one of the most important ports in the British Empire at the onset of the Revolutionary War.

The Revolutionary War disrupted the economic development of the region, as the British blockaded shipping and conducted raids along the shores of Delaware Bay (DeCunso and Catts 1990). Following the conclusion of the war, Delaware Valley merchants, now freed from the restrictions of the Navigation Acts, again prospered. Philadelphia became the most active port in North America, with its ships reaching new markets in the East Indies and across the world. By 1800 there were 40 Philadelphia vessels in the China Trade, about as many more trading in South America, and a considerable number still trading in Europe. The war of 1812 caused a second disruption to the social and economic life of Delaware Valley residents, but shortly thereafter, local inhabitants began to focus again on industry and agriculture. The water link between Delaware Bay and Chesapeake Bay was forged when the Chesapeake and Delaware Canal was opened in 1829. Traffic across the peninsula between the two bays was so heavy that it supported the canal, a previously constructed turnpike, and within a few years, the New Castle and Frenchtown Railroad, one of the first railroads in America (Tyler 1955). Manufacturing came to the upper Delaware Valley in the first half of the 19th century. By 1850 Wilmington had become a leading manufacturer of railroad cars, heavy machinery, gunpowder, textiles, flour, and iron ships (Weslager and Heite 1988).

There was little or no industrial development along the shores of lower Delaware Bay. The slow-moving tidal tributaries lacked the force to power a large industrial plant. The title rivers themselves were too shallow for most seagoing vessels to navigate. In addition to farming, fishing and oystering became major industries of the lower Delaware Bay during the 19th century. For nearly a century after the Civil War, oystering was the primary industry in many towns along the lower estuary in both New Jersey and Delaware fishing industries processing sturgeon and menhaden caught in Delaware Bay also peaked during the second half of the 19th century (Weslager and Heite 1988).

The introduction of steam technology had a dramatic effect on industries throughout the Delaware Valley. Regional companies became leaders in the production of steam engines for railroad locomotives and steamships. Several local companies also made railroad cars and car wheels, before expanding into the production of iron-hulled steamships. Delaware River shipyards gained an international reputation for producing quality iron-hulled steam vessels. Coal fuel was needed to power steam engines. Extensive anthracite coal reserves along the Lehigh and Schuylkill rivers were developed. Call became a leading export for Delaware River ports during the 19th and 20th centuries. Related industries of iron and steel, initially founded in the Delaware Valley since the colonial period, expanded after the 19th century.
The large chemical industry of the Delaware estuary began with the development of several small tanneries in and around New Castle County, Delaware, during the 19th century. Native black oak trees provided tan bark and local livestock production provided skins for the tanners. By the middle of the 19th century, Wilmington became a major producer of leather merchandise. Experiments were conducted in the tanning process that would revolutionize the leather making process. Prosperity gained from gunpowder production during the civil war, allowed the local du Pont company to expand over the next 30 years into one of the world's largest producer of chemicals and munitions. Petroleum related industries and refineries were also established shortly after the discovery of oil in central and northwestern Pennsylvania in the 19th century. Philadelphia refineries are among the oldest in the world still producing refined oil products (Weslager and Heite 1988).

Although Delaware Bay became a major thoroughfare for shipping activities calling on the ports of Philadelphia and Wilmington throughout the colonial period, there has been very limited historic activity along the Delaware’s Atlantic Coast. Much of the limited activity along the coast was related to assisting stranded or wrecked vessels that were attempting to reach Delaware Bay. Maritime activity within the project areas was almost exclusively transient. Vessel crossing the project area were involved with coastal trading networks linking the Delaware River ports and New York with other ports from Maine to Texas. Additionally, maritime traffic across the project areas extended to ports in the Caribbean central and South America.

Historically, Indian River inlet was not used for commercial navigation. Indian River inlet, connecting Indian River Bay and the Atlantic Ocean, was a narrow and unstable passage through the barrier beach until the USACE permanently improved the waterway in the late 1930s. As early as 1882, the US Government allocated money to secure A4 foot channel through the inlet, Bay and Indian River to Millsboro, 6 miles from the mouth. The results of this dredging rapidly disappeared. The inlet closed entirely periodically between 1910 and 1937, causing concern among the local interests who feared the loss of salinity would adversely affect the seafood industry in the bays and estuaries, and they feared flooding might ruin agricultural crops planted near the estuaries. The construction of two parallel stone jetties, 500 feet apart and extending seaward approximately 1500 feet was proposed in 1937. The USACE concluded that the proposed improvements would afford an adequate small boat channel from the Atlantic Ocean to Indian River Bay, and in addition would produce a flow of salt water into the bay sufficient to improve seafood production in those waters. As no commercial traffic used the inlet, the USACE found that the benefits to small craft, and particularly to pleasure craft, in affording access between the ocean and the sheltered waters of these bays is "sufficient in the opinion of the Board of Engineers for Rivers and Harbors, to warrant federal participation in the project" (Department of Army 1937). Indian River inlet is the only entrance to the ocean from the inland waters between Delaware Bay, 15 miles to the north, and Ocean City inlet, Maryland, 25 miles to the south.

4.3.1.5 Previous Investigations

The US Army Corps of Engineers, Philadelphia District (USACE) and others have coastline to identify and evaluate cultural resources that could be impacted by proposed beach nourishment, inlet jetty repair and other construction activities. The following is a summary of this previous work.

Gilbert/Commonwealth prepared a study titled, *Cultural Resources Overview in the Philadelphia COE District, Indian River and Bay, Delaware* in 1978. This study provided a preliminary cultural resources overview of the Indian River and Bay area and identified areas sensitive to cultural site locations.

Thunderbird Archaeological Associates prepared a Phase 1A cultural resource investigation in 1983 titled, *A Preliminary Cultural Resources Reconnaissance of the Delaware Atlantic Coast*. This research identified known archaeological and historic resources along the Atlantic coast beach line and adjacent areas extending from Cape Henlopen south to the state line.

Complementing the above referenced study, an offshore Phase 1A cultural resource study titled, *Underwater Cultural Resources Background Study and Field Survey of the Delaware Inner Continental Shelf*, prepared by Karell Archaeological Services, dated 1984 investigated historic map and archival documentation to identify known shipwreck sites. A predictive model for unidentified shipwreck locations was also prepared.

In a 2001 cultural resources investigation report titled, *Phase I Submerged and Shoreline Cultural Resources Investigation, Delaware Atlantic Coast, Rehoboth Beach and Dewey Beach, Sussex County, Delaware* prepared for the USACE by Dolan Research, Inc., February, 2001, researchers surveyed newly proposed offshore borrow areas “B”, “G” and “Indian River Inlet” Inspection of the remote sensing records confirmed the presence of one target in Borrow Area “G” that is suggestive of potentially significant submerged cultural resources. No potentially significant targets were identified in in the “Indian River Inlet Sand Borrow Area (*IRI Ebb-A*)”.

4.3.2 Socioeconomics

4.3.2.1 Population and Land Use

The affected area includes either state park land or open ocean and estuarine waters, which do not occupy any incorporated communities within the 950 square miles of Sussex County. Sussex County is the southernmost and largest of the three counties in Delaware, encompassing 48% of the state's land. Although it is the largest of the counties it is also the least populated, with only 197,145 year-round residents, totaling 21.9% of the state's permanent population, according to the 2010 Census.

Both the State of Delaware and Sussex County are projected to increase in population over the next twenty years. Sussex County is growing faster than the state of Delaware as a whole.

The affected areas are lightly developed. The North Beach is primarily composed of tidal shoreline and areas classified as beaches and riverbanks (Delaware Seashore State Park) with an adjacent highway and bridge (SR 1) (Table 15). Within the interior inlet where the flood shoal occurs, there are permanent residences (single family homes) on the south side of the interior Indian River Inlet as part of the South Shore Marina. Seasonal campsites and cabins are on both the north and south sides of Indian River Inlet and a U.S. Coast Guard Station along the north side. Burton Island Shoal alternative is bounded on the north by Delaware Seashore State Park to the north, which is composed of predominantly mixed forest, tidal marsh and shoreline. The Middle Island Shoal alternative area contains a tidal marsh island and is bounded by private development including permanent mobile homes (Indian Landing), recreational beaches, and recreational facilities.

The Coastal Barrier Resources Act (CBRA, and previously the Coastal Barrier Improvement Act (CBIA)) is intended to protect fish and wildlife resources and habitat, prevent loss of human life, and preclude the expenditure of Federal funds that may induce development on coastal barrier islands and adjacent nearshore areas. The CBRA established the Coastal Barrier Resources System (CBRS), which consists of mapping of those undeveloped coastal barriers and other areas located on the coasts of the U.S. that were made ineligible for most Federal expenditures and financial assistance. The CBIA of 1990 expanded the CBRS and created a new category of lands known as otherwise protected areas (OPAs). The only Federal funding prohibition within OPAs is Federal flood insurance. Other restrictions to Federal funding that apply to CBRS units do not apply to OPA’s. The North Shore Indian River Inlet is within an OPA, which is part of DE-07P in Delaware Seashore State Park. OPAs only prohibit Federal funding for flood insurance. Project activities are not restricted in OPAs.

Table 15. Land Use and Landcover (LULC) Within Affected Areas and Alternatives

PROJECT FEATURE OR ALTERNATIVE	LAND USE/LAND COVER WITHIN OR ADJACENT TO FEATURE/ALTERNATIVE	LULC Code	Prevailing Use
North Indian River Inlet Beach	Bays and Coves (Tidal) (W)	540	DSSP
	Tidal Shoreline (W)	770	DSSP
	Beaches and Riverbanks (W)	720	DSSP
	Highways/Roads (A)	141	DELDOT
	Inland Natural Sandy Areas (W)	730	DSSP
Indian River Inlet Ebb Shoal	Bays and Coves (Tidal) (W) (A)	540	NAV/SERV
	Tidal Shoreline (A)	770	DSSP
Indian River Inlet Flood Shoal	Bays and Coves (Tidal) (W)(A)	540	NAV/SERV
	Recreational/campground – north and south sides (A)	190	DSSP
	Institutional/Governmental – USCG Station north side (A)	180	DSSP
	Multi-Family Dwellings – State Park Cabins – north side (A)	112	DSSP
	Mixed Forest – north side (A)	430	DSSP
	Marinas/Port Facilities/Docks – north and south side (A)	146	DSSP
	Tidal Emergent Wetland – south side (A)	673	DSSP
	Single-Family Dwellings – south side (A)	111	PRIV
Burton Island Shoal	Bays and Coves (Tidal) (W)(A)	540	NAV/SERV
	Mixed Forest (A)	430	DSSP
	Tidal Emergent Wetland (A)	673	DSSP
	Tidal Shoreline (A)	770	DSSP
Middle Island Shoal	Bays and Coves (Tidal) (W)(A)	540	NAV/SERV
	Tidal Emergent Wetland (W)	673	NAV/SERV
	Beaches and Riverbanks (A)	720	PRIV
	Recreational (A)	190	PRIV
	Other Urban/Built-up Land (A)	170	PRIV
	Mobile Home/Parks/Courts	114	PRIV
W=within feature; A=adjacent to feature DSSP=Delaware Seashore State Park; DELDOT=Delaware Department of Transportation; NAV/SERV=Navigational Servitude; PRIV-Privately Owned			

4.3.2.2 Economic Development

Major industries providing employment in the county as per the census are construction, manufacturing of nondurable goods, and retail trade. Other industries providing employment are health services, educational services, food services; finance, insurance, and real estate; manufacturing of durable goods, wholesale trade; agriculture, forestry, and fisheries; transportation, public administration, communications, and other public utilities. The top sectors in Sussex County were Special Trade Contractors, Eating and Drinking Places, Miscellaneous Retail Trade, and General Building Contractors. The number of employees in these top sectors are not large. Special trades contractors only averaged 5 employees per business in Sussex County, while eating and drinking places averaged 14 employees.

The estimated Bureau of Labor Statistics unemployment rate for Sussex County for 2015 is 4.4%. This is slightly below the state average of 4.9%, and below the national average of 5.3%. Historically, Sussex County generally has a relatively low unemployment rate compared to the national and state averages.

The coastal area differs from the rest of Sussex County, and Delaware, in its reliance on the tourism industry rather than agriculture and manufacturing/processing. In Sussex County, 1/3 of those employed in the county are in retail or services, while another 1/3 are in manufacturing. The coastal study area is devoid of manufacturing, relying almost 100% on the service/retail industry.

Even when economically hard times hit the State's economy (particularly poor agricultural crops or recession in the manufacturing industry), the economy of the Delaware coast should remain buoyant as it serves as a summer resort for the residents of the regional urban and suburban areas.

4.3.3 At Risk Communities

A review of the surrounding land uses of the affected areas do not indicate the presence of at risk and disadvantaged communities vulnerable to disproportionate adverse environmental effects within or immediately adjacent to the affected areas.

4.3.4 Recreation

Recreation services provided by the beach areas are a major draw for tourism along the Delaware Coast, which is a vital part of the State's economy. The affected areas include Delaware Seashore State Park, and the surrounding areas offer numerous recreational opportunities. The ocean side offers residents and visitors boating and beach activities such as swimming, surfing (board and body), skimboarding, surf fishing, sunbathing, and many other beach activities. The North Beach is one of Delaware's premiere surfing beaches with strong advocacy for improving and maintaining the surf break, safety and water quality by groups such as the Delaware Chapter of the Surfriders. The nearshore and offshore offers activities such as boating, wave runners, kayaking, parasailing, and SCUBA diving/snorkeling. Many recreational charter boats, head boats and private boats fish within Indian River Inlet and along the Delaware Atlantic Coast's artificial reefs and structures. These boats generally launch from Indian River Marina, Lewes (Roosevelt Inlet), and Ocean City, MD. The area State Parks offer several surf fishing vehicle access points. Surf fishing and jetty fishing (Indian River Inlet) along the Delaware Atlantic Coast beaches are very popular activities year-round. Generally, recreational fishing along the beaches and Indian River Inlet is most productive in the spring and fall when anglers target fish such as striped bass (rockfish), bluefish, kingfish, summer flounder, weakfish, croaker, spot, red hake and red drum that migrate into inshore waters. Anglers can also target several shark species, but are required to release prohibited species such as sandbar shark and sand tiger shark. The jetties of IRI are a popular spot to catch tautog (blackfish) and other species transiting the inlet. Many of the State Park beaches are often filled with vehicles with surf fishing tag permits that allow them to drive on the beach. State laws require that vehicle occupants must be actively fishing and can only access the beaches from designated access points in the State Parks. Surf fishing and jetty fishing activities significantly slow down following the fall runs as the coastline has fewer numbers of targeted species in the area.

Nearshore and offshore fishing is also a popular activity where wrecks, artificial reefs, and lumps hold fish. Some of the same species targeted by surf fishers can be caught by boat on headboats/party boats, charter boats and private boats originating out of Indian River Inlet, Delaware Bay, and Ocean City, MD. Reef and other structured bottoms usually hold black seabass, tautog, scup and flounder. Highly pelagic species such as dolphinfish (*Coryphaena hippurus*), tunas and billfish (Xiphioidea) are targeted further offshore. The Inland Bays offer activities such as clamming, crabbing, fishing, hunting, sailing, windsurfing, and birdwatching.

Recreational interests are an important constituency along the Delaware Atlantic Coast and are represented by many advocacy organizations that promote their interests. Surfing and fishing are two such interests that are well represented in this area.

4.3.5 Visual and Aesthetic Values

Aesthetics refer to the sensory quality of the resources (sight, sound, smell, taste, and touch) and especially with respect to judgment about their pleasurable qualities (Canter, 1993; Smardon et al. 1986). The aesthetic quality of the study area is influenced by the natural and developed environment. The beachfront of the affected municipal areas is developed with homes, hotels, condominiums, restaurants, retail businesses, and boardwalks. However, these resort towns draw on the high aesthetic values of the seashore environment, which includes clean sandy beaches, dunes, and ocean views. Resident and visitor beachgoers are attracted to the area for the beach scenery and clean, attractive beaches and structures that are present in the affected area. The State Park beaches including Cape Henlopen State Park, Delaware Seashore State Park, and Fenwick Island State Park offer visitors a more natural aesthetic quality with natural beaches, vegetation, wildlife, and surf.

5.0 ENVIRONMENTAL EFFECTS

The environmental effects presented in this section include the preferred alternative, which includes the completion of the Phase 2 portion of the restoration of Indian River Inlet North Beach berm and dune system for approximately a distance extending approximately 5,000 feet north from the north jetty of the inlet. The completion of the Phase 2 beach restoration will require approximately 500,000 cubic yards of sand to be dredged from the Indian River Inlet Ebb Shoal (IRI-Ebb A) and placed along the North Beach shoreline. The preferred plan also includes the future restoration of the North Beach shoreline, on an as needed basis either to supplement the existing sand bypass plant operation or for major storm repairs and would utilize either the Indian River Inlet Flood Shoal or the Indian River Inlet Ebb Shoal (both IRI Ebb-A and IRI Ebb-B) as the sand sources. This section also considers the effects of the no action alternative.

5.1 Physical Environment

5.1.1 Floodplains

No Action: No action will continue with severe erosion along the North Beach shoreline, which will leave critical infrastructure such as State Route 1 more vulnerable to flooding, wave attack and overwash.

Preferred Alternative: The dredging of sand within the Indian River Inlet area ebb or flood shoals would occur entirely within open water subtidal environments and will not modify the floodplain or induce flooding. The placement of beachfill sand along the North Beach would occur in a severely eroded area within the VE zone along the Atlantic Coast shoreline. This activity will benefit infrastructure within the adjacent AE zone by providing coastal storm risk management benefits and will not modify the floodplain and/or induce flooding.

5.1.2 Climate

No Action: Without any action, changes in climatic conditions could lead to increased ocean temperatures, ocean acidification, sea level change, changes in currents, and upwelling and weather patterns, and has the potential to cause changes in the nature and character of the coastal ecosystem (USACE, 2017).

Preferred Alternative: The dredging of sand within the Indian River Inlet area ebb or flood shoals and beachfill placement will not entirely negate the effects of changes in climatic conditions and sea level change but would help maintain a more stable shoreline along the North Beach.

5.1.3 Coastal Hydraulics and Hydrodynamics

No Action: With no action, there would be no effect on coastal hydraulics and hydrodynamics. The processes of long-shore transport would still occur with an interruption created by the inlet jetties resulting with a sand deficit on the updrift side of the north jetty, which consequently results in severe erosion along the North Beach shoreline. The processes that contribute to shoaling that created both the Indian River Inlet Ebb Shoal and Flood Shoal would continue.

Preferred Alternative: Dredging within the presently delineated borrow area located directly offshore of the center line of Indian River Inlet would increase depths through the center of the ebb shoal complex. The depth of cut would be approximately 10 ft deeper than average depths of the existing and surrounding bathymetry. The effects of dredging the ebb shoal in the delineated area are considered in view of inlet sand transport, tidal currents, and wave processes.

The direction of net sand transport is from south to north along the shorelines adjacent to Indian River Inlet, and the inlet ebb shoal complex provides a natural pathway for sand to bypass the inlet from the south shoreline to the north shoreline. Sand that bypasses naturally across the ebb shoal reattaches to the north shoreline at a point approximately 5,000 ft north of the inlet. This natural inlet bypassing process interrupts supply of sand to the segment of the north shoreline located immediately north of the inlet. The Indian River Inlet bypass plant is designed to supply sand to this segment of shoreline that is cut off from the natural inlet bypassing process.

Sand removed from the delineated ebb shoal borrow area will be placed on the beach north of the inlet to restore the critically eroded shoreline that has resulted from inactivity of the bypass plant in recent years. Dredging of the borrow area will temporarily reduce the rate of natural sand bypassing across the inlet ebb shoal complex. Because the borrow area is in the active ebb shoal transport zone, it is expected to infill relatively rapidly and be restored to pre-dredge conditions within two to three years. During recovery of the borrow area, the rate of sand transport across the ebb shoal to the north shoreline attachment point will be reduced, but sand placed in the fill area north of the inlet will feed the shoreline north of the fill area to make up for the temporarily reduced rate of natural bypassing. As a result, dredging the ebb shoal is not expected to produce any negative impact on shoreline change of the adjacent beaches.

Dredging the delineated ebb shoal borrow area is not expected to substantially alter tidal current patterns or velocities. Any minor changes in tidal currents caused by the excavation will be temporary and will fully diminish as the borrow area recovers. Additionally, because the inlet ebb jet flows directly across the borrow area, the excavated area will continue to be subjected to strong tidal exchange, circulation, and mixing through the vertical water column that will deter formation of stagnant anoxic and hypoxic conditions in the dredged area.

Deepening of the delineated borrow area will temporarily increase the potential for wave energy to propagate into the inlet. Relative changes in depth in the borrow area compared to ambient depths and typical incident wave conditions will result in increases in wave energy on the order of approximately 5% based on linear wave theory assumptions. This magnitude of change in wave energy is not expected to substantially alter navigation conditions through the inlet or significantly modify wave conditions on the adjacent beaches. As the ebb shoal recovers, any changes in wave energy propagation will attenuate and revert to pre-dredge conditions.

For future north beach renourishments that may be required either in the absence of or in supplement to the operation of the bypass plant, consideration will be made to expand the proposed borrow area to encompass the south lobe of the ebb shoal. The south lobe of the ebb shoal has grown substantially in recent decades. This growth of the south lobe has altered wave and sand transport patterns on the south side of the inlet to the point of reducing the rate of longshore transport into the bypass plant borrow area located on the beach immediately south of the inlet. Dredging the south lobe of the ebb shoal will benefit the system by (a) restoring sand transport rates and patterns that existed previously on the south side of the inlet prior to growth of the south lobe and (b) enhancing capability of the bypass plant to operate at the design rate of production which is approximately 100,000 CY of sand pumped annually from the south beach to the north beach.

5.1.4 Geology

No Action: With No Action, continued sea level change would likely increase flooding and wave attack along the Atlantic Coast shoreline. The geomorphological processes of erosion and siltation and shoreline retreat would occur with potential effects to naturally occurring shorelines. Erosion, subsidence, and flooding events would continue.

Preferred Alternative: The dredging of either the Ebb Shoal or Flood Shoal complexes would affect the recently deposited Holocene sands and place them on the surface beach sands and nearshore of the North Beach shoreline nearby. Dredge cuts from within either of the borrow areas would not exceed ten feet deeper than existing deeper bathymetry and would remain within the Holocene units and therefore, would not have any effect on the Columbia, Pocomoke or Manokin aquifers.

5.1.5 Topography and Bathymetry

No Action: With No Action, continued erosion with direct wave attack of the North Beach would create a deflated beach profile adjacent to SR 1 and would threaten this important roadway through either overwash or undermining.

Preferred Alternative: The restoration of the beach berm and dune will result initially in a considerably wider berm that would extend the berm (dry portion of the beach) out approximately 250 feet. As described in Figure 12, the beachfill will adjust to a flatter foreshore slope while the berm diminishes in width over time as the sands become re-distributed into the nearshore. The berm may form escarpments during this phase, which will become smoothed out from normal wave processes. This process is expected to result in a flatter beach profile after a few storm cycles following the initial placement.

The dredging of the Ebb and Flood shoal areas would result in cuts approximately ten feet deeper than the pre-existing bathymetry. These cuts would be filled in through sloughing from adjacent deposits and in-filling from the dynamic inlet processes that originally formed these shoals. A ten-foot cut could affect approximately 31 acres of marine bottom to obtain 500,000 cubic yards of sand. Dredging would increase the depths of the shoal and may reduce the shoal profile to the same bathymetry surrounding the shoal. The affected portion of the IRI Ebb Shoal A is in depths of 8.8 m to 13.1 m (29 ft. to 43 ft.) and the southern portion (IRI-B) depth ranges from 4.0 m to 8.5 m (13 ft. to 28 ft.). Initially, the post dredge cuts could result in depths of 11.9 m to 16.2m (39 to 53 feet) for IRI-A, and for IRI-B, post dredge depths would be 7 m to 11.6 m (23 ft. to 38 ft.). For the flood shoal, future dredging would be limited to a depth of -24 ft. NAVD, which is the permitted depth for previous times this area was used for sand. Based on vibracore data, similar substrate characteristics would remain. The processes that created the IRI Ebb and Flood shoals are expected to regenerate these features over the long-term.

5.1.6 Soils

No Action: With No Action, continued erosion of the North Beach would occur resulting in increased losses of beach sands through cross shore and longshore currents.

Preferred Alternative: Sediments from the Flood and Ebb Shoals will be predominantly fine sands with some medium sands. Based on the sand texture data provided in Table 3, the beachfill sands will be slightly finer than the existing beach sands. This difference will not have adverse effects on the existing beach profile, beach fauna, or on recreation.

5.1.7 Indian River Inlet Ebb Shoal Sediments

No Action: With no action, it is expected that sands would continue to accumulate within the ebb shoal area particularly within the southern lobe of the ebb shoal complex.

Preferred Alternative: The removal of approximately 500,000 cubic yards of sand to complete the Phase 2 portion of the project would result in a maximum 10-foot cut in the ebb shoal, which would leave a depression in that location. It is expected that natural in-filling with similar sandy sediments would occur soon after dredging is completed since this area is in a dynamic, high-energy location where fine-grained materials are not likely to accumulate, but sand transport mechanisms are active. In-filling of the dredge cuts are expected to result in a re-establishment of the shoal feature over time. This effect is also expected for future uses of both the ebb shoal and flood shoal complexes as sand sources.

5.1.8 Hazardous, Toxic and Radioactive Waste

No Action: The no action alternative is not expected to increase the likelihood of encountering or generating any HTRW.

Preferred Alternative: An updated review of the DEN State database does not provide any indications of significant HTRW within the beachfill placement area or the sand borrow areas. However, this does not rule out a potential for encountering HTRW from unknown sources.

Dredging sand from within the proposed sand sources along the Delaware Atlantic Coast has a potential for encountering MEC associated with past artillery target practice activities along the Delaware Atlantic Coast. Therefore, it is necessary that safeguards are implemented to avoid any potential for exposure of MEC to the public and workers during and after construction.

Because a potential for encountering MEC has been identified for the existing and proposed borrow areas, MEC screening devices would be placed on the dredge intake or in pipeline section prior to reaching the dredge pump, and at the discharge end of the pipeline on the beach. Specifically, the screening device on the dredge intake would prevent the passage of any material greater than 1.25 inches in diameter and the discharge end screening device would retain all items 0.75 inches in diameter or larger. The beachfill operation would be overseen by an Ordnance and Explosives Safety Specialist(s) (OESS) from the Corps of Engineers Military Munitions Design Center. The OESS will be on-site or in the vicinity (within a 15-minute response time after notification) during the duration of the placement of beachfill. Strict inspection protocols and procedures would be implemented for inspection of screens and detection of oversized materials and our detection of MECs to insure worker and public safety. MEC screening measures have been in place since 2004 on all of the Delaware Atlantic Coast Federal beachfill projects.

The contractor would be responsible for proper storage and disposal of any hazardous material such as oils and fuels used during the dredging and beach nourishment operations. The U.S. EPA and U.S. Coast Guard regulations require 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 effects to water quality from construction activity. No accidental spills of diesel fuel from the dredge plant or tender vessels are expected.

5.1.9 Sediment Quality

No Action: The no action alternative is not expected to incur any deleterious effects on sand resource areas.

Preferred Alternative: Sediment quality analyses performed for the three shoal areas (IRI Flood Shoal, Burton Island Shoal and Middle Island Shoal) interior of the inlet and one area offshore of the inlet (IRI Ebb A) did not identify any chemicals of particular concern when compared to the Delaware HSCA sampling (Table 6 thru Table 10). There were no exceedances of Delaware HSCA screening levels for soils for inorganics (including heavy metals), polynuclear aromatic hydrocarbons (PAHs), pesticides, polychlorinated biphenyls, and dioxins and furans. Additionally, no ecological screening levels from the NOAA Effects Range-Low were exceeded for any of the constituents analyzed. The chemical composition coupled with the grain size analyses (Table 4 and Table 5) of the proposed IRI Flood Shoal and IRI Ebb shoal areas confirm that these areas contain beachfill quality sand suitable for use on the North Beach shoreline.

5.1.10 Water Quality

No Action: The no action alternative is not expected to affect water quality within the affected area and existing water quality conditions would continue to persist.

Preferred Alternative: The discharges associated with dredging and placement of sand would result in short-term minor adverse effects to water quality in the immediate vicinity of the dredging and beachfill placement. The direct effects on water quality result from the associated dredging and discharge of a sand slurry material mixed with water as it is pumped on the beach and nearshore area, which would temporarily increase turbidity/suspended solids at the point of dredging and receiving waters. A turbidity plume would be noticeable in both locations but would dissipate within hours to days after pumping ceases. Based on sediment grain size analyses, the sediments are greater than 90% sands; therefore, suspended particles should settle-out quickly after discharge.

Turbidity could also be generated offshore if a barge or hopper of a hopper dredge is allowed to overflow. This process is called “economic loading”, which is used to maximize sand loads per haul by allowing coarse grained materials to settle into the hopper and fine-grained sediments and mostly water is allowed to overflow back into the water body (Atlantic Ocean). Since the material is beachfill quality sand with little amounts of fines and low-level contaminants present, these effects are also expected to be minor. As such, the proposed project is not expected to violate State of Delaware water quality standards.

The results of the analytical testing of the sediments do not indicate that Delaware water quality criteria would be exceeded during the dredging and placement of beachfill. This was confirmed by the utilization Equilibrium partitioning (EqP), which can predict levels of contaminants that may become dissolved in the water column at the point of dredging, and to further understand the potential ecological effects of sediment contaminant concentrations and bioavailability to aquatic life. This approach was adapted from procedures described in Greene (2010) for application within the Delaware Estuary. EqP theory is a simple mathematical method of estimating the proportion a chemical sorbed to sediment to the chemical dissolved in water. With a known concentration of chemical per unit weight of sediment/soil, and a known weight of total sediment/soil, this method can be used to determine the concentration of the chemical in the water. Assuming linear relationships between sediment concentration, fraction of organic carbon, and the octanol/water partition coefficient, concentrations of organic chemicals in sediment can be multiplied by a factor to yield a concentration of that chemical in the water column. The partitioning between sorbed and dissolved metals, PAH's and PCBs were modeled using the data from the sediment samples presented in Table 5 through Table 9. These outputs were computed as ratios with chronic and/or acute water quality criteria for aquatic life in Delaware.

For heavy metals, the ratio of the inorganic metal concentration in the porewater to the applicable criterion was expressed as toxic units (TUs), where ratios greater than 1.0 suggest exposure concentrations in excess of the criterion and, additionally, the chronic toxic units for cadmium, copper, lead, nickel, silver and zinc were summed to produce an interstitial water benchmark unit (IWBU) as described in EPA, 2005b. Among the samples for the shoal complex areas, there were no individual TUs that exceeded acute or chronic ratio of 1.0 and no chronic IWBUs exceeded the 1.0 suggesting that even the most stringent water quality criteria would be met for metals.

Sediment PCBs were only detected in the sample collected from the Indian River Inlet Ebb Shoal from 75 targeted congeners using EPA Method 1668. No PCBs were detected in the Indian River Inlet Flood Shoal, Burton Island Shoal, and Middle Island Shoal, which analyzed for the 10 PCB homolog groups utilizing EPA Method 680. For both EPA methods, PCBs with an "undetected" result were reported with a value that is 1/2 of the Method Detection Level to provide a conservative concentration estimate since presence is not known below these levels. The estimated concentration data for PCBs were compared with an organic carbon normalized Sediment Quality Benchmark (SQB) (Fuchsman, 2006). If the ratio of the measured organic carbon normalized concentration in the sediment to the SQB is less than 1, then chronic aquatic life toxicity in the sediments is unlikely. All of the estimated PCB values were far below the ratio of 1 for the SQB indicating that there would be no PCB toxicity from dredging and placement activities.

No polynuclear aromatic hydrocarbons (PAHs) were detected in the sediments in the IRI-Ebb A area and the IRI-Flood Shoal area. The samples obtained from the Burton Island Shoal and Middle Island Shoal had low level detections for several PAH's. The method used to evaluate toxicity of the majority of the PAHs was to compare carbon normalized concentrations to literature derived EqP based mechanistic sediment quality guidelines called Equilibrium Partitioning Sediment Benchmarks (ESBs) (Burgess et. al. 2013). Sediment concentrations less than or equal to the ESB values may result in adverse effects to benthic organisms. The results are expressed as a ratio of the organic carbon normalized concentration to the ESB with ratios greater than 1 indicating an increased likelihood of risk to ecological receptors. The resulting ratios were far below the value of 1.0. Therefore, based on the results of the toxicological evaluation for PAHs, there appears to be low to no potential for chronic and acute toxicity to aquatic life from the proposed dredging/dewatering activities.

5.1.11 Air Quality

No Action: The no action alternative is not expected to affect air quality within the affected area and existing air quality conditions would continue to persist.

Preferred Alternative: Air quality effects resulting from the release of carbon monoxide and particulate emissions will occur at the site during project related activities and may be considered offensive but are generally not considered far-reaching. Exhaust from the construction equipment will have an effect on the immediate air quality around the construction operation but should not impact areas away from the construction area. These emissions will subside upon cessation of operation of heavy equipment.

The 1990 Clean Air Act Amendments include the provision of Federal Conformity, which is a regulation that ensures that Federal Actions conform to a non-attainment area's State Implementation Plan (SIP) thus not adversely impacting the area's progress toward attaining the National Ambient Air Quality Standards (NAAQS). In the case of the proposed action, the Federal action is to restore the beach and dune along the North Beach as part of the Phase 2 project, and repairs made on an as needed basis in the future. The U.S. Army Corps of Engineers, Philadelphia District would be responsible for the construction, which includes dredging from a sand borrow area and construction activities along the beach. Sussex County, Delaware is within the Philadelphia-Wilmington-Atlantic City, PA-NJ-MD-DE air region within which the Federal Action will take place and is classified as a marginal non-attainment based on the 2008 8-hour ozone standard.

Total direct and indirect emissions are calculated by determining horsepower-hours (hp-hrs), which are generated by cost engineers as part of the Micro Computer Aided Cost Estimating System (MCACES) cost estimate of the project. The cost estimate provides a detailed account of power equipment, the horsepower of the equipment, and the amount of time the equipment is being used. Once the hp-hrs are generated, a load factor is assigned to the equipment, which provides an average of the degree of how hard the equipment is operating (e.g. full power or half power). Once the hp-hrs are adjusted based on load factor, they are multiplied by the emissions factor, which is an estimate of the amount of emissions produced per hp-hr (an example would be grams of NOx per hp-hr). This value is then converted to tons of the constituent emitted. Indirect emissions for this project are typically computed by estimating the work crew travel trips to the work site and back during the construction period with an estimate of the emissions produced by this activity.

The Preferred Alternative would result in the maintenance of existing regional air quality conditions in New Castle County, Delaware, which is part of the Philadelphia-Wilmington-Atlantic City, PA- NJ-MD-DE nonattainment area for the 8-hour ozone NAAQS. There would be some minor, short-term effects during dredge material placement operations from the use of additional diesel engines and construction equipment during dredge material disposal operations. The use of additional construction equipment during the dredging material placement will produce temporary localized increases in NOx, VOCs, CO, SO2 and PM2.5 emissions.

The use of diesel engines on a hydraulic dredge and associated construction equipment for a typical beachfill dredging project of 500,000 cubic yards will produce temporary localized increases in NOx, VOCs, CO, SO_2 and $PM_{2.5}$ emissions. Based on the size of the operation and duration, air emissions are expected to be below the de minimus threshold for a marginal ozone nonattainment area. An emissions estimate for criteria pollutants is provided in Table 16 and Appendix B. The proposed action would meet de minimus thresholds for ozone (100 tons NOx and 50 tons VOCs per calendar year) and sulfur dioxide (100 tons per year). The other pollutants are in attainment of NAAQS for Sussex County and de minimis thresholds do not apply. Therefore, a General Conformity determination is not required based on the expected de minimus level emissions.

Table 16. Criteria Pollutant Emissions Estimates (Tons)

	NO_x (O_3 precursor)	VOC (O_3 precursor)	$PM_{2.5}$	SO_x	CO
IRI North Beach Restoration (500,000 CY)	**64.4**	**1.9**	**3.2**	**0.04**	**7.7**
Clean Air Act General Conformity Rule Limit (Threshold Tons/Year)	100	50	NA	NA	NA

5.1.12 Noise

No Action: The no action alternative is not expected to affect noise conditions within the affected area and existing noise conditions would continue to persist.

Preferred Alternative: Project-related noise at the placement site during construction will consist of the sound of dredged material passing through the pipe and discharging in a plume of water. Earth-moving equipment, such as bulldozers, will shape the newly deposited dredged material and produce engine noise in the nearby vicinity. These activities would produce noise levels in the 70 to 90 dBA (50 feet from the source) range. Utilizing heavy machinery fitted with approved muffling apparatus reduces noise, and vibration will reduce noise effects, but will not eliminate them.

At the offshore borrow areas, hydraulic suction dredging involves raising loosened material to the sea surface by way of a pipe and centrifugal pump along with large quantities of water. Suction dredgers produce a combination of sounds from relatively continuous sources including engine and propeller noise from the operating vessel and pumps and the sound of the drag head moving across the substrate. Robinson et al. (2011) carried out an extensive study of the noise generated by a number of trailing suction hopper dredgers during marine aggregate extraction. Source levels at frequencies below 500 hertz (Hz) were generally in line with those expected for a cargo ship travelling at modest speed. The dredging process is interspersed with quieter periods when the dragheads are raised to allow the dredge to change positions. Clarke et al. (2003) evaluated sound levels produced by a hopper dredge during its "fill" cycle working in a sandy substrate. They found that most of the sound energy produced fell within the 70 to 1,000 Hz range, with peak pressure levels in the 120 to 140 decibel (dB) range at 40 meters from the dredge. These data correlate well with a study conducted in the United Kingdom which found trailing suction hopper dredge sounds to be predominately in the low frequency range (below 500 Hz), with peak spectral levels at approximately 122 dB at a range of 56 meters (DEFRA, 2003).

In a review by Southall et.al. (2007), several studies showed altered behavior or avoidance by dolphins to increased sound related to increased boat traffic. Clarke et al. (2004) found that cutterhead dredging operations are relatively quiet compared to other sounds in aquatic environments, whereas hopper dredges produce somewhat more intense sounds. Thomsen et al. (2009) conducted a field study to better understand if and how dredge-related noise is likely to disturb marine fauna. This study found that the low-frequency dredge noise would potentially affect low- and mid-frequency cetaceans, such as bottlenose dolphins. Noise in the marine environment has also been responsible for displacement from critical feeding and breeding grounds in several other marine mammal species (Weilgart, 2007). Michel et al. (2013) conducted a review on noise effects to sea turtles and found that there is limited data on sea turtle hearing, no data specifically for sea turtles on which to determine the levels of sound that will cause adverse effects, either temporary or permanent. Michel et al. (2013) cites work done by McCauley et al. (2000) and Finneran and Jenkins (2012), who proposed a behavioral disturbance threshold (for sea turtles) as a weighted sound pressure level of 175 dB re 1 μPa. Noise has also been documented to influence fish behavior (Thomsen et al., 2009). Fish detect and respond to sound utilizing cues to hunt for prey, avoid predators, and for social interaction (LFR, 2004). High intensity sounds can also permanently damage fish hearing (Nightingale and Simenstad, 2001). It is likely that at close distances to the dredge vessel, the noise may produce a behavioral response in mobile marine species, with individuals moving away from the disturbance, thereby reducing the risk of physical or physiological damage. Accordingly, any resulting effects would be negligible.

5.2 Biological Environment

5.2.1 Terrestrial

No Action: No action would continue with losses of terrestrial beach and dune habitats that would adversely affect the flora and fauna that inhabit these areas that are described in 4.2.1.1.

Preferred Alternative: Existing dune vegetation would be disturbed by dune reconstruction in areas where dune erosion occurs, however, the dunes would be replanted with dune grasses. Rapid recolonization of other types of vegetation such as sea rocket and seaside goldenrod, cocklebur, and other dune associated vegetation is expected, which would provide additional diversity. Effects to wildlife species inhabiting the beach and dune areas are expected to be short-term and minor as most are highly mobile and capable of moving outside of the impacted areas until construction ceases. Beach and dune re-construction activities may temporarily displace resting and feeding shorebirds. Beach nesting birds such as piping plover, black skimmer, least tern and American oystercatchers could potentially be disturbed by construction activities, if present.

5.2.2 Aquatic Environment

5.2.2.1 Benthic Environments

5.2.2.1.1 Benthos of Intertidal Zone and Nearshore Zone

No Action: No action is not expected to significantly affect benthic organisms that inhabit the nearshore subtidal zone along the North Beach shoreline. This habitat would likely transgress westward as the shoreline retreats. With transgression, the intertidal zone may experience losses if constrained by a hardened roadway and efforts to maintain that roadway such as exposed stone revetment or steel sheeting.

Preferred Alternative: Beachfill placement would affect approximately 30 acres of marine intertidal and subtidal habitat along the North Beach shoreline. Beachfill placement will directly impact benthic organisms within the intertidal and nearshore subtidal zones of the North Beach through burial. Most of the organisms inhabiting these dynamic zones are highly mobile and respond to stress by displaying large diurnal, tidal, and seasonal fluctuations in population densities (Reilly *et al*., 1983). Species impacted in this zone include the mole crab, coquina clam and the haustorid amphipod. Despite the resiliency of intertidal benthic fauna, the initial effect of beachfill will result in some mortalities of existing benthic organisms. Recolonization is expected to be rapid because this habitat is extremely turbulent and consists of benthic organisms adapted to high disturbance and environmental stresses. Larval and horizontal recruitment is expected from nearby unaffected beaches. However, beach slope may play a role in the ability for intertidal organisms to recover if the slope is severe, which may be the case initially until the foreshore slope adjusts through wave action. Losses of intertidal habitat are offset by gains of this habitat seaward. Losses of nearshore subtidal habitat are minor as this would be offset seaward, likewise. Grain size compatibility analyses conducted on sediments from the proposed sand sources suggest that fine-grained materials (silts and clays) are low and should not significantly affect recolonization of benthic organisms in the intertidal and nearshore zones.

5.2.2.1.2 Benthos of Offshore Zones

No Action: No action is not expected to have any effects on offshore benthic communities.

Preferred Alternative: Essentially, dredging will result in the temporary complete loss and removal of the benthic community within the affected areas of the borrow site. However, this is expected to be a temporary condition. Recolonization by benthic organisms would occur shortly after being impacted as the affected areas would be available for larval and juvenile recruitment along with horizontal migration into the affected areas. Recolonization may initially result in a different benthic community that may change over time. Recovery rates may vary depending on the habitat impacted and the post impact condition of the affected area. Factors such as sediment grain size, dissolved oxygen, and availability of larva and horizontal recruitment can affect the recovery rate of benthos in dredged areas. Two post-dredge monitoring investigations were done by Scott (2009a) and Scott (2009b) in Delaware Atlantic Coastal waters three years after the use of the Fenwick Island South Borrow Area and Area G. Post dredge monitoring of the Fenwick South Borrow area (Scott, 2009a) showed that with the exception of one station, abundances of infauna taxa and major taxonomic groups were similar. Stations in the affected and unaffected areas of the Fenwick South site tended to be dominated by the amphipod *Unciola serrata* and polychaete *Polygordius* spp., which comprised a cluster grouping of the entire southern portion of the Fenwick Island Borrow Area. However, one station did exhibit a significant difference from the other stations with fewer taxa, biomass and abundances, and was dominated by the bivalve *Tellina agilis*. This station was in the deepest part of the affected area and may have been experiencing lingering effects of the dredging because it had the highest percent of fine sands and lowest percent of coarse sands and gravels compared to all of the other stations sampled. Scott (2009b) evaluated the post-dredge environment of borrow Area G and found a highly variable benthic community that attributes changes to the benthic community based on post dredge sediment composition and temporal differences. Stations from affected/deepened portions of the borrow area clustered similarly as those in the Fenwick Island South borrow area where there was a higher percentage of fine to medium sands, and lesser coarse sands and gravels. These stations were dominated by the amphipods *Unciola serrata* and *Tanaissus psammophilus*. Although there were some changes in sediment habitat among the deepened areas, Scott (2009b) concludes that a long-term impact of such a change on higher living resources in the area should be minimal.

The Indian River Inlet ebb and flood shoal complexes are very active with dynamic currents and sedimentation. These areas are expected to infill rapidly with sand shortly after dredging is complete. The existing benthic communities of these areas are adaptable to frequent disturbance. It is expected that these areas will begin to re-establish a benthic community similar to what existed prior to dredging within a few months after dredging.

5.2.2.2 Fisheries

<u>No Action</u>: No action is not expected to have any effects on fisheries (finfish or shellfish) and their habitats.

<u>Preferred Alternative:</u> The potential effects of a dredging and beachfill operation on fishery resources include direct physical injury to organisms, and indirect injury due to factors such as water quality degradation, loss of benthic or planktonic food resources, disruption of spawning or nursery habitats and disruption of spawning activities (USACE, 1992). With the exception of some small finfish, most bottom and pelagic fishes are highly mobile and should be capable of avoiding entrainment into the dredging intake stream or burial at the placement location. Turbidity can clog gills and affect sight feeders. However, turbidity is expected to be temporary and localized to the dredging location and placement sites. It is anticipated that some finfish

would avoid the turbidity plume while others may become attracted to the suspension of food materials in the water column. Minor effects to fish eggs and larvae are expected because these life stages are widespread throughout the Middle Atlantic Bight, and not particularly concentrated in the borrow site or surf zone of the project area (Grosslein and Azarovitz, 1982). The Indian River Inlet is approximately 500 feet wide seaward of the Charles W. Cullen Memorial Bridge and represents the narrowest constriction within the inlet area. The Indian River Inlet Flood Shoal occurs west of the bridge where the interior inlet area opens up to widths ranging from 1,300 ft. to 1,900 ft. Dredging within the Indian River Inlet flood shoal area has the potential to disrupt seasonal fish migrations for migratory fish transiting through the inlet. Therefore, a time of year restriction would be implemented from March 1 to June 30 for dredging the flood shoal sand source to avoid the peak migration period for marine species entering the estuaries. However, the Indian River Inlet Ebb Shoal complex is situated offshore of the inlet within the unrestricted high energy open ocean and is not likely to adversely affect migratory fish since it is not constricted and would not limit fish passage. Therefore, a dredging TOYR is not recommended for the ebb shoal complex. Beachfill placement along the North Beach would not affect migratory fish passage and also would not require a TOYR.

The primary indirect impact to fisheries will be from the immediate loss of a food source by disturbing benthic macroinvertebrate communities. Demersal finfish feed heavily on bottom-dwelling species, thus, the loss of benthos and epibenthos entrained or smothered during the project will temporarily disrupt the food chain in the impact area. This effect is expected to be temporary as these areas become rapidly recolonized by infaunal and epifaunal macroinvertebrates.

Megabenthos such as the channeled and knobbed whelks and horseshoe crabs would be affected during dredging operations and their complete removal within the borrow areas would result. Although these species are present in the borrow areas, they are not known to be particularly concentrated within these locations. It is expected that these species would return following dredging and after some recruitment of the benthic community has occurred.

5.2.2.3 Essential Fish Habitat

<u>No Action</u>: The no-action alternative should not have any effect on EFH as defined by the 1996 Magnuson-Stevens Act.

<u>Preferred Alternative:</u> A review of EFH designations and associated direct and indirect effects along the Delaware Atlantic Coast project area, which is defined by the Indian River Inlet Ebb and Flood Shoal complexes (sand sources) and the beachfill placement location North Beach (north shoreline of IRI) was completed in Table 17. Dredging and beachfill placement have the potential to impact EFH several ways: by direct entrainment of eggs and larvae; the creation of higher suspended sediment levels in the water column, reduce feeding success for site-feeding fish, alter physical bottom habitat structure, eliminate benthic food resources and reduce water oxygen levels. All of these effects are temporary in nature, either during the actual dredging period or for a period thereafter. Substrate conditions typically return to

preconstruction conditions and the benthic community recovers through recolonization provided deep pits are not created. Effects to fish species with designated EFH occurs primarily within inlets and estuaries (*i.e.* inshore) as a variety of fish species migrate in and out of inlets, such as summer flounder. The IRI Ebb shoal complex (IRI Ebb A – 192 acres and IRI Ebb B – 388 acres) occurs in nearshore water in variable depth (13-39 feet). Based on the sand quantities required, it is not likely that the entire sand area would be impacted at one time. A hopper dredge could affect a larger area by making shallow cuts, whereas a hydraulic cutter-suction pipeline dredge could affect smaller areas making deeper cuts. Given the location in the nearshore environment, it is more likely that a hydraulic cutter-suction pipeline dredge would be used. Dredging depths can be variable based on the quality of material and dredging methods. However, these depths/cuts generally would not exceed 10 feet at one time or incrementally.

Table 17. Direct and Indirect Effects on Federally Managed Species and EFH

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
Albacore Tuna (*Thunnus alalunga)*			Albacore tuna juveniles are epipelagic in habit in the offshore and would not be directly affected by dredging/beachfill. Indirect effects would be incurred through temporary disruptions in the food chain from loss of benthic prey species.	
Bluefin Tuna (*Thunnus thynnus*)			Bluefin tuna juveniles are pelagic in habit in the offshore and would not be directly affected by dredging/beachfill. Indirect effects would be incurred through temporary disruptions in the food chain from loss of benthic prey species.	
Skipjack Tuna (*Katsuwonus pelamis*)				Skipjack tuna adults are epipelagic in habit in the offshore and would not be directly affected by dredging/beachfill. Indirect effects would be incurred through temporary disruptions in the food chain from loss of benthic prey species.
Yellowfin Tuna *(Thunnus albacares)*			Yellowfin tuna juveniles are pelagic in habit in the offshore and would not be directly affected by dredging/beachfill. Indirect effects would be incurred through temporary disruptions in the food chain from loss of benthic prey species.	
Red hake *(Urophycis chuss)*	Eggs occur in surface waters; therefore, no direct or indirect	Larvae occur in surface waters; therefore, no direct	**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredge conditions.	**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredge conditions. Shoreline placement areas and stormwater

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
	effects are expected.	or indirect effects are expected.	However, some mortality of juveniles could be expected from entrainment into the dredge. **Indirect:** Temporary disruption of benthic food prey organisms.	outfall construction are not expected to have any effects on red hake habitat. **Indirect:** Temporary disruption of benthic food prey organisms.
Windowpane flounder *(Scopthalmus aquosus)*	Eggs occur in surface waters; therefore, no direct or indirect effects are expected.	Larvae occur in pelagic waters; therefore, no direct or indirect effects are expected.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.
Atlantic sea herring *(Clupea harengus)*			**Direct:** Occur in pelagic and near bottom. Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** None, prey items are planktonic	**Direct:** Occur in pelagic and near bottom. Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** None, prey items are primarily planktonic
Bluefish *(Pomatomus saltatrix)*			**Direct:** Juvenile bluefish are pelagic species. No significant direct effects anticipated. **Indirect:** Temporary disruption of benthic food prey organisms.	**Direct:** Adult bluefish are pelagic species. No significant direct effects anticipated. **Indirect:** Temporary disruption of benthic food prey organisms.
Long finned squid *(Loligo pealei)*	n/a	Pre-recruits are pelagic. No effects are anticipated.		
Atlantic butterfish *(Peprilus tricanthus)*		Larvae occur in pelagic waters. No effects are expected.	**Direct:** Juvenile butterfish are pelagic species. No significant direct effects anticipated. **Indirect:** Temporary disruption of benthic food prey organisms in food chain.	**Direct:** Adult butterfish are pelagic species. No significant direct effects anticipated. **Indirect:** Temporary disruption of benthic food prey organisms in food chain.
Summer flounder *(Paralichthys dentatus)*		Larvae occur in pelagic waters; therefore, no direct or indirect effects are expected.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
			placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.	
Scup *(Stenotomus chrysops)*	n/a	n/a	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Adults should be capable of relocating during impact. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms.
Black sea bass *(Centropristus striata)*	n/a	Larvae are mainly pelagic, however, larvae later become more bottom oriented, which are potentially susceptible to entrainment into the dredge.	**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredge conditions. Black seabass are oriented to rocky bottoms and structure. The north jetty of the inlet, which makes-up intertidal and subtidal rocky habitat may be impacted due to sand partially covering it along the shoreline. **Indirect:** Temporary disruption of benthic food prey organisms.	**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredge conditions. Black seabass are oriented to rocky bottoms and structure. The north jetty of the inlet, which makes-up intertidal and subtidal rocky habitat may be impacted due to sand partially covering it along the shoreline. **Indirect:** Temporary disruption of benthic food prey organisms.
Spiny dogfish *(Squalus acanthias)*			**Direct:** Juveniles are bottom oriented. Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of food chain by removal of benthic food prey organisms.	**Direct:** Adults are bottom oriented. Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of small adults could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of food chain by removal of benthic food prey organisms.
Sand tiger shark *(Odontaspis taurus)*		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of neonates could be expected from entrainment into the		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of young could be expected from entrainment into the dredge because they may be oriented with the bottom. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward.

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
		dredge because they may be oriented with the bottom. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.		**Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.
Atlantic angel shark *(Squatina dumerili)*		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of neonates could be expected from entrainment into the dredge because they may be oriented with the bottom. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of juveniles could be expected from entrainment into the dredge. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Adults are mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.
Dusky shark *(Charcharinus obscurus)*		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Mortality from dredge unlikely because embryos are reported up to 3 feet in length Therefore, the newborn or neonates may be mobile enough to avoid a dredge or placement areas. Shoreline placement area bottom habitats will be temporarily		

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
		impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.		
Sandbar shark *(Charcharinus plumbeus)*		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. However, some mortality of neonates may be possible from entrainment into the dredge or burial in nearshore, but not likely since newborns are approx. 1.5 ft. in length and are considered to be mobile. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Juveniles are mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Adults are highly mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.
Atl. sharpnose shark *(Rhizopriondon terraenovae)*				**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Adults are highly mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.
Smoothhound Shark Complex (*Mustelus mustelus*)		**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Neonates are mobile and are mostly capable of avoiding impact areas. Shoreline placement area	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Juveniles are highly mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward.	**Direct:** Physical habitat in borrow site should remain basically similar to pre-dredge conditions. Adults are highly mobile and are capable of avoiding impact areas. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
		bottom habitats will be temporarily impacted and displaced seaward. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	**Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow and placement sites.	
Little Skate (*Raja erinacea*)			**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredged conditions. Juveniles are highly mobile, and most are capable of avoiding impact areas, although some entrainment into dredge is possible. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. Juveniles are expected to avoid placement areas during construction. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow area and placement sites.	
Winter Skate (*Raja ocellata*)			**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredged conditions. Juveniles are mobile, and most are capable of avoiding impact areas, although some entrainment into dredge is possible. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. Juveniles are expected to avoid placement areas during construction. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow area and placement sites.	
Clearnose Skate *(Raja eglanteria*)			**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredged conditions. Juveniles are mobile, and most are capable of avoiding impact areas, although some entrainment into dredge is possible. Shoreline placement area bottom habitats will be temporarily impacted and	**Direct:** Physical habitat in borrow sites should remain basically similar to pre-dredged conditions. Adults are highly mobile, and most are capable of avoiding impact areas, although some entrainment into dredge is possible. Shoreline placement area bottom habitats will be temporarily impacted and displaced seaward. Adults are expected to avoid placement areas during construction.

MANAGED SPECIES	EGGS	LARVAE	JUVENILES	ADULTS
			displaced seaward. Juveniles are expected to avoid placement areas during construction. **Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow area and placement sites.	**Indirect:** Temporary disruption of benthic food prey organisms and food chain within borrow area and placement sites.

Beachfill placement can affect EFH in the surf zone by displacing intertidal and nearshore shallow habitat, generation of turbidity, and burial/smothering of benthic food prey resources. The displacement of intertidal and shallow nearshore habitat would be likely created seaward assuming that similar substrates remain. Also, beachfill can initially affect fish-holding structures such as manmade rock groins, and nearshore bars and troughs by covering them. Subsequent storms may form new cuts and expose the groins, but these would likely be covered again with periodic nourishment. During construction, turbidity can inhibit respiration and sight feeders but would be a temporary effect once pumping ceases and fine grained sediments settle out. The loss of benthic food resources is a temporary effect as the benthic organisms that inhabit this zone are typically more resilient to frequent disturbances and are capable of rapid recolonization of newly placed beachfill.

In conclusion, of the species identified with Fishery Management Plans, and highly migratory pelagic species known to occur in the vicinity, the potential for adverse effects to EFH is considered temporary and minimal. The neonate stages of several shark species are predominately located in shallower coastal waters, but the proposed dredging/beachfill placement will not result in any habitat conversions. Additionally, since the work is located in highly dynamic environments, regeneration of shoal features is expected to occur within a few years of the disturbance by the same processes that created them.

The effect on benthic organisms (that include food prey items) in the borrow areas is considered to be temporary as benthic studies have demonstrated recolonization following dredging operations within 13 months to 2 years.

At the beachfill placement site (intertidal and nearshore zones), the slurry of dredged material and water pumped onto the beach typically results in an increase in localized turbidity. The Atlantic States Marine Fisheries Commission (Greene, 2002) review of the biological and physical effects of beach nourishment cites several studies on turbidity plumes and elevated suspended solids that drop off rapidly seaward of the sand placement operation. Other studies support this finding that turbidity plumes and elevated TSS levels are typically limited to a narrow area of the swash zone down current of the discharge pipe (USACE, 2001). Fish eggs and larvae are the most vulnerable to increased sediment in the water column and are subject to burial and suffocation. Given the location of the placement site (ocean coast as opposed to inlets) effects to eggs and/or larvae is considered minimal. Juvenile fish and adults are capable of avoiding sediment plumes. Increased turbidity due to placement operations will temporarily affect fish foraging behavior and concentrations of food sources are expected to return to the nearshore zone once placement operations cease due to the dynamic nature of nearshore benthic communities (USACE, 2001). Turbidity effects are anticipated to be minimized by the placement of the dredge pipe above the mean high water line during pump-out and development of the raised beach berm moving along the shoreline. Most shallow water coastal species will leave the area of disturbance at the immediate placement site. No overall conversions of intertidal and subtidal fish habitat are expected as these habitats would be displaced seaward equally along the shoreline. Sand coverage along the north side of the inlet jetty would reduce intertidal rocky shoreline habitat but would become exposed intermittently with erosion.

5.2.2.4 Marine Mammals and Seabirds

No Action: No action is not expected to have any effects on marine mammals and seabirds.

Preferred Alternative: Many marine mammals are highly mobile and capable of avoiding a dredging operation; however, marine mammals could potentially be directly impacted by collisions with moving dredges and support vessels resulting in severe injury or mortality. As discussed in 5.1.11, dredging noises may elicit behavioral responses in some marine mammals near a dredging operation. Most effects of offshore dredging on marine mammals are indirect, which may temporarily inhibit sight feeding and filter feeding from sediment plumes and the temporary loss of benthic forage resources in the borrow area. The beachfill component could have similar effects on nearshore marine mammals with noise and turbidity during pump-out operations. Additionally, active work areas may become temporarily inaccessible to pinnipeds attempting to “haul out” to rest on the beach.

Little is known on the effects of sand dredging on seabirds in the Delaware neashshore coastal waters. Potential effects to seabirds that could occur from dredging borrow areas include direct interactions with dredging equipment and support vessels (causing birds to flee location during foraging or resting; or collisions, which are not as likely), noise, turbidity (affecting sight feeding), benthic habitat alterations (removal or fragmentation of shoals and/or altering bathymetry where depths are inaccessible to benthic feeders), and temporary losses of benthic food resources to seabird feeding guilds that prey on benthic invertebrates or to feeding guilds that prey on fish that feed on benthic organisms. Pelagic seabirds (gulls, terns, kittiwakes, shearwaters, gannet, petrel, etc.) have a wide distribution and are not particularly concentrated in sand extraction areas (Michel et al. 2013). However, heavy use of the nearshore waters by overwintering sea ducks has been documented. The Delaware Division of Fish and Wildlife (WSCRP, 2015) reports that recent surveys have identified larger numbers of scoters, particularly black and surf scoters, as well as long-tailed ducks to be prevalent in the nearshore environment off the Delaware coast during fall and winter months. A review by Michel et al. (2013) discusses that peak numbers of scoters (particularly surf scoters) overwinter in coastal waters (2.2 to 4.1 nautical miles from shore) in depths of 10 meters (32.8 ft.) over sandy shoals to feed on benthic taxa such as bivalves, gastropods, crustaceans, polychaetes and annelids. The Indian River Inlet Ebb Shoal borrow area is ½ mile offshore of the coast. Sand extraction would temporarily impact the food source in these areas by removing the benthic community, which could take up to 2 years to recover after disturbance. Post dredge depths could also potentially affect the accessibility of benthic food resources. The IRI Ebb Shoal A is in depths of 8.8 m to 13.1 m (28 ft. to 41 ft.) and the southern lobe (IRI-

Ebb B) has depth ranges of 4.0 m to 8.5 m (13 ft. to 28 ft.). Michel et al. (2013) and Geo-Marine (2010) report that in a study off the coast of New Jersey, the distribution of scoters peaked at depths of 10 m (32.8 ft.). The existing depths of the IRI Ebb Shoal are variable with post dredge depths of 12 m to 16 m (40 to 50 feet) for IRI-A, and post dredge depths would be 7 m to 11.6 m (23 ft. to 38 ft.) for IRI-B. Therefore, with subsequent in-filling and re-generation of the shoal, the dredge cuts are not expected to make bottom foraging habitat inaccessible to seabirds.

5.2.3 Threatened and Endangered Species

No Action: No action would result in continued loss of terrestrial beach habitat along the North Beach shoreline, which would make this area uninhabitable for beach nesting birds and other coastal species. No action is not expected to have any effects on marine species.

Preferred Alternative: The North Beach has historically supported the nesting of beach nesting birds such as the piping plover, which is Federally listed as threatened and State listed as endangered, and the least tern, American oystercatcher, and black skimmer (both State endangered species).

Beach replenishment can potentially have significant direct and indirect adverse effects on these species. Sand placement can bury nests, and machinery on the beach can crush eggs, nestlings, and adults. Human disturbance related to noise and lights can disrupt successful nesting of these birds (Louis Berger Group, 1999). Also, pipelines used during construction may become barriers to young chicks trying to reach intertidal areas to feed. The presence of these species in the project area will require the implementation of protection measures, which may include the establishment of a buffer zone around any nests and limiting construction to be conducted outside of the nesting period (1 March – 31 August).

Other indirect effects associated with the proposed plan include the temporary reduction in the quality of foraging habitat for piping plover and other shorebirds within the intertidal zone until the area becomes recolonized by benthic fauna such as polychaete worms, mollusks, and crustaceans. This impact is expected to be short-lived as the area could become recolonized as early as a few weeks after filling is completed. The construction of a wider beach may result in the beach becoming more attractive to nesting birds such as piping plover, least tern, and black skimmers. Although this may appear beneficial, it is believed that this could have adverse effects on these species. This is based on the fact that a replenished wider beach may attract these birds away from natural areas with less human disturbance.

Based on previous coordination with the U.S. Fish and Wildlife Service (USFWS) and the Delaware Division of Fish and Wildlife (DFW), North Beach has not had any nesting piping plovers within the last 10 years. However, since this action potentially involves maintaining the beach on an as needed basis, there is a potential to impact future nesting plovers. Therefore, prior to renourishment activities, the District will consult with USFWS and DFW to identify any nesting piping plovers and to establish appropriate buffer zones around any nests, if present. Beach nourishment construction specifications currently have protocols developed in case beach nesting birds are present in an active construction area that provide for monitoring and establishment of buffer zones.

The Federally threatened, red knot, is a migratory shorebird that can be found on Atlantic Coast beaches during spring and fall migrations. Construction during this period (especially the fall migration) could affect foraging patterns by disturbing habitat and temporarily displacing a food source by burying intertidal benthic organisms. Since the affected area is a highly dynamic beach area, this would be a temporary effect.

Another species which may be found within the project area is the Federally-listed threatened plant, seabeach amaranth, which inhabits overwash flats, accreting ends of coastal barrier beaches and lower foredunes of non-eroding beaches. Seabeach amaranth has sporadically appeared along the Delaware Atlantic Coast (within Cape Henlopen State Park, Delaware Seashore State Park and Fenwick Island State Park) and most recently 1.4 miles north of the Indian River Inlet. Therefore, it is possible that seabeach amaranth may become naturally established within the affected project areas within the life of the project. As such, the dunes and upper beach areas that would be affected by beach nourishment should be inspected prior to renourishment activities. If a plant or groups of plants are located within the affected areas, the District would consult with the USFWS and the Delaware Division of Fish and Wildlife – Wildlife Species Conservation and Research Program (WSCRP) to determine an appropriate course of action to avoid impacting this species. This may involve seasonal restrictions, sand stockpiling or relocation of the plant(s) to a safer location.

The proposed Federally threatened monarch butterfly could potentially be present within the dune habitats that contain seaside goldenrod and other nectar bearing flowers. Seaside goldenrod typically flowers in the late summer and into the fall, which is timed with the monarch migration. The proposed beachfill activities would affect severely eroded beach and dune areas where goldenrods may not be established. Seaside goldenrod plants are common in dune habitat areas and are likely to recolonize re-constructed dunes. However, opportunities to enhance their re-establishment on dunes such as planting or seeding will be considered to benefit monarch butterflies.

Using the USFWS IPaC, a biological analysis was performed to provide an effect determination on the three species identified in the IPaC search. This determination resulted in a “no effect” (NE) determination for the roseate tern since it does not nest within the affected area, and “not likely to adversely affect” (NLAA) for the seabeach amaranth and the monarch butterfly provided that conservation measures are implemented as described in Appendix C.

State of Delaware protected species identified in Table 14 include the Bethany Beach firefly (also a Federal candidate species) and the rare plants: witch grass, Carolina fimbry, slender marsh pink, and twisted ladies’ tresses. These species occur within interdunal swales and depressions, which could be in close proximity to project activities. However, they are not likely to be impacted since beach nourishment project activities are mostly limited to the seaward side of the dunes. Any future activities that could occur in these areas (such as access and staging) will be coordinated with the Delaware Division of Fish and Wildlife and Division of Parks and Recreation prior to the action to ensure that appropriate measures can be implemented.

From June through November, Delaware’s coastal waters are inhabited by migratory sea turtles, especially the loggerhead (Federally listed threatened) or the Kemp's ridley (Federally listed endangered). Sea turtles have been known to be adversely impacted during dredging operations that have utilized a hopper dredge. Dredging encounters with sea turtles are more prevalent within waters of the southern Atlantic and Gulf coasts; however, incidences of "taking" sea turtles with hopper dredges have been increasing in waters of the Middle Atlantic Coast. Endangered whales such as the endangered Right whale may also transit the project area. As with all large vessels, there is a potential for a collision of the dredge that could injure or kill a whale.

As discussed in Section 4.2.3, the New York Bight Distinct Population Segment (DPS) of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) is listed as endangered by NMFS, and although this species is migratory in the marine environment, this species could be present within the project area. With regard to physical injuries to the Atlantic sturgeon, the potential exists for them to become entrained during dredging operations. It is expected, however, that most adult sturgeon would actively avoid a working dredge. As with other fish species, the temporary effects to water quality due to increased turbidity can impact prey availability during construction activities. Noise generated from a working dredge at the dredge site and beachfill placement could potentially be a factor affecting sturgeon. However, it is expected that sturgeon will avoid the borrow areas and nearshore beachfill areas during construction. Due to the open water nature of the borrow sites, this temporary movement away from the borrow areas does not constitute a significant effect on this species.

Formal consultation with the National Marine Fisheries Service (NMFS) in accordance with Section 7 of the Endangered Species Act was initially undertaken in 1995 on all dredging projects (including navigation, coastal engineering, and authorizations carried out under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act) with a Biological Opinion (BO) issued in 1996 (NMFS, 1996) and subsequent incidental take statement (ITS) in 1999 for the shortnose sturgeon: loggerhead, Kemp’s ridley, green and leatherback sea turtles; and humpback and right whales. Subsequent consultation was undertaken in 2013 to further refine the activities including the use of MEC screens for each authorized beach nourishment project and associated offshore sand sources in New Jersey and Delaware. This consultation culminated in the issuance of a Programmatic Biological Opinion (PBO) prepared by the NMFS (NMFS, 2014). The PBO considered the effects of the various dredges that are typically used including self-propelled hopper dredges and hydraulic cutterhead pipeline dredges and the species within the action area that may be affected by the proposed actions that include the Northwest Atlantic DPS of loggerhead sea turtle (threatened), Kemp’s ridley sea turtle (endangered), green sea turtle (endangered/threatened), and Atlantic sturgeon: Gulf of Maine DPS (threatened), New York Bight DPS (endangered), Chesapeake Bay DPS (endangered), South Atlantic DPS (endangered), and Carolina DPS (endangered). The PBO also considered the affected beach areas and the sand sources, which included the IRI sand bypass plant/North Beach and the IRI Flood Shoal as a sand source. However, at the time of issuance of the PBO, the IRI Ebb Shoal complex was not considered, but is presumed to have similar effects as described in the PBO.

The PBO evaluated project activity effects on protected marine species and concluded: “After reviewing the best available information on the status of endangered and threatened species under our jurisdiction, the environmental baseline for the action area, the effects of the action, and the cumulative effects, it is NMFS’ biological opinion that the proposed actions may adversely affect but are not likely to jeopardize the continued existence of the Gulf of Maine, New York Bight, Chesapeake Bay and South Atlantic DPS of Atlantic sturgeon, Kemp’s ridley or green sea turtles or the Northwest Atlantic DPS of loggerhead sea turtles and is not likely to adversely affect leatherback sea turtles, the Carolina DPS of Atlantic sturgeon, right, fin or humpback whales. Because no critical habitat is designated in the action area, none will be affected by the proposed action.”

The conclusion reached for the North Atlantic right whale, fin whale and humpback whale are based on a rationale presented in NMFS (2014), which states: “Whales in the action area will be exposed to effects of the proposed actions including vessel traffic, increased turbidity/suspended sediment (which may affect prey), and potential removal of prey during dredging. All sand will be placed on beaches or in nearshore shallow areas adjacent to beaches. Whales do not occur in these areas; therefore, no whales will be exposed to effects of sand placement. We have determined that all effects of the proposed actions on right, humpback and fin whales will be insignificant and discountable.” This rationale can also apply to other whale species that may occur within the project area listed in Table 14.

Since NMFS determined that these actions “may adversely affect” sea turtles and Atlantic sturgeon, an Incidental Take Statement (ITS) was developed in the PBO. Due to the uncertainty of monitoring for these species with MEC screens in place, the ITS within the PBO provides incidental takes “by proxy” as 1 take per every 3.8 million cubic yards dredged for sea turtles and 1 take per every 8.6 million cubic yards dredged for Atlantic sturgeon. The PBO also issued reasonable and prudent measures (RPMs), which are necessary and appropriate to minimize and monitor effects of incidental take resulting from these actions. Adherence to the RPMS ensures project compliance with Section 7 ESA. RPMS are implemented through the “Terms and Conditions”. NMFS (2014) also provided a number of discretionary conservation recommendations. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat, to help implement recovery plans, or to develop information. The RPMS, Terms and Conditions, and Conservation Recommendations are presented in an excerpt of the BO (NMFS, 2014) in Appendix C.

State listed endangered marine birds that may be found feeding in the offshore and nearshore affected areas include the common tern, least tern, Forster’s tern and the black skimmer. These birds may be potentially disrupted by dredging operations, particularly when they are foraging, which can result in changes to their daily movements, including distances travelled of adults tending to young. The Delaware Division of Fish and Wildlife (DFW-WSCRP, 2015) notes that disruptions to established feeding patterns may affect the ability and capacity of adult birds to adequately tend to chicks. These disruptions would be temporary and limited to when there is active construction during dredging and use of support vessels in offshore and nearshore waters.

5.3 Cultural and Social Environment

5.3.1 Cultural Resources

No Action: The no action alternative is not expected to have any adverse effects on cultural resources or historic properties eligible for or listed on the National Register of Historic Places (NRHP).

Preferred Alternative: The USACE is in consultation with the DESHPO, the Tribes and other consulting parties pursuant to Section 106 of the NHPA, as amended, during the preparation of this Environmental Assessment to identify and evaluate historic properties in order to fulfill our responsibilities under the National Historic Preservation Act of 1966, as amended, and its implementing regulations, 36 CFR Part 800. As part of this work, the Philadelphia District conducted an evaluation of existing site conditions and previous cultural resources investigations to determine the potential for significant cultural resources in the four proposed APEs.

Indian River Inlet North Beach Shoreline (APE1) - The shoreline and near shore areas have been subjected to numerous episodes of erosion and filling over the last decades; therefore, little likelihood exists for the proposed sand placement to impact historic properties eligible for inclusion in the NRHP.

Indian River Inlet Flood Shoal (APE2) – There are no historic properties listed on the NRHP located within the boundaries of the IRI Flood Shoal. This area was previously surveyed and subsequently dredged several times as a sand source (most recently by DNREC as part of the Phase 1 Indian River North Beach restoration in 2024-2025).

Indian River Inlet Ebb A (APE3) - There are no historic properties listed on the NRHP located within Ebb A APE. The Indian River Inlet borrow area was previously surveyed in 2001 with no significant targets located, and the flood shoal area has been previously dredged.

Indian River Inlet Ebb B (APE4) – Although the Indian River Inlet was previously surveyed, the area surrounding it has not been surveyed for potential shipwrecks. The USACE, in consultation with the DESHPO, the Tribes and other consulting parties will coordinate the Section 106 process within this APE prior to any future use of the area. Any sensitive anomalies located during that investigation will be avoided by a sufficient buffer or will require further analysis.

The USACE has determined that the proposed use of the flood shoal sediments within its current width and depth (APE2), the placement of the sediments on the beach segment (APE1), and the use of the ebb shoal within the area previously surveyed (Ebb Shoal A) (APE3) will have No Effect to historic properties eligible for or listed on the NRHP. The USACE has further determined that the Ebb Shoal B (APE4) will require a marine remote sensing investigation prior to use to determine if there are any sensitive anomalies that can be avoided or tested further.

5.3.2 Socioeconomics

No Action: Under the no action alternative, the significant erosion that threatens critical infrastructure such as the Charles W. Cullen Memorial Bridge and the approach to SR 1 along the North Beach shoreline would continue. Damages to these structures would incur significant costs on the State. SR1 is a critical artery in coastal Delaware and is an important component of the coastal economy. Disruptions from road closures would require traffic to re-route, increasing travel times for emergency vehicles, commerce, and local travel inconveniences for local travelers. SR1 is also an important emergency evacuation route, and its closure could have significant life safety issues during a coastal emergency.

Preferred Alternative: Sand placement used to restore the beach and dune along the North Beach shoreline would permit the accommodation of both present and expected future demands for recreational beach areas along the Delaware Atlantic Coast. The SR1 is a critical link to all the beach communities along the Delaware Coast and is important to the seasonal coastal economy. The influx of seasonal population is reflected by a greater demand for social services such as housing, transportation, health, safety, and sanitation facilities. The coastal communities are supported by a tourist economy, which they cannot afford to lose, and their expansion would provide fuller employment and greater revenues. As the demand for recreation gradually increases, it is expected that State and local efforts would be made to satisfy these needs. Because of this, noise and air quality levels would similarly degrade through personal activity and auto utilization. They will not however, become a significant problem. Various indicators of the presence and/or level of Corps activity in beachfront communities generally have no statistically significant relation to development in those areas. Thus, the statistical evidence indicates that the effect of the Corps on induced development is, at most, insignificant, compared to the general forces of economic growth which are stimulating development in these areas, many of which are induced through other municipal infrastructure developments such as roads, wastewater treatment facilities, etc. (USACE, 1995c). Implementation of the preferred alternative is expected to have long-term beneficial effects on socioeconomics.

Implementation of the preferred alternative is not expected to change or adversely impact existing land use within the affected area. The Coastal Barrier Resources Act restricts certain Federal expenditures for areas designated within the Coastal Barrier Resources System. The North Beach area is within an area designated as an “Otherwise Protected Area (OPA)”, which is part of DE-07P in Delaware Seashore State Park. OPAs only prohibit Federal funding for flood insurance. Therefore, the proposed project activities are not restricted in OPAs.

5.3.3 At Risk Communities

No Action: There are no at risk and disadvantaged communities within the affected area. Therefore, no action would not have any disproportional adverse or beneficial effects on disadvantaged communities.

Preferred Alternative: A review of the surrounding land uses of the affected areas does not indicate the presence of at risk and disadvantaged communities vulnerable to disproportionate adverse environmental effects within or immediately adjacent to the affected areas. Therefore, the proposed dredging and beachfill placement activities will not incur any direct or indirect effects on disadvantaged communities.

5.3.4 Recreation

No Action: With no action, significant erosion would continue to occur if there are any unforeseen shutdowns of the sand bypass plant or following a major storm event that requires full beach and dune restoration. A diminished beach results in the loss of recreational beach. Overcrowding of any remaining available beach above the high tide line would occur along with the potential safety issues associated with exposed debris similar to what was experienced in 2024.

Preferred Alternative: Direct adverse effects on recreation are temporary and localized in nature. Project construction during warm season months may temporarily displace beachgoers such as bathers and others enjoying the beach within the immediate impact area. Recreational beachgoers engaged in sunbathing, surf fishing, surfing, skim boarding, bathing, etc. will be temporarily affected by the project, since the public will not be permitted to enter the actual work segments. However, since the project will be constructed in segments (approximately 1,000 feet long at a time), only the segment actually under construction will be closed to the public, which would typically last a few days to a week. Therefore, effects to beach and fishing access will be localized and relatively short-lived. This impact would be further minimized if beach nourishment activities were considered from late fall to early spring when beach recreation activities are minimal.

In the long-term, beach nourishment will not impede public access to the beach. Public access to the beaches in the affected areas will be maintained by the maintenance of existing dune walkovers and existing vehicle access ramps for authorized vehicles.

Boating and offshore fishing may be temporarily displaced in the vicinity of the dredging operations within the sand borrow areas for safety reasons. This impact is temporary and localized and boaters will be allowed to return to the borrow area(s) after construction ceases. Recreational fishing may be temporarily reduced in portions of the borrow area after dredging due to the temporary loss of benthic prey organisms, which provide a food source for some target species such as summer flounder or as a food source for other prey species. However, the borrow areas represent a small portion of available coastal waters.

It is generally regarded that shoreline areas with structure produce the best fishing spots and are frequently targeted for surf fishing. Structured areas can be natural or man-made. Natural structure along the Delaware Atlantic shoreline is formed by waves and currents in the form of cuts and sloughs with nearshore sand bars that can attract and hold fish. These areas are most pronounced where rip currents are present. Man-made structures that attract fish are in the forms of groins and jetties. These structures (man-made or natural) initially become buried during beach nourishment activities. After initial profile adjustment, portions of the North Beach jetty may become uncovered along the north side of the jetty, but the degree of its exposure is variable. A complete exposure would return this structure to a pre-project state but would likely signify that the beach is in need of periodic nourishment to perform its storm damage reduction purpose. Natural structure can also reform, but this would be dependent on post-fill profile adjustment and the formation of new cuts, sloughs and nearshore bars, particularly after storm events. Although fishing structure would initially be affected, targeted fish species may return to the filled areas within hours or days after a beachfill is completed (USACE, 2001).

5.3.5 Visual and Aesthetic Values

No Action: No action would result in adverse effects on aesthetics as continued erosion would diminish the natural beach landscape. This erosion, as experienced in 2024, resulted in the exposure of scattered debris along the remaining beach which also detracted from the aesthetic values of the North Beach.

Preferred Alternative: With dredging and beachfill placement, there are potentially two temporary adverse aesthetic effects that would come in the form of visual effects and odor effects that are expected to be present during and immediately after construction. These effects stem from the chemically reduced state of the beachfill material, which would initially be darker in color and may produce unpleasant odors (rotten egg odor) from the presence of naturally occurring hydrogen sulfide gas. Generally, if there is a high amount of organic material in the sediments, this impact would be more significant. However, since this material is predominantly sandy material (less than 1% total organic carbon), these effects are expected to be minor and temporary. The material once placed on the beach is expected to undergo chemical oxidation as the beach dewaters and sorts from the high wave energy and becomes exposed to direct sunlight. The sand is expected to become lighter, and any odors would quickly subside within a few days after pumping ceases. With the exception of short-term effects during construction, overall aesthetics of the beach would be improved as a result. A natural-looking beach and dune would be more aesthetically pleasing and attractive to beachgoers.

6.0 COMPLIANCE WITH ENVIRONMENTAL STATUTES

Table 18 provides a complete listing of compliance status relative to environmental quality protection statutes and other environmental review requirements for the proposed action.

Table 18. Compliance with Environmental Quality Protection Statutes and Other Environmental Review Requirements

FEDERAL STATUTES	COMPLIANCE W/PROPOSED PLAN
Archeological - Resources Protection Act of 1979, as amended	Full
Clean Air Act, as amended	Full
Clean Water Act of 1977	Partial
Coastal Barrier Resources Act	Full
Coastal Zone Management Act of 1972, as amended	Partial
Endangered Species Act of 1973, as amended	Partial
Estuary Protection Act	Full

FEDERAL STATUTES	COMPLIANCE W/PROPOSED PLAN
Federal Water Project Recreation Act, as amended	N/A
Fish and Wildlife Coordination Act	Partial
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
National Historic Preservation Act of 1966, as amended	Partial
National Environmental Policy Act, as amended	Partial
Rivers and Harbors Act	Full
Watershed Protection and Flood Prevention Act	N/A
Wild and Scenic River Act	N/A
Executive Orders, Memorandums, etc.	
EO 11988, Floodplain Management	Full
EO 11990, Protection of Wetlands	Full
EO12114, Environmental Effects of Major Federal Actions	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. **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.	

- **National Environmental Policy Act (NEPA)**: Table 1-1 provides a list of previous NEPA documents incorporated by reference. This EA evaluates a proposed new sand borrow area, the Indian River Inlet Ebb Shoal, and the continued use of the Indian River Inlet Flood Shoal sand borrow area. These borrow areas would be used to supplement the Delaware Coast Protection - Indian River Inlet Sand Bypass Project. Full compliance with NEPA for these changes will be achieved following the full consideration of public and agency comments and a determination that a Finding of No Significant Impact (FONSI) is appropriate. A draft FONSI is provided in the front of this document.
- **Endangered Species Act (ESA):** Formal consultation with NMFS was concluded in 2014 with a Programmatic Biological Opinion (NMFS, 2014), which included the Indian River Inlet Sand Bypass Plant and the use of the Indian River Inlet Flood Shoal. NMFS

concluded “that the proposed actions may adversely affect but are not likely to jeopardize the continued existence of the Gulf of Maine, New York Bight, Chesapeake Bay and South Atlantic DPS of Atlantic sturgeon, Kemp’s ridley or green sea turtles or the Northwest Atlantic DPS of loggerhead sea turtles and is not likely to adversely affect leatherback sea turtles, the Carolina DPS of Atlantic sturgeon, right, fin or humpback whales. Because no critical habitat is designated in the action area, none will be affected by the proposed action.” Since the Indian River Inlet Ebb Shoal was not included in the PBO, informal consultation with NMFS will be initiated and concluded prior to undertaking the proposed actions in this document. The USACE has made a determination based on an IPaC review that the preferred alternative will have “no effect” on the roseate tern and a NLAA determination for the seabeach amaranth and monarch butterfly. Informal consultation with USFWS will conclude upon concurrence with this determination prior to construction.

- **Fish and Wildlife Coordination Act (FWCA):** The draft EA was distributed to the U.S. Fish and Wildlife Service for review and comment in accordance with the FWCA.
- **Magnuson-Stevens Fishery Conservation and Management Act (MSFCMA) (Essential Fish Habitat)**. An evaluation to address the dredging and placement of beachfill is provided in Sections 4.0 and 5.0 of this document. A copy of the draft EA was provided to NMFS for review in accordance with the MSFCMA.
- **Clean Water Act Section 404(b)(1) Evaluation**. A Section 404(b)(1) evaluation to address the discharges associated with dredging and placement of beachfill along the North Beach shoreline is provided in Appendix A.
- **Clean Water Act Section 401 Water Quality Certification (WQC).** A Section 401 WQC was requested from DNREC authorizing the use of the proposed sand sources and beachfill placement along the North Beach shoreline.
- **Coastal Zone Management Act - Federal Consistency Determination.** The proposed use of the Indian River Inlet Ebb Shoal and Indian River Inlet Flood Shoal and placement of beachfill in 2025 and potential future placements on an as needed basis were reviewed in accordance with Delaware Coastal Management Program Policies. A Federal Consistency Certification request was submitted to the Delaware Coastal Management Program (DECMP) upon submittal of the Draft EA for public review. Compliance will be achieved upon a concurrence with the Corps’ Federal Consistency determination by the Delaware Department of Natural Resources and Environmental Control.
- **Coastal Barrier Resources Act (CBRA).** The North Beach area is within an “Otherwise Protected Area” (OPA), which is part of DE-07P in Delaware Seashore State Park. OPAs only prohibit Federal funding for flood insurance. Project activities are not restricted in OPAs.
- **Section 106 National Historic Preservation Act**. The USACE has determined that the preferred plan will have “no effect” on properties eligible for, or listed in, the NRHP. This determination requires a concurrence with the Delaware State Historic Preservation Officer (DESHPO).
- **Clean Air Act (CAA)**. The proposed action is not expected to exceed thresholds for NOx and VOCs based on analyses that assumed a fixed quantity of sand (500,000 cubic yards). A Record of Non-Applicability (RONA) is provided in Appendix B with supporting analysis.

7.0 CONCLUSIONS

This EA evaluated the environmental effects of the utilization of two proposed sand borrow areas (Indian River Inlet Ebb Shoal and Indian River Inlet Flood Shoal) to support the restoration of the berm and dune of the Indian River Inlet North Beach shoreline extending for a distance of 5,000 feet north of the north jetty. Effects associated with dredging in the sand borrow areas are considered to be temporary and minor on marine biota. The Indian River Inlet Ebb Shoal A will be utilized to complete the Phase 2 restoration of the beach in 2025. Subsequent needs for additional sand resources utilizing the southern lobe of IRI Ebb Shoal B would require supplemental investigations to be undertaken for submerged cultural resources, benthic community and sand quality analyses, if necessary.

Based on the information presented and continuing coordination with State and Federal resource agencies, no significant adverse environmental effects are expected to occur as a result of the proposed action. Since the potential effects identified have been determined to be minor, localized and temporary, the preparation of a new or Supplemental Environmental Impact Statement is not warranted and a Finding of No Significant Impact (FONSI) for the proposed action is appropriate.

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APPENDIX-A

CLEAN WATER ACT SECTION 404(B)(1) EVALUATION

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EVALUATION OF 404 (b)(1) GUIDELINES

A review of the effects associated with discharges of dredged or fill material to waters of the United States for the Indian River Inlet Ebb and Flood shoal dredging and subsequent beachfill placement on the North Beach side of the inlet in Delaware Seashore State Park, Sussex County, Delaware is required by Section 404(b)(1) of the Clean Water Act, as amended (Public Law 92-500).

I. PROJECT DESCRIPTION

A. Location

The project discharge site is located along a 5,000 ft. stretch of beach (North Beach) on the north side of Indian River Inlet in Sussex County, Delaware. Dredging for sand would either occur within the Indian River Inlet Ebb Shoal (offshore of the inlet) or the Indian River Inlet Flood Shoal (inshore of the inlet).

B. General Description

The beachfill portion of the project consists of a design template with a 100-foot berm at an elevation of +9.2 feet NAVD with a dune at elevation +16.0 feet NAVD. The berm width may be considerably wider than 100 feet to accommodate advanced (sacrificial) nourishment quantities and to hold a construction template profile. The proposed work includes the completion of the Phase 2 restoration of the North Beach shoreline, which consists of dredging 500,000 cubic yards of sand from the Indian River Inlet Ebb Shoal and placement of sand along a 5,000-foot stretch of beach along the North Beach shoreline to reconstruct the beach berm and dune to its design dimensions. The plan also consists of future nourishment/restoration activities to supplement the sand bypass plant operation and/or to make major repairs following significant storm/erosion events. The supplemental sand sources would be either the Indian River Inlet Flood Shoal or Ebb Shoal. This project was first constructed in 1990 and has been maintained by routine periodic nourishment (operation of the sand bypass facility) and storm repairs in accordance with PL-84-99 under the Flood Control and Coastal Emergencies (FCCE) Program. Beachfill quantities and extents will vary depending on conditions and needs at the time of each placement and emergency storm repairs in order to maintain the design template.

C. Authority and Purpose

The Delaware Coast Protection project is a Flood and Coastal Storm Damage Reduction project, which is authorized by the Flood Control Act of 1968 and the Water Resources Development Act of 1986 (P.L. 99-662). This project was authorized to address chronic beach erosion along the North Beach of the Indian River inlet caused by the inlet jetties. Here, the jetties interrupt the northward longshore transport of sand resulting in a deficiency of sand on the north side of the inlet. The plan of improvement consists of constructing a sand bypassing plant and operation of said plant for periodic nourishment of a feeder beach (approximately 100,000 cubic yards of sand, annually) to nourish approximately 3,500 feet of feeder beach on the north side of the inlet and protect the Delaware Route 1 highway. Initial construction was completed in 1990, and the sand bypass plant has been subsequently operated and maintained by the non-Federal sponsor, the Delaware Department of Natural Resources and Environmental Control. In 2013, USACE conducted a major emergency repair of the beach in response to a disaster declaration from Hurricane Sandy under the

P.L. 84-99 (Flood Control and Coastal Emergencies) utilizing the interior flood shoal as a sand source where approximately, 520,000 cubic yards of sand was used to restore a 5,000-foot segment of beach and dune north of the inlet.

The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

D. General Description of Dredged or Fill Material

1. General Characteristics of Material.
> 90% Fine to Medium Sands with trace gravels/silts

2. Quantity of Material. The quantity of material required to be discharged is approximately 500,000 cubic yards for completion of Phase 2 and up to 800,000 cubic yards for subsequent beach restorations along the North Beach.

3. Source of Material.

The source of material would be from the Indian River Inlet Ebb Shoal for completion of Phase 2 of the North Beach restoration and either the Indian River Inlet Flood Shoal or Indian River Inlet Ebb Shoal for future needs for either supplementing the Indian River Inlet Sand Bypass operation or for major storm damage repairs and erosion.

E. Description of the Proposed Discharge Site

1. Location. The proposed discharge locations include the upper beach and dunes, lower beach intertidal areas and nearshore areas of the Indian River Inlet North Beach shoreline.

2. Size. 30 acres (the approximate footprint of fill below MHW)

3. Type of Site. Aquatic/shoreline (sandy beach)

4. Type(s) of Habitat. Tidal/marine sandy beach, tidal estuarine open water (flood shoal), and tidal marine open water (ebb shoal)

5. Timing and Duration of Discharge. Approximately 2-3 months for total project construction

F. Description of Discharge Method

Material will be placed using a hydraulic pipeline dredge

II. FACTUAL DETERMINATION

A. Physical Substrate Determinations

1. **Substrate Elevation and Slope.** The beachfill construction template will have a berm elevation of +9.2 ft NAVD with a foreshore slope of 5 Horizontal:1 Vertical. This slope is expected to become flatter as wave action redistributes the beachfill, which will change the profile after construction.

2. **Sediment Type.** > 90% sand

3. **Dredged/Fill Material Movement.** The planned construction would establish an initial construction template, which is wider than the final intended design template or profile. It is expected that the placement, erosion and sorting would be the primary processes resulting in the change to the design template. The loss or winnowing of fine grain materials into the water column would occur during the initial settlement. These materials may become re-deposited within subtidal nearshore waters and reworked and re-distributed by tidal and long-shore currents.

4. **Physical Effects on Benthos.** The proposed construction and discharges would result in initial burial of the existing beach and nearshore benthic communities when this material is discharged during berm construction. Substrate is expected to be composed of material that is similar to existing substrate, which is expected to become recolonized by the same type of benthos that previously existed at the location.

5. **Other Effects.** Other effects would include a temporary increase in suspended sediment load and a change in the beach profile, particularly in reference to elevation. Bathymetric changes in the placement site would raise the bottom several feet, which would be offset seaward.

6. **Actions Taken to Minimize Impacts.** Actions taken to minimize impacts include selection of fill material that is similar in nature to the pre-existing substrate.

B. Water Circulation, Fluctuation, and Salinity Determinations

1. **Water. Consider effects on:**

    a. **Salinity** - No effect.
    b. **Water chemistry** - No significant effect.
    c. **Clarity** - Minor short-term increase in turbidity during construction.
    d. **Color** - No effect.
    e. **Odor** - No significant effect.
    f. **Taste** - No effect.
    g. **Dissolved gas levels** - No significant effect.
    h. **Nutrients** - Minor effect.
    i. **Eutrophication** - No effect.
    j. **Others as appropriate** - None.

2. **Current patterns and circulation**

   a. **Current patterns and flow** – Minor effects to circulation patterns and flow in the beach zone and nearshore where the existing circulation pattern and flow would be offset seaward the width of the beachfill placement.

   b. **Velocity** - No effects on tidal velocity and longshore current velocity regimes.

   c. **Stratification** - Thermal stratification normally occurs beyond the mixing region created by the surf zone. The normal pattern should continue after construction of the proposed project.

   d. **Hydrologic regime** - The regime is tidal marine. This will remain the case following construction of the proposed project.

3. **Normal water level fluctuations** - The tides are semidiurnal. The mean tide range for the area is 3.6 feet. Beachfill placement would not affect the tidal regime. Mean High Water occurs at +1.3 ft. NAVD and Mean Low Water occurs at -2.3 ft. NAVD.

4. **Salinity gradients** - There should be no significant effect on the existing salinity gradients.

5. **Actions that will be taken to minimize impacts**- None are required; however, utilization of clean sand that matches existing beach sand would minimize water chemistry effects.

C. <u>**Suspended Particulate/Turbidity Determinations**</u>

1. **Expected Changes in Suspended Particulates and Turbidity Levels in the Vicinity of the Disposal (Beachfill Placement) Site** - There would be a short-term elevation of suspended particulate concentrations during construction phases in the immediate vicinity of the fill discharge locations. Elevated levels of particulate concentrations at the discharge locations may also result from "washout" after beachfill is placed.

2. **Effects (degree and duration) on Chemical and Physical Properties of the Water Column** -

   a. **Light penetration** - Short-term, limited reductions would be expected at the discharge sites from fill placement and berm washout, respectively.

   b. **Dissolved oxygen** - There is a potential for a decrease in dissolved oxygen levels but the anticipated low levels of organics in the fill material should not generate a high, if any, oxygen demand.

   c. **Toxic metals and organics** – No effect. Testing of sands do not indicate the presence of any significant contaminants.

d. **Pathogens** – No significant effect. However, temporary increases in indicator bacteria levels may occur during beachfill discharges as bottom sediments in the intertidal and nearshore become stirred-up during the discharge.

e. **Aesthetics** - Minor adverse and temporary effects limited to the construction period. Sand color would initially be darker, but would lighten within a short time period following placement.

3. **Effects on Biota**

a. **Primary production, photosynthesis** - Minor, short-term effects related to turbidity.

b. **Suspension/filter feeders** - Minor, short-term effects related to suspended particulates outside the immediate deposition zone. Sessile organisms would be subject to burial if within the deposition area.

c. **Sight feeders** - Minor, short-term effects related to turbidity.

4. **Actions taken to minimize impacts** include the selection of clean sand with a small fine grain component and a low organic content. Standard construction practices would also be employed to minimize turbidity and erosion.

D. <u>Contaminant Determinations</u>

The material is not expected to introduce, relocate, or increase contaminant levels at the placement location.

E. <u>Aquatic Ecosystem and Organism Determinations</u>

1. **Effects on Plankton** - The effects on plankton should be minor and mostly related to light level reduction due to turbidity. Significant dissolved oxygen level reductions are not anticipated.

2. **Effects on Benthos** – Initially, sand placement would result in the burial of benthos within the discharge (beachfill) location. The losses of benthic organisms are somewhat offset by the expected rapid opportunistic recolonization from adjacent areas that would occur following cessation of construction activities. Recolonization is expected to occur rapidly in the discharge (beachfill placement) area through horizontal and in some cases vertical migrations of benthos. Some minor losses of benthos associated with rocky intertidal habitat are expected, as portions of the inlet jetty would become temporarily covered with beachfill material.

3. **Effects on Nekton** - Only a temporary displacement is expected, as the nekton would probably avoid the active work area. The proposed action is not expected to have significant adverse effects on essential fish habitat (EFH) for the species and their life stages identified within the impact area.

4. **Effects on Aquatic Food Web** – Localized effects in the affected areas due to loss of benthos as a food source through burial at the beachfill placement site. This is expected to be short-term as the beachfill placement sites could become recolonized by benthos within a few days or weeks.

5. **Effects on Special Aquatic Sites** - No special aquatic sites such as sanctuaries and refuges, wetlands, mud flats, vegetated shallows, coral reefs and riffle and pool complexes are present at the discharge site.

6. **Threatened and Endangered Species** - The piping plover (*Charadrius melodus*), a Federal and State threatened species, utilizes sandy beach habitat in Delaware. This bird nests on the beach, however, no nesting sites have been reported within the project impact area. The sea beach amaranth (*Amaranthus pumilus*) is a Federally threatened plant that can be found on the upper beach and lower dunes in along the Atlantic Coast Beaches of Delaware. However, this plant has not been identified within the project impact area. The rufa red knot (*Calidris canutus rufa*) could occur in the area, but the USFWS has concluded that its use of the project area would be minimal. Beachfill placement in the intertidal and shallow nearshore is not expected to affect the Federally threatened or endangered Atlantic sturgeon (*Acipenser oxyrhynchus oxyrhynchus*), sea turtles, and whales.

7. **Other Wildlife** - The proposed plan would not significantly affect other wildlife.

8. **Actions to minimize impacts** – None required. The utilization of suitable sand as beachfill minimizes effects to benthic and pelagic organisms at the discharge locations.

F. **<u>Proposed Disposal/Discharge (Beachfill Placement) Site Determinations</u>**

1. **Mixing Zone Determination**

   a. **Depth of water** - 0 to-10 feet NAVD
   b. **Current velocity** - Generally less than 3 feet per second
   c. **Degree of turbulence** - Moderate to high
   d. **Stratification** - None
   e. **Discharge vessel speed and direction** - Not applicable
   f. **Rate of discharge** – N/A. Rate is continuous with a hydraulic pipeline dredge with intermittent shutdowns. Fill manipulation with dozers will also affect rate of discharge.
   g. **Dredged material characteristics** - Medium-fine sand and gravels with low silts, clays and organics
   h. **Number of discharge actions per unit time** - Continuous over the construction period

2. **Determination of Compliance with Applicable Water Quality Standards** - Prior to construction, a Section 401 Water Quality Certificate will be obtained from the State of Delaware.

3. **Potential Effects on Human Use Characteristics** -

a. **Municipal and private water supply** - No effect

b. **Recreational and commercial fisheries** - Short-term effect during construction; there would be a temporary disruption to fisheries at the placement locations where finfish may avoid construction area. Burial of benthos would result in temporary loss of food source for finfish. Beach access for recreational fisherman may be temporarily restricted in segments during construction.

c. **Water related recreation** - Short-term effect during construction where potential beachgoers, bathers, surfers, and surf-fishermen would be prohibited from accessing active construction locations.

d. **Aesthetics** - Short-term adverse effects to noise sight and smell during construction are anticipated.

e. **Parks, national and historic monuments, national seashores, wilderness areas, research sites and similar preserves** – No effects.

G. **Determination of Cumulative Effects on the Aquatic Ecosystem**- Effects on benthos and the aquatic ecosystem in general are considered to be temporary and do not represent a significant loss of habitat. This action in concert with other existing or proposed similar actions, may produce measurable temporary cumulative effects to benthic resources. However these effects are short-term.

H. **Determination of Secondary Effects on the Aquatic Ecosystem** – Secondary effects such as turbidity on aquatic organisms or temporary loss of food sources through the burial of benthos are considered to be of short duration.

III. FINDINGS OF COMPLIANCE OR NON-COMPLIANCE WITH THE RESTRICTIONS ON DISCHARGE

A. **Adaptation of the Section 404(b)(1) Guidelines to this Evaluation.** No significant adaptation of the Section 404(b)(1) Guidelines were made relative to this evaluation.

B. **Evaluation of Availability of Practicable Alternatives to the Proposed Discharge Site, Which Would Have Less Adverse Impact on the Aquatic Ecosystem.** The alternative measures considered for accomplishing the project objectives were previously evaluated in USACE (1984) and Section 3.0 of the Environmental Assessment. The No Action alternative would likely have less adverse effects on the aquatic ecosystem.

C. **Compliance with Applicable State Water Quality Standards.** This action is not expected to violate State of Delaware Water Quality Standards. A Section 401 water quality certificate will be obtained from the Delaware Department of Natural Resources and Environmental Control prior to initiation of discharges associated with this project.

D. **Compliance with Applicable Toxic Effluent Standards or Prohibition Under Section 307 of the Clean Water Act.** The proposed action is not expected to violate the Toxic Effluent Standards of Section 307 of the Clean Water Act.

E. **Compliance with Endangered Species Act.** The selected plan will comply with the Endangered Species Act of 1973. Informal Section 7 consultation will be completed with the U.S. Fish and Wildlife Service and NMFS for this the project prior to project construction.

F. **Compliance with Specified Protection Measures for Marine Sanctuaries Designated by the Marine Protection, Research, and Sanctuaries Act of 1972.** The proposed action will not violate the protective measures for any Marine Sanctuaries designated by the Marine Protection, Research, and Sanctuaries Act of 1972.

G. **Evaluation of Extent of Degradation of the Waters of the United States.** The proposed action is not expected to result in permanent significant adverse effects on human health and welfare, including municipal and private water supplies, recreation and commercial fishing, plankton, fish, shellfish, wildlife, and special aquatic sites. Significant adverse effects on life stages of aquatic life and other wildlife dependent on aquatic ecosystems; aquatic ecosystem diversity, productivity, and stability; and recreational, aesthetic, and economic values is not expected to occur or have long-term effects on impacted resources.

H. **Appropriate and Practicable Steps Taken to Minimize Potential Adverse Impacts of the Discharge on the Aquatic Ecosystem.** Appropriate steps to minimize potential adverse effects of the discharge on aquatic systems include selection of fill material that is low in silt content, has little organic material, and is expected to be uncontaminated.

I. **On the basis of the guidelines**, the proposed discharge sites for the dredged material is specified as complying with the requirements of these guidelines, with the inclusion of appropriate and practical conditions to minimize pollution or adverse effects on the aquatic ecosystem.

APPENDIX-B

CLEAN AIR ACT RECORD OF NON-APPLICABILITY

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RECORD OF NON-APPLICABILITY (RONA)

Project Name: Delaware Coast Protection – Indian River Inlet North Beach Restoration

Project/Action Point of Contact: Steven Allen, CENAP-PL-E

Begin Date: August 2025

End Date: November 2025

1. Project Description: The Delaware Coast Protection project is a Flood and Coastal Storm Damage Reduction project, which is authorized by the Flood Control Act of 1968 and the Water Resources Development Act of 1986 (P.L. 99-662). This project was authorized to address chronic beach erosion along the North Beach of the Indian River inlet caused by the inlet jetties. Here, the jetties interrupt the northward longshore transport of sand resulting in a deficiency of sand on the north side of the inlet. The plan of improvement consists of constructing a sand bypassing plant and operation of said plant for periodic nourishment of a feeder beach (approximately 100,000 cubic yards of sand, annually) to nourish approximately 3,500 feet of feeder beach on the north side of the inlet and protect the Delaware Route 1 highway. Initial construction was completed in 1990, and the sand bypass plant has been subsequently operated and maintained by the non-Federal sponsor, the Delaware Department of Natural Resources and Environmental Control. The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

2. The proposed work includes the completion of the Phase 2 restoration of the North Beach shoreline, which consists of the dredging of 500,000 cubic yards of sand from the Indian River Inlet Ebb Shoal and placement of sand along a 5,000-foot stretch of beach along the North Beach shoreline to reconstruct the beach berm and dune to its design dimensions. The plan also consists of future nourishment/restoration activities to supplement the sand bypass plant operation and/or to make major repairs following significant storm/erosion events.

3. An emissions estimate was completed to determine the Nitrogen Oxides (NOx) and Volatile Organic Carbon (VOC) emissions (precursors to ozone formation) associated with the sand quantity required to complete Phase 2 of the North Beach restoration. This sand quantity is estimated at 500,000 cy. The dredging and placement of beachfill is calculated to generate a total of 64.4 tons of NOX and 1.9 tons of VOCs within one calendar year of work.

4. The project described above has been evaluated for Section 176 of the Clean Air Act. Project related emissions associated with the federal action were estimated to evaluate the applicability of General Conformity regulations (40CFR§93 Subpart B).

5. The project is located in Sussex County, Delaware, which has the following nonattainment-related designations with respect to the National Ambient Air Quality Standards (40CFR§81.133): Marginal Nonattainment 2008 8-hour Ozone Standard (primary and secondary).

6. The requirements of this rule do not apply because the total direct and indirect emissions from this project are less than the 100 tons trigger level for NO_x for each project year and significantly below the 50 tons trigger level for VOC (40CFR§93.153(b)(1) & (2)), as VOCs, are typically a fraction of total NOx emissions. The estimated emissions for the project for each pollutant are provided below.

CALENDAR YEAR	MONTHS	TONS NOx	TONS VOC
2025	3	64.4	1.9
TOTAL	**3**	**64.4**	**1.9**

7. The project conforms with the General Conformity requirements (40CFR§93.153(c)(1)) and is exempted from the requirements of 40 CFR §93 Subpart B.

Adrian Leary
Chief, Planning Division

Estimated NOX and VOX emissions calculator - CUTTER

Project: FY25 Indian River Inlet North Beach Restoration

Mob/Demob duration (days): 20

Volume (CY): 500,000

Estimated production rate* (CY/day): 6,506

Percent Effective Time* (EWT): 43.8%

*based on W912BU12C0047 recorded data

								CRITERIA POLLUTANTS										OTHER EMISSIONS					
								NOx	NOx	VOC	VOC	PM 2.5	PM 2.5	SOx	SOx	CO	CO	CO2	CO2	CH4	CH4	N2O	N2O
Equipment	**# of Engines**	**HP**	**Load Factor (LF)**	**Days of Operation**	**Hrs/Day**	**Total Hours**	**hp-hr**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**	**EF (g/hp-hr)**	**Emissions (tons)**
Water equipment																							
Mob/Demob																							
PIPELINE DREDGE, PRIME ENGINE	0	3400	0.66	20.0	12	0.0	0	9.70	0.00	0.20	0.00	0.51	0.00	0.005	0.00	1.06	0.00	515	0.00	0.067	0.00	0.015	0.00
PIPELINE DREDGE, ELECTRIC GENERATOR	1	830	0.40	20.0	12	240.0	79,680	7.50	0.66	0.20	0.02	0.29	0.03	0.005	0.000	1.27	0.11	515	45.23	0.067	0.01	0.015	0.00
PIPELINE DREDGE, DREDGE PUMP	0	1900	0.80	20.0	12	0.0	0	7.50	0.00	0.20	0.00	0.51	0.00	0.005	0.000	1.06	0.00	515	0.00	0.067	0.00	0.015	0.00
WORK TUG, PRIMARY	2	1000	0.69	20.0	12	480.0	331,200	9.70	3.54	0.37	0.14	0.51	0.19	0.005	0.002	1.06	0.39	515	188.02	0.067	0.02	0.015	0.01
WORK TUG, SECONDARY Electric	2	25	0.40	20.0	12	480.0	4,800	7.50	0.04	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.01	515	2.72	0.067	0.00	0.015	0.00
SURVEY BOAT, SHORE	1	210	0.50	14.0	12	168.0	17,640	9.70	0.19	0.37	0.01	0.51	0.01	0.005	0.000	1.06	0.02	515	10.01	0.067	0.00	0.015	0.00
SURVEY BOAT, SHORE, SECONDARY Electric	1	40	0.40	14.0	12	168.0	2,688	7.50	0.02	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.00	515	1.53	0.067	0.00	0.015	0.00
DERRICK, PRIMARY	1	200	0.40	20.0	12	240.0	19,200	7.50	0.16	0.20	0.00	0.51	0.01	0.005	0.000	1.06	0.02	515	10.90	0.067	0.00	0.015	0.00
DERRICK, SECONDARY Electric	1	40	0.20	20.0	12	240.0	1,920	7.50	0.02	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.00	515	1.09	0.067	0.00	0.015	0.00
TENDER TUG, PROPULSION	0	4000	0.69	20.0	12	0.0	0	9.70	0.00	0.37	0.00	0.51	0.00	0.005	0.000	1.06	0.00	515	0.00	0.067	0.00	0.015	0.00
TENDER TUG, SECONDARY	0	50	0.40	20.0	12	0.0	0	7.50	0.00	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.00	515	0.00	0.067	0.00	0.015	0.00
SUVEY BOAT, OFFSHORE	0	500	0.50	20.0	12	0.0	0	9.70	0.00	0.20	0.00	0.51	0.00	0.005	0.000	1.06	0.00	515	0.00	0.067	0.00	0.015	0.00
SUVEY BOAT, OFFSHORE, SECONDARY Electric	0	40	0.40	20.0	12	0.0	0	7.50	0.00	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.00	515	0.00	0.067	0.00	0.015	0.00
Dredging																							
PIPELINE DREDGE, PRIME ENGINE	1	3400	0.66	76.9	10.51	807.9	1,812,860	9.70	19.38	0.20	0.40	0.51	1.02	0.005	0.010	1.06	2.12	515	1,029.13	0.067	0.13	0.015	0.03
PIPELINE DREDGE, ELECTRIC GENERATOR	1	830	0.40	76.9	10.51	807.9	268,213	7.50	2.22	0.20	0.06	0.29	0.09	0.005	0.001	1.27	0.38	515	152.26	0.067	0.02	0.015	0.00
PIPELINE DREDGE, DREDGE PUMP	1	1900	0.80	76.9	10.51	807.9	1,227,962	7.50	10.15	0.20	0.27	0.51	0.69	0.005	0.007	1.06	1.43	515	697.09	0.067	0.09	0.015	0.02
WORK TUG, PRIMARY	2	1000	0.69	76.9	10.51	1,615.7	1,114,860	9.70	11.92	0.37	0.45	0.51	0.63	0.005	0.006	1.06	1.30	515	632.88	0.067	0.08	0.015	0.02
WORK TUG, SECONDARY Electric	2	25	0.40	76.9	10.51	1,615.7	16,157	7.50	0.13	0.20	0.00	0.29	0.01	0.005	0.000	1.27	0.02	515	9.17	0.067	0.00	0.015	0.00
SURVEY BOAT, SHORE	1	210	0.50	76.9	10.51	807.9	84,826	9.70	0.91	0.37	0.03	0.51	0.05	0.005	0.000	1.06	0.10	515	48.15	0.067	0.01	0.015	0.00
SURVEY BOAT, SHORE, SECONDARY Electric	1	40	0.40	76.9	10.51	807.9	12,926	7.50	0.11	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.02	515	7.34	0.067	0.00	0.015	0.00
DERRICK, PRIMARY	1	200	0.40	76.9	10.51	807.9	64,630	7.50	0.53	0.20	0.01	0.51	0.04	0.005	0.000	1.06	0.08	515	36.69	0.067	0.00	0.015	0.00
DERRICK, SECONDARY Electric	1	40	0.20	76.9	10.51	807.9	6,463	7.50	0.05	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.01	515	3.67	0.067	0.00	0.015	0.00

TENDER TUG, PROPULSION	1	1000	0.69	76.9	10.51	807.9	557,430	9.70	5.96	0.37	0.23	0.51	0.31	0.005	0.003	1.06	0.65	515	316.44	0.067	0.04	0.015	0.01
TENDER TUG, SECONDARY	1	50	0.40	76.9	10.51	807.9	16,157	7.50	0.13	0.20	0.00	0.29	0.01	0.005	0.000	1.27	0.02	515	9.17	0.067	0.00	0.015	0.00
SURVEY BOAT, OFFSHORE	0	500	0.50	76.9	10.51	0.0	0	9.70	0.00	0.20	0.00	0.51	0.00	0.005	0.000	1.06	0.00	515	0.00	0.067	0.00	0.015	0.00
SURVEY BOAT, OFFSHORE, SECONDARY Electric	1	40	0.40	76.9	10.51	807.9	12,926	7.50	0.11	0.20	0.00	0.29	0.00	0.005	0.000	1.27	0.02	515	7.34	0.067	0.00	0.015	0.00
Land equipment (assumes tier 2 engines)																							
Mob/Demob																							
TRUCK TRAILER, LOWBOY, 75 TON, 3 AXLE (ADD TOWING TRUCK)	2	310	0.59	20.0	8	320.00	58,528	10.72	0.69	0.66	0.04	0.16	0.01	0.005	0.000	1.21	0.08	536	34.58	0.034	0.00	0.015	0.00
TRUCK, HIGHWAY, 55,000 LBS (24,948KG) GVW, 6X4, 3 AXLE, (ADD ACCESSORIES)	1	310	0.59	20.0	8	160.00	29,264	10.72	0.35	0.66	0.02	0.16	0.01	0.005	0.000	1.21	0.04	536	17.29	0.034	0.00	0.015	0.00
LOADER/BACKHOE, WHEEL, 0.80 CY FRONT END BUCKET, 9.8' DEPTH OF HOE, 24" DIPPER, 4X4	1	78	0.59	20.0	8	160.00	7,363	9.50	0.19	1.30	0.01	0.16	0.00	0.005	0.000	1.21	0.01	694	5.63	0.034	0.00	0.015	0.00
TRUCK, HIGHWAY, CONVENTIONAL, 8,600 LBS (3,901KG)GVW, 4X2, 2 AXLE, 3/4 TON -PICKUP	4	135	0.59	20.0	8	640.00	50,976	10.33	0.58	0.54	0.03	0.16	0.01	0.005	0.000	1.21	0.07	536	30.12	0.034	0.00	0.015	0.00
																					0.00	0.015	0.00
Dredged Material Placement																					0.00	0.015	0.00
TRUCK, HIGHWAY, 8,600 GVW, 4X4 (SUBURBAN)	2	135	0.59	76.9	10.51	1,615.74	128,694	10.33	1.47	0.54	0.08	0.16	0.02	0.005	0.001	1.21	0.17	536	76.04	0.034	0.00	0.015	0.00
TRACTOR ATTACHMENTS, BLADE, UNIVERSAL, HYDRAULIC, FOR D9, 21.40 CY (ADD D9 TRACTOR)	0	0	0	76.9	10.51	0.00	0	4.90	0.00	1.30	0.00	0.16	0.00	0.005	0.000	1.21	0.00	536	0.00	0.034	0.00	0.015	0.00
TRACTOR, CRAWLER (DOZER), 410 HP, POWERSHIFT, W/17.7 CY SEMI-U BLADE (ADD ATTACHMENTS)	2	410	0.59	76.9	10.51	1,615.74	390,847	9.50	4.09	0.19	0.08	0.16	0.07	0.005	0.002	1.21	0.52	595	256.34	0.034	0.01	0.015	0.01
LOADER, FRONT END, WHEEL, INTEGRATED TOOL CARRIER, 1.75 CY (1.3 M3) LOADER; 6,303 LB (2,859 KG) @ 12.17' (3.7 M) HIGH, FORK LIFT, OR 1,841 LB (835 KG) @ 22.42' (6.8 M) HIGH, MATERIAL HANDLING ARM	1	90	0.59	76.9	10.51	807.87	42,898	9.50	0.45	0.19	0.01	0.16	0.01	0.005	0.000	1.21	0.06	694	32.82	0.034	0.00	0.015	0.00
LOADER/BACKHOE, WHEEL, 0.80 CY FRONT END BUCKET, 9.8' DEPTH OF HOE, 24" DIPPER, 4X4	1	78	0.59	76.9	10.51	807.87	37,178	9.50	0.39	0.19	0.01	0.16	0.01	0.005	0.000	1.21	0.05	694	28.44	0.034	0.00	0.015	0.00
TOTAL EMISSIONS (tons)									64.44		1.92		3.21		0.04		7.70		3,690.09		0.45		0.11
(Sussex County)																							
CLEAN AIR ACT GENERAL CONFORMITY RULE LIMIT (THRESHOLD TONS/YEAR)									100.00		50.00												
Emissions Factors Obtained from:																							
South Shore of Staten Island (SSSI) Feasibility Study/EIS																							
Equipment Emission Estimates																							
and NY/NJ Harbor and Tributaries Feasibility Study/EIS																							

APPENDIX-C

ENDANGERED SPECIES ACT CONSULTATION

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United States Department of the Interior

FISH AND WILDLIFE SERVICE
Chesapeake Bay Ecological Services Field Office
177 Admiral Cochrane Drive
Annapolis, MD 21401-7307
Phone: (410) 573-4599 Fax: (410) 266-9127

In Reply Refer To: 02/27/2025 19:35:15 UTC
Project code: 2025-0062061
Project Name: Delaware Coast Protection Indian River Inlet North Beach Restoration

Federal Nexus: yes
Federal Action Agency (if applicable): Army Corps of Engineers

Subject: Technical assistance for 'Delaware Coast Protection Indian River Inlet North Beach Restoration'

Dear Steven Allen:

This letter records your determination using the Information for Planning and Consultation (IPaC) system provided to the U.S. Fish and Wildlife Service (Service) on February 27, 2025, for "Delaware Coast Protection Indian River Inlet North Beach Restoration" (here forward, Project). This project has been assigned Project Code 2025-0062061 and all future correspondence should clearly reference this number.

The Service developed the IPaC system and associated species' determination keys in accordance with the Endangered Species Act of 1973 (ESA; 87 Stat. 884, as amended; 16 U.S.C. 1531 et seq.) and based on a standing analysis. All information submitted by the Project proponent into the IPaC must accurately represent the full scope and details of the Project. Failure to accurately represent or implement the Project as detailed in IPaC or the Northeast Determination Key (Dkey), invalidates this letter. ***Answers to certain questions in the DKey commit the project proponent to implementation of conservation measures that must be followed for the ESA determination to remain valid.***

To make a no effect determination, the full scope of the proposed project implementation (action) should not have any effects (either positive or negative effect(s)), to a federally listed species or designated critical habitat. Effects of the action are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action. (See § 402.17). Under Section 7 of the ESA, if a federal action agency makes a no effect determination, no further consultation with, or concurrence from, the Service is required (ESA §7). If a proposed Federal action may affect a listed species or designated critical habitat, formal consultation is required (except when the Service concurs, in writing, that a proposed action "is not likely to adversely affect (NLAA)" listed species or designated critical habitat [50 CFR §402.02, 50 CFR§402.13]).

The IPaC results indicated the following species is (are) potentially present in your project area and, based on your responses to the Service's Northeast DKey, you determined the proposed Project will have the following effect determinations:

Species	**Listing Status**	**Determination**
Roseate Tern (*Sterna dougallii dougallii*)	Endangered	No effect
Seabeach Amaranth (*Amaranthus pumilus*)	Threatened	May affect

Consultation with the Service is not complete. Further consultation or coordination with the Service is necessary for those species or designated critical habitats with a determination of "May Affect". Please contact our Chesapeake Bay Ecological Services Field Office to discuss methods to avoid or minimize potential adverse effects to those species or designated critical habitats.

In addition to the species listed above, the following species and/or critical habitats may also occur in your project area and are not covered by this conclusion:

- Monarch Butterfly *Danaus plexippus* Proposed Threatened

Please Note: If the Action may impact bald or golden eagles, additional coordination with the Service under the Bald and Golden Eagle Protection Act (BGEPA) (54 Stat. 250, as amended, 16 U.S.C. 668a-d) by the prospective permittee may be required. Please contact the Migratory Birds Permit Office, (413) 253-8643, or PermitsR5MB@fws.gov, with any questions regarding potential impacts to Eagles.

If you have any questions regarding this letter or need further assistance, please contact the Chesapeake Bay Ecological Services Field Office and reference the Project Code associated with this Project.

Action Description

You provided to IPaC the following name and description for the subject Action.

1. Name

Delaware Coast Protection Indian River Inlet North Beach Restoration

2. Description

The following description was provided for the project 'Delaware Coast Protection Indian River Inlet North Beach Restoration':

> The action being undertaken by USACE is to complete the Phase 2 portion of the beach berm and dune restoration of approximately 5,000 feet of shoreline on the north side of Indian River Inlet. The Delaware DNREC is completing the first phase (Phase 1) with the placement of approximately 300,000 cubic yards of sand being dredged from the Indian River Inlet Flood Shoal and placed on the North Beach shoreline, which will end by April 1. The USACE Phase 2 will likely commence approximately in August 1 and end by December 31. The USACE Phase 2 component will complement the Phase 1 component, and involve the dredging of approximately 500,000 cubic yards of sand from the Indian River Inlet Ebb Shoal (offshore of the inlet in the Atlantic Ocean) via hydraulic cutter suction pipeline dredge and sand would be placed along the North Beach shoreline extending north approximately 5,000 feet from the IRI north jetty. The IRI Ebb shoal borrow area is approximately 192 acres of marine sandy bottom. Approximately 50 acres of this location will be deepened by approximately ten feet. The construction template of the beach will result in a 100 to 150-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of 5H:1V. The berm will have a dune on top with an overall dune crest elevation of +16.0 ft NAVD and width of 25 ft with 3H:1V slopes. The installation of dune fencing, crossovers and dune grass plantings would subsequently be conducted by the State of Delaware.

The approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/@38.6094932,-75.04332761776413,14z

QUALIFICATION INTERVIEW

1. As a representative of this project, do you agree that all items submitted represent the complete scope of the project details and you will answer questions truthfully?

   Yes

2. Does the proposed project include, or is it reasonably certain to cause, intentional take of listed species?

   Note: This question could refer to research, direct species management, surveys, and/or studies that include intentional handling/encountering, harassment, collection, or capturing of any individual of a federally listed threatened, endangered, or proposed species.

   No

3. Is the action authorized, permitted, licensed, funded, or being carried out by a Federal agency in whole or in part?

   Yes

4. Is the Federal Highway Administration (FHWA), Federal Railroad Administration (FRA), or Federal Transit Administration (FTA) the lead agency for this project?

   No

5. Are you including in this analysis all impacts to federally listed species that may result from the entirety of the project (not just the activities under federal jurisdiction)?

   Note: If there are project activities that will impact listed species that are considered to be outside of the jurisdiction of the federal action agency submitting this key, contact your local Ecological Services Field Office to determine whether it is appropriate to use this key. If your Ecological Services Field Office agrees that impacts to listed species that are outside the federal action agency's jurisdiction will be addressed through a separate process, you can answer yes to this question and continue through the key.

   Yes

6. Are you the lead federal action agency or designated non-federal representative requesting concurrence on behalf of the lead Federal Action Agency?

   Yes

7. Is the lead federal action agency the Environmental Protection Agency (EPA) or Federal Communications Commission (FCC)?

   No

8. Is the lead federal action agency the Federal Energy Regulatory Commission (FERC)?

   No

9. Is the lead federal action agency the Natural Resources Conservation Service?

   No

10. Will the proposed project involve the use of herbicide where listed species are present?

    No

11. Are there any caves or anthropogenic features suitable for hibernating or roosting bats within the area expected to be impacted by the project?

    No

12. Does any component of the project associated with this action include activities or structures that may pose a collision risk to **birds** (e.g., plane-based surveys, land-based or offshore wind turbines, communication towers, high voltage transmission lines, any type of towers with or without guy wires)?

    Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No

13. Does any component of the project associated with this action include activities or structures that may pose a collision risk to **bats** (e.g., plane-based surveys, land-based or offshore wind turbines)?

    Note: For federal actions, answer ‘yes’ if the construction or operation of wind power facilities is either (1) part of the federal action or (2) would not occur but for a federal agency action (federal permit, funding, etc.).

    No

14. Will the proposed project result in permanent changes to water quantity in a stream or temporary changes that would be sufficient to result in impacts to listed species?

    For example, will the proposed project include any activities that would alter stream flow, such as water withdrawal, hydropower energy production, impoundments, intake structures, diversion structures, and/or turbines? Projects that include temporary and limited water reductions that will not displace listed species or appreciably change water availability for listed species (e.g. listed species will experience no changes to feeding, breeding or sheltering) can answer "No". Note: This question refers only to the amount of water present in a stream, other water quality factors, including sedimentation and turbidity, will be addressed in following questions.

    No

15. Will the proposed project affect wetlands where listed species are present?

    This includes, for example, project activities within wetlands, project activities within 300 feet of wetlands that may have impacts on wetlands, water withdrawals and/or discharge of contaminants (even with a NPDES).

    No

16. Will the proposed project activities (including upland project activities) occur within 0.125 miles of the water's edge of a stream or tributary of a stream where listed species may be present?

    No

17. Will the proposed project directly affect a streambed (below ordinary high water mark (OHWM)) of the stream or tributary where listed species may be present?

    No

18. Will the proposed project bore underneath (directional bore or horizontal directional drill) a stream where listed species may be present?

    No

19. Will the proposed project involve a new point source discharge into a stream or change an existing point source discharge (e.g., outfalls; leachate ponds) where listed species may be present?

    No

20. Will the proposed project involve the removal of excess sediment or debris, dredging or in-stream gravel mining where listed species may be present?

    No

21. Will the proposed project involve the creation of a new water-borne contaminant source where listed species may be present?

    Note New water-borne contaminant sources occur through improper storage, usage, or creation of chemicals. For example: leachate ponds and pits containing chemicals that are not NSF/ANSI 60 compliant have contaminated waterways. Sedimentation will be addressed in a separate question.

    No

22. Will the proposed project involve perennial stream loss, in a stream of tributary of a stream where listed species may be present, that would require an individual permit under 404 of the Clean Water Act?

    No

23. Will the proposed project involve blasting where listed species may be present?

    No

24. Will the proposed project include activities that could negatively affect fish movement temporarily or permanently (including fish stocking, harvesting, or creation of barriers to fish passage).

    No

25. Will the proposed project involve earth moving that could cause erosion and sedimentation, and/or contamination along a stream or tributary of a stream where listed species may be present?

    Note: Answer "Yes" to this question if erosion and sediment control measures will be used to protect the stream.

    No

26. Will the proposed project impact streams or tributaries of streams where listed species may be present through activities such as, but not limited to, valley fills, large-scale vegetation removal, and/or change in site topography?

    No

27. Will the proposed project involve vegetation removal within 200 feet of a perennial stream bank where aquatic listed species may be present?

    No

28. Will erosion and sedimentation control Best Management Practices (BMPs) associated with applicable state and/or Federal permits, be applied to the project? If BMPs have been provided by and/or coordinated with and approved by the appropriate Ecological Services Field Office, answer "Yes" to this question.

    No

29. Is the project being funded, lead, or managed in whole or in part by U.S Fish and Wildlife Restoration and Recovery Program (e.g., Partners, Coastal, Fisheries, Wildlife and Sport Fish Restoration, Refuges)?

    No

30. Will the proposed project result in changes to beach dynamics that may modify formation of habitat over time?

    Note: Examples of projects that result in changes to beach dynamics include 1) construction of offshore breakwaters and groins; 2) mining of sand from an updrift ebb tidal delta; 3) removing or adding beach sands; and 4) projects that stabilize dunes (including placement of sand fences or planting vegetation).

    Yes

31. [Hidden Semantic] Is the project area located within the roseate tern AOI?

    Automatically answered
    Yes

32. If you have determined that the roseate tern is unlikely to occur within your project's action area or that your project is unlikely to have any potential effects on the roseate tern, you may wish to make a "no effect" determination for the roseate tern. Additional guidance on how to make this decision can be found in the project review section of your local Ecological Services Field Office's website. CBFO: https://www.fws.gov/office/chesapeake-bay-ecological-services/project-review ; MEFO: https://www.fws.gov/office/maine-ecological-services ; NJFO: https://www.fws.gov/office/new-jersey-ecological-services/new-jersey-field-office-project-review-guide ; NEFO: https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review#Step5 ; WVFO: https://www.fws.gov/office/west-virginia-ecological-services/project-planning. If you are unsure, answer "No" and continue through the key.

    Would you like to make a no effect determination for the roseate tern?

    Yes

33. [Hidden Semantic] Is the action area located within the seabeach amaranth AOI?

    Automatically answered
    Yes

34. If you have determined that seabeach amaranth is unlikely to occur within your project's action area or that your project is unlikely to have any potential effects on the seabeach amaranth, you may wish to make a "no effect" determination for the seabeach amaranth. Additional guidance on how to make this decision can be found in the project review section of your local Ecological Services Field Office's website. CBFO: https://www.fws.gov/office/chesapeake-bay-ecological-services/project-review ; MEFO: https://www.fws.gov/office/maine-ecological-services ; NJFO: https://www.fws.gov/office/new-jersey-ecological-services/new-jersey-field-office-project-review-guide ; NEFO: https://www.fws.gov/office/new-england-ecological-services/endangered-species-project-review#Step5 ; WVFO: https://www.fws.gov/office/west-virginia-ecological-services/project-planning. If you are unsure, answer "No" and continue through the key.

    Would you like to make a no effect determination for the seabeach amaranth?

    No
35. Did a qualified surveyor conduct a survey within the time frame when seabeach amaranth would be expected to be present and identifiable?

    Note: The following date ranges are the accepted survey times by State:
    Maryland - July 1 through September 30
    New York - May 1 through November 1
    New Jersey - May 15 through November 30

    No
36. Will the project involve direct impacts (crushing, burying, and/or digging, including placement of fill on sandy beaches where seabeach amaranth plants and/or seeds may be present) to seabeach amaranth plants or potential removal/burial of seeds?

    Yes
37. [Semantic] Does the project intersect the Virginia big-eared bat critical habitat?

    Automatically answered
    No
38. [Semantic] Does the project intersect the Indiana bat critical habitat?

    Automatically answered
    No
39. [Semantic] Does the project intersect the candy darter critical habitat?

    Automatically answered
    No
40. [Semantic] Does the project intersect the diamond darter critical habitat?

    Automatically answered
    No
41. [Semantic] Does the project intersect the Big Sandy crayfish critical habitat?

    Automatically answered
    No

42. [Hidden Semantic] Does the project intersect the Guyandotte River crayfish critical habitat?

    Automatically answered
    No

43. Do you have any other documents that you want to include with this submission?

    No

PROJECT QUESTIONNAIRE

1. Approximately how many acres of trees would the proposed project remove?

   0

2. Approximately how many total acres of disturbance are within the disturbance/ construction limits of the proposed project?

   262

3. Briefly describe the habitat within the construction/disturbance limits of the project site.

   Dredging would occur within a 192-acre ebb shoal area offshore of Indian River Inlet. Dredging depths would vary but would have a maximum 10-foot cut. This area is very dynamic and is expected to infill with a new shoal feature. Beachfill slurry of sand would be pumped onto the North Beach affecting a 5,000 foot stretch of severely eroded Atlantic Coast shoreline extending north from the north jetty of Indian River Inlet. Approximately 70 acres of dune, beach, and shallow subtidal would be affected.

IPAC USER CONTACT INFORMATION

Agency: Army Corps of Engineers
Name: Steven Allen
Address: 1650 Arch Street
City: Philadelphia
State: PA
Zip: 19103-2004
Email steven.d.allen@usace.army.mil
Phone: 2156566559

DELAWARE COAST PROTECTION INDIAN RIVER INLET NORTH BEACH RESTORATION

BIOLOGICAL ANALYSIS

Prepared using IPaC

Generated by Steven Allen (steven.d.allen@usace.army.mil)

March 11, 2025

The purpose of this document is to assess the effects of the proposed project and determine whether the project may affect any federally threatened, endangered, proposed, or candidate species. If appropriate for the project, this document may be used as a biological assessment (BA), as it is prepared in accordance with legal requirements set forth under Section 7 of the Endangered Species Act (16 U.S.C. 1536 (c)).

In this document, any data provided by U.S. Fish and Wildlife Service is based on data as of February 27, 2025.

Prepared using IPaC version 6.123.0-rc6

DELAWARE COAST PROTECTION INDIAN RIVER INLET NORTH BEACH RESTORATION BIOLOGICAL ASSESSMENT

TABLE OF CONTENTS

1 DESCRIPTION OF THE ACTION

1.1 PROJECT NAME

Delaware Coast Protection Indian River Inlet North Beach Restoration

1.2 EXECUTIVE SUMMARY

The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

The selected plan is a combination of the dredging and beachfill plan and sand source alternatives for the restoration of the North Beach shoreline. The Phase II portion of the beach berm and dune restoration will complement the Phase I portion to be completed by DNREC prior to Phase II. For the completion of the Phase II berm and dune restoration, approximately 500,000 cubic yards of sand beachfill would be placed along the shoreline of the North Beach extending north from the north Indian River Inlet jetty for approximately 5,000 feet. The construction template will result in a 100 to 150-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of 5H:1V. The berm will have a dune on top with an overall dune crest elevation of +16.0 ft NAVD and width of 25 ft with 3H:1V slopes. The installation of dune fencing, crossovers and dune grass plantings would subsequently be conducted by the State of Delaware. The Phase II sand would be obtained from the hydraulic dredging of the Indian River Inlet Ebb Shoal (IRI-Ebb A). The selected plan also includes the periodic nourishment of the North Beach on an as needed basis to supplement the Indian River Inlet sand bypass plant operations to maintain the Phase II berm and dune template.

The IPaC search identified three species potentially occurring within the affected area of the action along the North Beach shoreline and dune habitat. These species included: the roseate tern, the monarch butterfly, and the seabeach amaranth.

Based on the known biological factors of the species and the construction activities and timing of these activities. Impact determinations were made resulting in the following conclusions:

The presence of breeding roseate terns is highly unlikely within the project area, therefore a no effect determination of the action is warranted.

Monarch butterflies are likely to be present in the project area during construction activities. The equipment and associated construction activities are not likely to directly affect monarch butterflies; however, the nectar food source (seaside goldenrod) could be affected in some locations by burial of sand. This would not result in a significant loss of seaside goldenrod and it is expected to recolonize rapidly after construction from nearby windblown seed sources. Therefore, for the monarch butterfly, it is concluded that this activity may affect, but is not likely to adversely affect this species.

The seabeach amaranth has historically been present in the vicinity of the affected area. Current conditions with severe erosion make it not likely to be present within the action area. However, based on completion of the Phase 1 prior to initiating Phase 2 (this action), a potential exists that seabeach amaranth could appear in created supratidal locations prior to the start of construction of Phase 2. Therefore, a foot survey to look for the presence of this plant would occur prior to construction. Any found plants would be isolated and avoided. The USFWS and DNREC would be consulted on appropriate actions to conserve this plant from either letting it complete its lifecycle in place and collecting its seed to transplanting it. Therefore, with these measures in place, it is concluded that the activity may affect but is not likely to adversely affect this species.

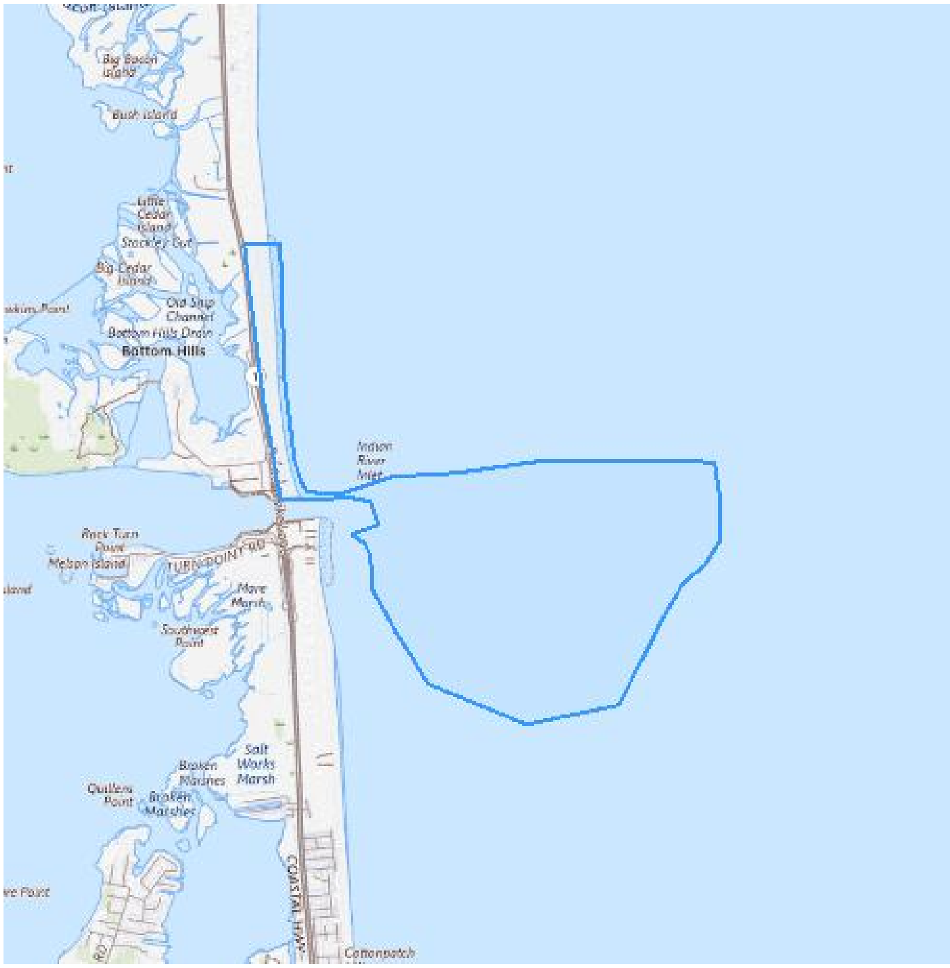
1.3 EFFECT DETERMINATION SUMMARY

SPECIES (COMMON NAME)	SCIENTIFIC NAME	LISTING STATUS	PRESENT IN ACTION AREA	EFFECT DETERMINATION
Monarch Butterfly	Danaus plexippus	Proposed Threatened	Yes	NLAA
Roseate Tern[†]. **This species or critical habitat is covered by a DKey.**	Sterna dougallii dougallii	Endangered		NE
Seabeach Amaranth	Amaranthus pumilus	Threatened	Yes	NLAA

[†] This species or critical habitat has been analyzed through a Determination Key.

1.4 PROJECT DESCRIPTION

1.4.1 LOCATION



LOCATION

Sussex County, Delaware

1.4.2 DESCRIPTION OF PROJECT HABITAT

The affected area includes a severely eroded beach and dune along the north side of the Indian River Inlet, Delaware. This erosion is most severe nearest to the north jetty and extends about a 1,000 feet north where the beach has experienced inundation and overwash onto the adjacent State Route 1 highway. Efforts to recreate the dune with truck imported sand have been challenged by persistent waves and tides. The State of Delaware has embarked on a beach nourishment project (Phase 1) commencing in November 2024 and is expected to complete the Phase 1 portion by March 15, 2025. This will result in a widened beach for the completion of Phase 2 under the proposed action, which would complement the beachfill conducted by the State of Delaware. Another habitat affected by the proposed action is an offshore marine ebb shoal area that is the sand source for the beach nourishment.

1.4.3 PROJECT PROPONENT INFORMATION

Provide information regarding who is proposing to conduct the project, and their contact information. Please provide details on whether there is a Federal nexus.

REQUESTING AGENCY

Department of Defense

Army Corps of Engineers

FULL NAME

Steven Allen

STREET ADDRESS

1650 Arch Street

CITY	STATE	ZIP
Philadelphia	PA	19103-2004

PHONE NUMBER	E-MAIL ADDRESS
2156566559	steven.d.allen@usace.army.mil

LEAD AGENCY

Lead agency is the same as requesting agency

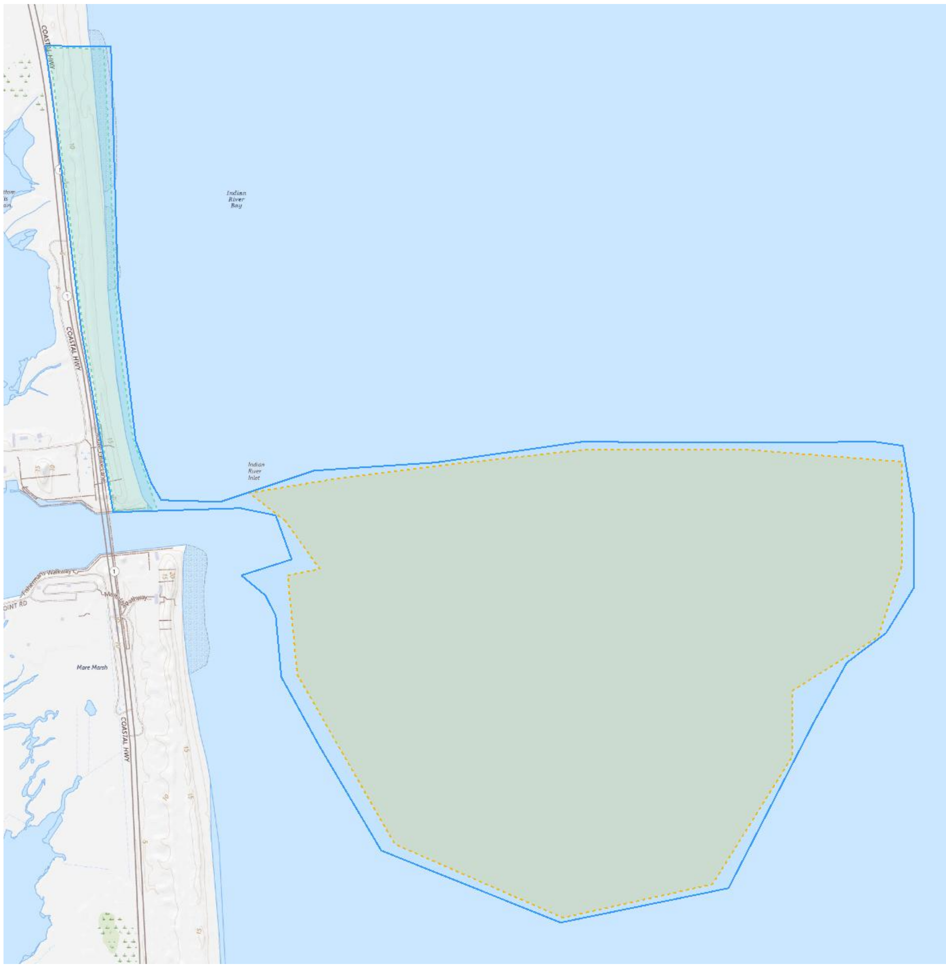
1.4.4 PROJECT PURPOSE

The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

1.4.5 PROJECT TYPE AND DECONSTRUCTION

This project is a beach nourishment project.

1.4.5.1 PROJECT MAP



LEGEND

Project footprint

Layer 1: Marine dredging

Layer 2: Biological surveys (coastal), dune building, install sand fence, pipeline sand transport/placement, redistribute sand, restore / establish coastal vegetation, stockpile sand, transport sand

1.4.5.2 BIOLOGICAL SURVEYS (COASTAL)

ACTIVITY START DATE
July 01, 2025

ACTIVITY END DATE
August 31, 2025

STRESSORS
This activity is not expected to have any impact on the environment.

DESCRIPTION
A foot survey to identify the presence and any locations of the threatened plant, seabeach amaranth, will occur along the upper beach/lower dune areas prior to construction.

1.4.5.3 DUNE BUILDING

ACTIVITY START DATE
August 15, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS
- Decrease in vegetation
- Increase in water turbidity
- Change in topography
- Increase in noise
- Increase in soil disturbance

DESCRIPTION
Dune building will occur where there is severe erosion and our diminishment of the existing dune. Some vegetation may be covered by this activity to build-up a diminished dune to achieve the design template. Noise from construction equipment conducting earthwork/soil disturbance would occur. This activity would occur along the entire 5,000 foot span of beach habitat, but dune building may not be required in all locations if a sufficient dune profile already exists. Beach nourishment will temporarily increase water turbidity in the ocean within the affected areas.

1.4.5.4 INSTALL SAND FENCE

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
March 15, 2026

STRESSORS
- Increase in vegetation

DESCRIPTION
Sand fencing would be installed once the constructed dune dimensions are achieved. Posts would require power augers for excavation and handheld power tools to install fencing. Fencing would require delivery most likely from front-end loaders or small trucks.

1.4.5.5 MARINE DREDGING

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS
- Increase in water turbidity
- Increase in noise

DESCRIPTION
The marine dredging component would be limited to the offshore subtidal areas and will not affect onshore habitats.

1.4.5.6 PIPELINE SAND TRANSPORT/PLACEMENT

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS
- Change in topography
- Increase in noise

DESCRIPTION
A pipeline would make landfall from the offshore dredge plant offshore. The pipeline would be positioned parallel along the beach for the entire 5,000 foot span of beachfill. The pipeline will typically have a "Y" valve which can be used to re-direct sand slurry flows. The pipeline will be increased or decreased in length as needed. The pipeline will be disassembled and removed from site upon cessation of dredging/beachfill activities.

1.4.5.7 REDISTRIBUTE SAND

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS
- Increase in water turbidity
- Change in topography
- Increase in noise
- Increase in soil disturbance

DESCRIPTION
Once deposited sand slurry has settled and sufficiently de-watered, the re-distribution of sand would occur with dozers to achieve final grades of berm and dune template configuration.

1.4.5.8 RESTORE / ESTABLISH COASTAL VEGETATION

ACTIVITY START DATE
October 31, 2025

ACTIVITY END DATE
March 15, 2026

STRESSORS

- Increase in vegetation

DESCRIPTION
The restoration of coastal vegetation would consist of the planting of sprigs of American beachgrass on the reconstructed dunes to stabilize the dunes. This activity would occur during dormancy of the plants generally from late October to mid-March. Seeding of the upper dune crest and back side of the dune with coastal panicgrass may also occur.

1.4.5.9 STOCKPILE SAND

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS

- Change in topography

DESCRIPTION
Temporary stockpiles of sand may occur as the sands are de-watered prior to their re-distribution to achieve final grades.

1.4.5.10 TRANSPORT SAND

ACTIVITY START DATE
August 31, 2025

ACTIVITY END DATE
December 31, 2025

STRESSORS
- Increase in noise

DESCRIPTION
Sand may be transported either by dozers or placed in dump trucks to designated locations to achieve final grades of the berm and dune features.

1.4.6 ANTICIPATED ENVIRONMENTAL STRESSORS

Describe the anticipated effects of your proposed project on the aspects of the land, air and water that will occur due to the activities above. These should be based on the activity deconstructions done in the previous section and will be used to inform the action area.

1.4.6.1 PLANT FEATURES

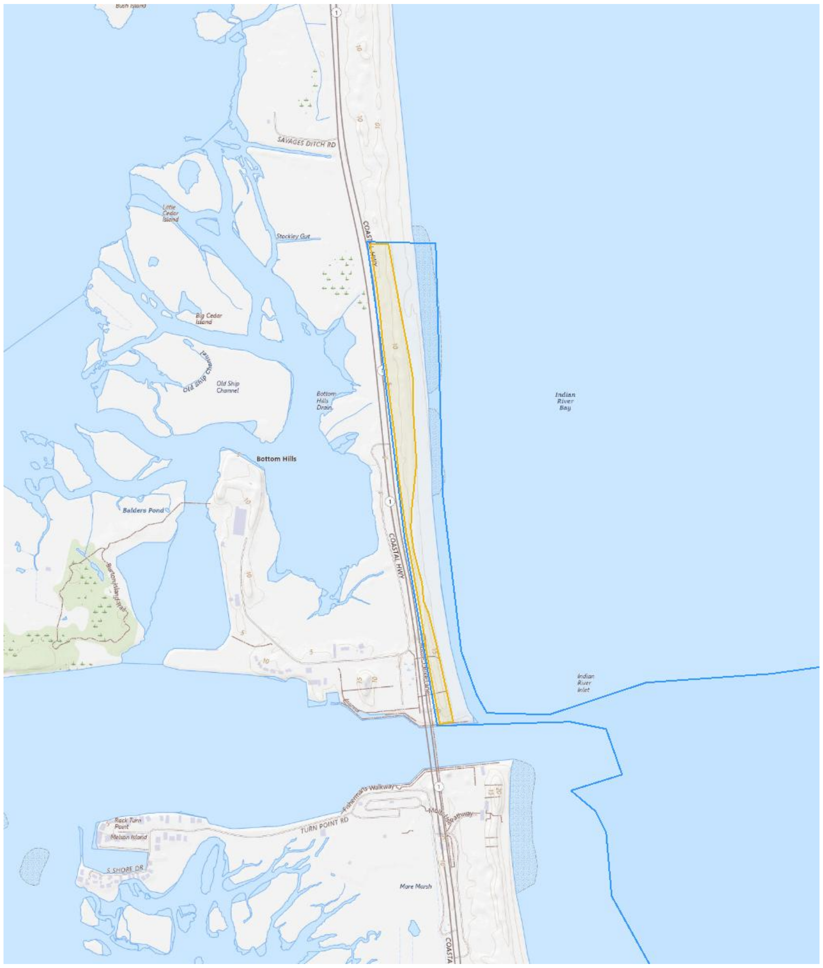
Individuals from the Plantae kingdom, such as trees, shrubs, herbs, grasses, ferns, and mosses. This feature also includes products of plants (e.g., nectar, flowers, seeds, etc.).

1.4.6.1.1 DECREASE IN VEGETATION

ANTICIPATED MAGNITUDE

Minor decreases in vegetation could occur where colonizing beach vegetation may have grown on a dune/upper beach area that is below the design template. Therefore, these areas may get buried by new sand. Since this area is very dynamic by wind and water movement of sand, the vegetation that typically grows in the upper beach would quickly recolonize the affected areas. Dune grass would be planted after the dune dimensions are achieved to stabilize the sand dunes.

STRESSOR LOCATION



LEGEND

Project footprint

Stressor location

CONSERVATION MEASURES

No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

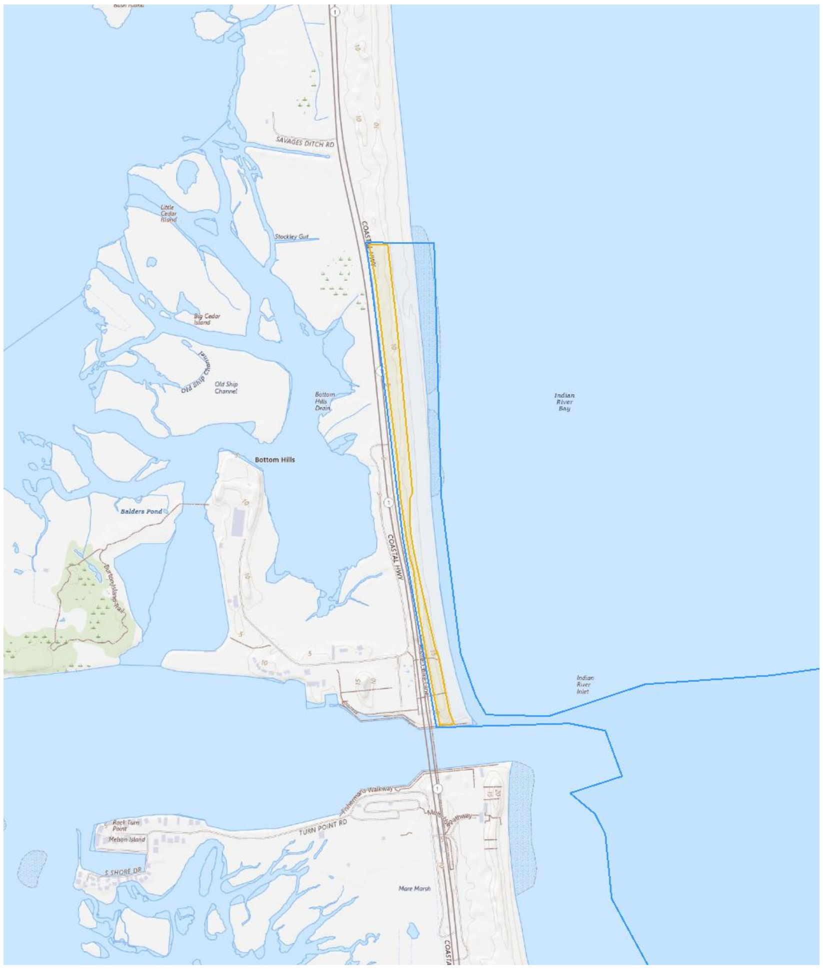
- Dune building

1.4.6.1.2 INCREASE IN VEGETATION

ANTICIPATED MAGNITUDE

Increases in vegetation would occur in newly constructed dune areas that require the planting of American beachgrass and the seeding of seaside panic grass. This would only affect areas where the dune has become reconstructed.

STRESSOR LOCATION



LEGEND

Project footprint

Stressor location

CONSERVATION MEASURES

No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

- Restore / establish coastal vegetation
- Install sand fence

1.4.6.2 ENVIRONMENTAL QUALITY FEATURES

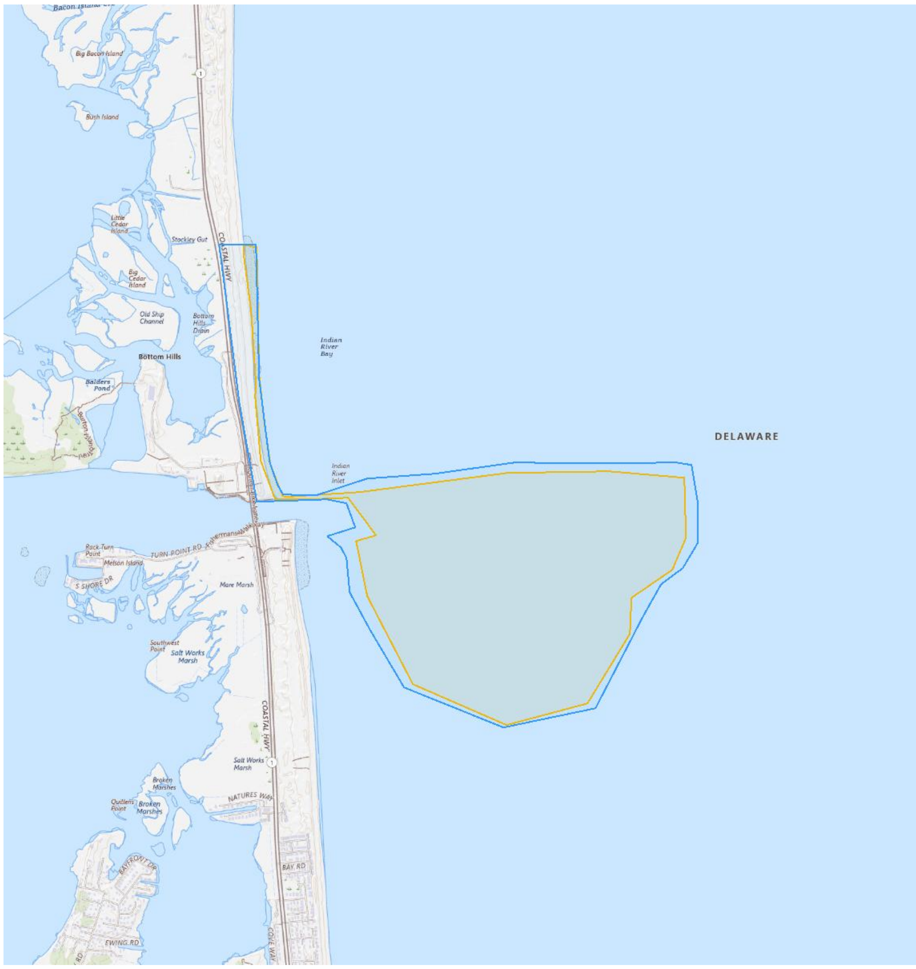
Abiotic attributes of the landscape (e.g., temperature, moisture, slope, aspect, etc.).

1.4.6.2.1 INCREASE IN WATER TURBIDITY

ANTICIPATED MAGNITUDE

Increases in turbidity are localized to the dredging location and the placement location along the nearshore. Since the material is clean sand, the turbidity will be localized and temporary.

STRESSOR LOCATION



LEGEND

Project footprint

Stressor location

CONSERVATION MEASURES

No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

- Redistribute sand
- Marine dredging
- Dune building

1.4.6.3 LANDFORM (TOPOGRAPHIC) FEATURES

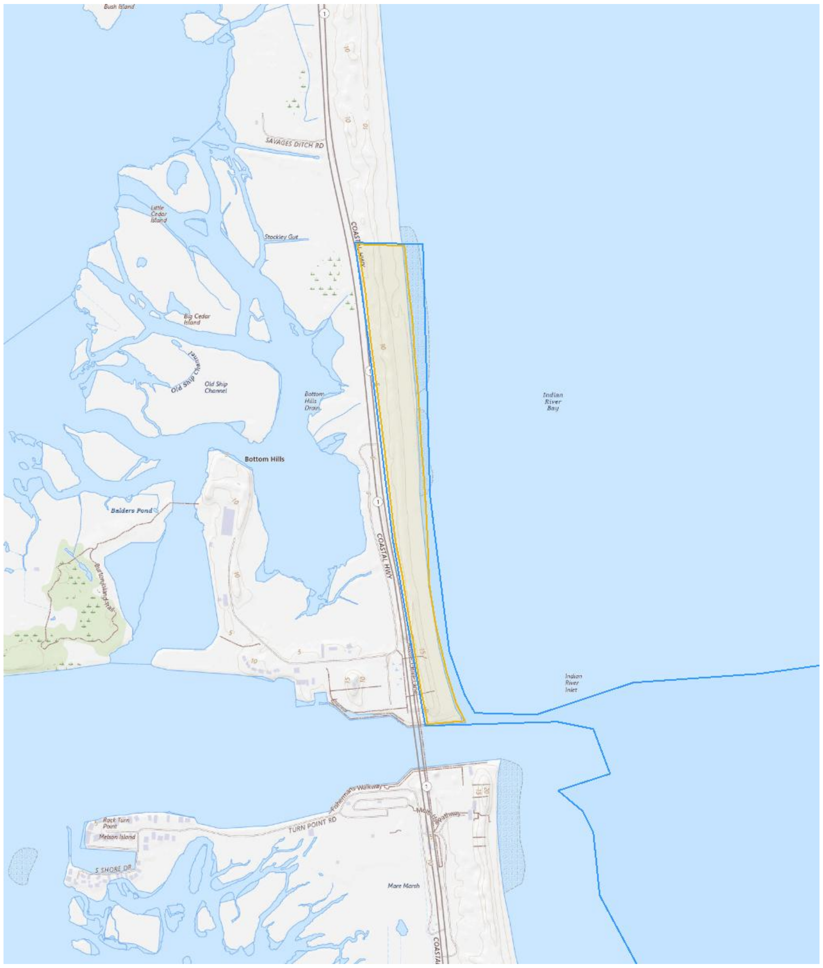
Topographic (landform) features that typically occur naturally on the landscape (e.g., cliffs, terraces, ridges, etc.). This feature does not include aquatic landscape features or man-made structures.

1.4.6.3.1 CHANGE IN TOPOGRAPHY

ANTICIPATED MAGNITUDE

The existing beach berm and dune have experienced severe erosion and is in a deflated condition. The beach nourishment will increase the elevations of the berm and dune to the specified design dimensions. This will also increase the width of the beach significantly.

STRESSOR LOCATION



LEGEND

Project footprint

Stressor location

CONSERVATION MEASURES

No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

- Stockpile sand
- Pipeline sand transport/placement
- Redistribute sand
- Dune building

1.4.6.4 SOIL AND SEDIMENT

The topmost layer of earth on the landscape and its components (e.g., rock, sand, gravel, silt, etc.). This feature includes the physical characteristics of soil, such as depth, compaction, etc. Soil quality attributes (e.g, temperature, pH, etc.) should be placed in the Environmental Quality Features.

1.4.6.5 HUMAN ACTIVITIES

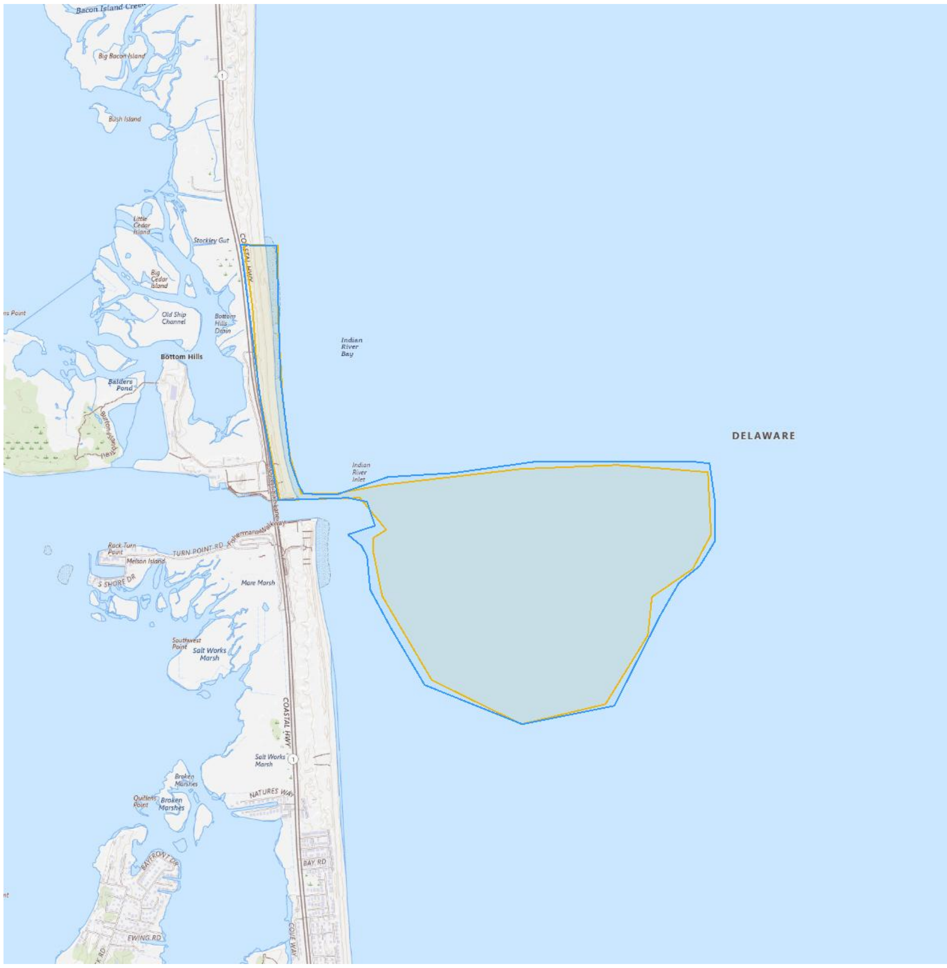
Human actions in the environment (e.g., fishing, hunting, farming, walking, etc.).

1.4.6.5.1 INCREASE IN NOISE

ANTICIPATED MAGNITUDE

Increases in noise would occur at the dredging location where large diesel engines and pumps would be used as part of the dredging operation. Other marine vessels such as tugs, survey boats and crew boats will generate noise during the construction. Construction equipment such as generators, dozers (engines and backup beeping), graders, forklifts, backhoes, and dump trucks would create noise disturbance during construction.

STRESSOR LOCATION



LEGEND

Project footprint

Stressor location

CONSERVATION MEASURES

No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

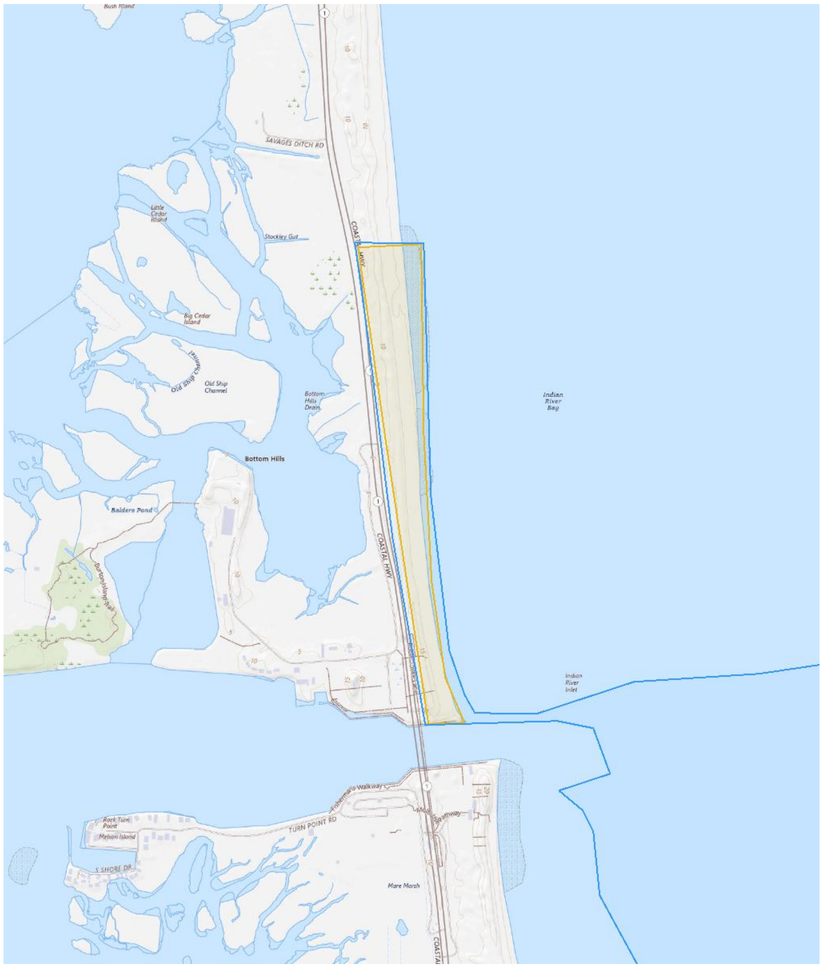
- Transport sand
- Pipeline sand transport/placement
- Redistribute sand
- Marine dredging
- Dune building

1.4.6.5.2 INCREASE IN SOIL DISTURBANCE

ANTICIPATED MAGNITUDE

Dredging/beach nourishment projects result in significant disturbance of soils. However, the soils are beach sands that are part of a dynamic coastal environment where frequent disturbance is a natural occurrence. The dredging/filling and redistribution of sand will not have significant adverse effects with respect to soil disturbance.

STRESSOR LOCATION



LEGEND

Project footprint

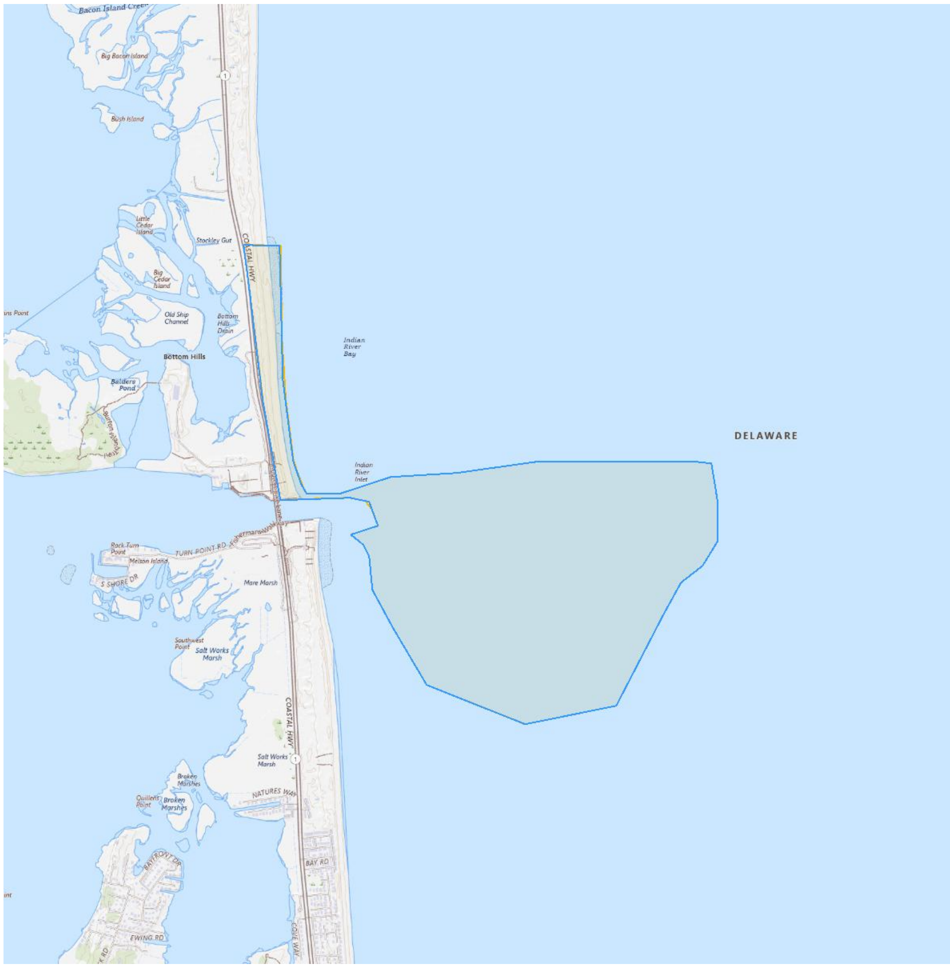
Stressor location

CONSERVATION MEASURES
No conservation measures for this stressor

STRUCTURES AND ACTIVITIES

- Redistribute sand
- Dune building

1.5 ACTION AREA



LEGEND

Project footprint

Stressor location

1.6 CONSERVATION MEASURES

1.6.1 CONDUCT PRE-CONSTRUCTION SURVEY FOR SEABEACH AMARANTH AND PRACTICE AVOIDANCE DURING CONSTRUCTION

DESCRIPTION

Prior to construction, a foot survey will be conducted along the upper beach and lower dune supra tidal zone to look for any established or emerging plants in this zone. If plants are observed, they will be located and isolated with exclusion fencing to alert construction crews and these locations will be avoided. USFWS and DNREC would be notified to determine a course of action on either transplantation during the growing season or to let the plants complete their life-cycle in place. In similar situations, seed that had dropped from the plants was collected and then placed in the new beachfill area location.

RESOURCE NEEDS

- beaches
- substrate structure and characteristics (type: sand)

1.7 PRIOR CONSULTATION HISTORY

Informal consultation has occurred periodically and occurred initially in 1990 with the construction of the sand bypass plant and operation at Indian River Inlet. Informal consultation occurred in 2013 for the repairs and restoration of the beach and dune following Hurricane Sandy under the Flood Control and Coastal Emergencies Program (FCCE). Informal consultation occurred in 2015 to add sand borrow areas to be interchangeable along the Delaware Atlantic Coast. This consultation also included an update to the Indian River Inlet North Beach location.

1.8 OTHER AGENCY PARTNERS AND INTERESTED PARTIES

None

1.9 OTHER REPORTS AND HELPFUL INFORMATION

None

2 SPECIES EFFECTS ANALYSIS

This section describes, species by species, the effects of the proposed action on listed, proposed, and candidate species, and the habitat on which they depend. In this document, effects are broken down as direct interactions (something happening directly to the species) or indirect interactions (something happening to the environment on which a species depends that could then result in effects to the species).

These interactions encompass effects that occur both during project construction and those which could be ongoing after the project is finished. All effects, however, should be considered, including effects from direct and indirect interactions and cumulative effects.

2.1 MONARCH BUTTERFLY

2.1.1 STATUS OF THE SPECIES

This section should provide information on the species' background, its biology and life history that is relevant to the proposed project within the action area that will inform the effects analysis.

2.1.1.1 LEGAL STATUS

The Monarch Butterfly is federally listed as 'Proposed Threatened' and additional information regarding its legal status can be found on the ECOS species profile.

2.1.1.2 RECOVERY PLANS

Available recovery plans for the Monarch Butterfly can be found on the ECOS species profile.

2.1.1.3 LIFE HISTORY INFORMATION

For information on monarch conservation, visit https://www.fws.gov/initiative/pollinators/monarchs, http://www.mafwa.org/?page_id=2347, and, for the West, https://wafwa.org/committees-working-groups/monarch-working-group/.

Adult monarch butterflies are large and conspicuous, with bright orange wings surrounded by a black border and covered with black veins. The black border has a double row of white spots, present on the upper side of the wings. Adult monarchs are sexually dimorphic, with males having narrower wing venation and scent patches. The bright coloring of a monarch serves as a warning to predators that eating them can be toxic.

During the breeding season, monarchs lay their eggs on their obligate milkweed host plant (primarily Asclepias spp.), and larvae emerge after two to five days. Larvae develop through five larval instars (intervals between molts) over a period of 9 to 18 days, feeding on milkweed and sequestering toxic chemicals (cardenolides) as a defense against predators. The larva then pupates into a chrysalis before emerging 6 to 14 days later as an adult butterfly. There are multiple generations of monarchs produced during the breeding season, with most adult butterflies living approximately two to five weeks; overwintering adults enter into reproductive diapause (suspended reproduction) and live six to nine months.

In many regions where monarchs are present, monarchs breed year-round. Individual monarchs in temperate climates, such as eastern and western North America, undergo long-distance migration, and live for an extended period of time. In the fall, in both eastern and western North America, monarchs begin migrating to their respective overwintering sites. This migration can take monarchs distances of over 3,000 km and last for over two months. In early spring (February-March), surviving monarchs break diapause and mate at the overwintering sites before dispersing. The same individuals that undertook the initial southward migration begin flying back through the breeding grounds and their offspring start the cycle of generational migration over again.

IDENTIFIED RESOURCE NEEDS

Nectar

In the affected area of an atlantic coast beach/dune, the primary impacted area is the primary dune. the only plant that would occur in this area that would be utilized by the monarch butterfly is the seaside goldenrod, which is a nectar provider for adult monarchs.

2.1.1.4 CONSERVATION NEEDS

Indiscriminate uses of herbicides, development and loss of flowering/nectar producing prairie type habitats.

2.1.2 ENVIRONMENTAL BASELINE

The environmental baseline describes the species' health ***within the action area only*** *at the time of the consultation, and does not include the effects of the action under review. Unlike the species information provided above, the environmental baseline is at the scale of the Action area.*

2.1.2.1 SPECIES PRESENCE AND USE

Migratory monarch butterflies may be present on the dune areas where goldenrod flowers are blooming in the late summer and fall.

2.1.2.2 SPECIES CONSERVATION NEEDS WITHIN THE ACTION AREA

Monarchs would require nectar-bearing flowers such as the seaside goldenrod during their late summer/fall migration, which occurs in dune habitats potentially affected by project actions. Priority will be given to conserve seaside goldenrods on dune areas wherever practicable.

2.1.2.3 HABITAT CONDITION (GENERAL)

NECTAR (IN THE AFFECTED AREA OF AN ATLANTIC COAST BEACH/DUNE, THE PRIMARY IMPACTED AREA IS THE PRIMARY DUNE. THE ONLY PLANT THAT WOULD OCCUR IN THIS AREA THAT WOULD BE UTILIZED BY THE MONARCH BUTTERFLY IS THE SEASIDE GOLDENROD, WHICH IS A NECTAR PROVIDER FOR ADULT MONARCHS.)

The seaside goldenrod is expected to occur within the affected area. Typically where this plant occurs, it may be at a location where dune restoration/disturbance would not be required because it would be in an area not subject to high erosion. However, there may be exceptions and instances where seaside goldenrod could be disturbed by construction activities.

2.1.2.4 INFLUENCES

Severe erosion of the coastal dunes north of Indian River Inlet have diminished the vegetation such as the seaside goldenrod plant that is used by monarch butterflies.

2.1.2.5 ADDITIONAL BASELINE INFORMATION

N/A

2.1.3 EFFECTS OF THE ACTION

This section considers and discusses all effects on the listed species that are caused by the proposed action and are reasonably certain to occur, including the effects of other activities that would not occur but for the proposed action.

2.1.3.1 INDIRECT INTERACTIONS

RESOURCE NEED	STRESSORS	CONSERVATION MEASURES	AMOUNT OF RESOURCE IMPACTED	INDIVIDUALS AFFECTED
Nectar (in the affected area of an atlantic coast beach/dune, the primary impacted area is the primary dune. the only plant that would occur in this area that would be utilized by the monarch butterfly is the seaside goldenrod, which is a nectar provider for adult monarchs.)	Increase in soil disturbance Decrease in vegetation		***There will be no impacts to this resource*** Seaside goldenrod, for the most part, will be in locations that may not require beachfill disturbance because it typically inhabits upper dune, dune crests and the back side of dunes. It is also likely to quickly colonize and establish on newly restored dunes.	***There will be no impacts to this resource, so no individuals will be affected.***

2.1.3.2 DIRECT INTERACTIONS

No direct interactions leading to effects on species are expected to occur from the proposed project.

Justification:

Since monarch butterflies are mobile. They are not likely to be affected directly by construction activities.

2.1.4 CUMULATIVE EFFECTS

The proposed activities of dredging/beachfill placement are not likely to have any significant direct or indirect effects, and by default will not have cumulative effects on this species.

2.1.5 DISCUSSION AND CONCLUSION

DETERMINATION: NLAA

COMPENSATION MEASURES
None. The nectar producing seaside goldenrod is expected to colonize and establish on restored dunes from nearby windblown seed sources.

2.2 SEABEACH AMARANTH

2.2.1 STATUS OF THE SPECIES

This section should provide information on the species' background, its biology and life history that is relevant to the proposed project within the action area that will inform the effects analysis.

2.2.1.1 LEGAL STATUS

The Seabeach Amaranth is federally listed as 'Threatened' and additional information regarding its legal status can be found on the ECOS species profile.

2.2.1.2 RECOVERY PLANS

Available recovery plans for the Seabeach Amaranth can be found on the ECOS species profile.

2.2.1.3 LIFE HISTORY INFORMATION

No description available

IDENTIFIED RESOURCE NEEDS

- Beaches
- Substrate structure and characteristics
  - Type: sand

2.2.1.4 CONSERVATION NEEDS

The sea beach amaranth or “pigweed” (*Amaranthus pumilus*) is a Federally threatened plant that primarily occurs on overwash flats at accreting ends of barrier islands and lower foredunes and upper strands on non-eroding beaches. This plant has been found within Cape Henlopen State Park, Delaware Seashore State Park, and Fenwick Island State Park. Most recently, seabeach amaranth was observed growing 1.4 miles north of the Indian River Inlet. This species has not been found in any of the municipal Federal project beaches, but did occur within the affected project area of the North Beach area of Indian River Inlet in 2002. However, the severe erosion of the North Beach area in recent years makes this area unlikely to be inhabited by sea beach amaranth.

2.2.2 ENVIRONMENTAL BASELINE

The environmental baseline describes the species' health ***within the action area only*** *at the time of the consultation, and does not include the effects of the action under review. Unlike the species information provided above, the environmental baseline is at the scale of the Action area.*

2.2.2.1 SPECIES PRESENCE AND USE

This species has historically occurred in the affected area of the beach. However, this area has undergone significant erosion in recent years, which would preclude its establishment in the area. However, given the Phase 1 beachfill efforts to be completed by the Delaware Department of Natural Resources and Environmental Control, which will be completed in March, there is a potential that seabeach amaranth could appear within the project area prior to the Phase 2 component, which is the action described in this consultation.

2.2.2.2 SPECIES CONSERVATION NEEDS WITHIN THE ACTION AREA

This species requires beaches to be left in a natural state with no vehicular or foot traffic that would trample on this delicate plant. Also, this plant requires a sandy beach that isn't severely eroded, but can experience periodic overwash.

2.2.2.3 HABITAT CONDITION (GENERAL)

BEACHES
The beaches north of Indian River inlet have all of the life requisites that would allow for the growth and reproduction of seabeach amaranth. The affected area is currently stressed due to the significant erosion of this habitat. This may improve following project construction.

SUBSTRATE STRUCTURE AND CHARACTERISTICS (TYPE: SAND)
The affected area includes a sandy beach that is significantly eroded. However, some locations may be supratidal where waves and inundation may not adversely impact seabeach amaranth habitat suitability.

2.2.2.4 INFLUENCES
Severe erosion, hardened structures (bulkheads, revetments), vehicular and foot traffic and habitat alterations have resulted in significant declines.

2.2.2.5 ADDITIONAL BASELINE INFORMATION
None

2.2.3 EFFECTS OF THE ACTION
This section considers and discusses all effects on the listed species that are caused by the proposed action and are reasonably certain to occur, including the effects of other activities that would not occur but for the proposed action.

2.2.3.1 INDIRECT INTERACTIONS

RESOURCE NEED	STRESSORS	CONSERVATION MEASURES	AMOUNT OF RESOURCE IMPACTED	INDIVIDUALS AFFECTED
Beaches	Increase in soil disturbance Change in topography Decrease in vegetation	Conduct pre-construction survey for seabeach amaranth and practice avoidance during construction	***There will be no impacts to this resource*** If this species is present, the plant locations will be fenced off and will be allowed to complete their life cycle. Upon coordination with USFWS and DNREC, it will be determined whether if the seed source can be collected	***There will be no impacts to this resource, so no individuals will be affected.***

RESOURCE NEED	STRESSORS	CONSERVATION MEASURES	AMOUNT OF RESOURCE IMPACTED	INDIVIDUALS AFFECTED
			and redeposited on the new beach following construction.	
Substrate structure and characteristics (type: sand)	Increase in water turbidity Change in topography Decrease in vegetation	Conduct pre-construction survey for seabeach amaranth and practice avoidance during construction	***There will be no impacts to this resource*** If this species is present, the plant locations will be fenced off and will be allowed to complete their life cycle. Upon coordination with USFWS and DNREC, it will be determined whether if the seed source can be collected and redeposited on the new beach following construction.	***There will be no impacts to this resource, so no individuals will be affected.***

2.2.3.2 DIRECT INTERACTIONS

No direct interactions leading to effects on species are expected to occur from the proposed project.

Justification:

If this species is present, the plant locations will be fenced off and will be allowed to complete their life cycle. Upon coordination with USFWS and DNREC, it will be determined whether if the seed source can be collected and redeposited on the new beach following construction.

2.2.4 CUMULATIVE EFFECTS

The activity is not expected to result in the burial or removal of this species if surveys and avoidance are practiced. Therefore, this activity will not contribute to significant cumulative effects on this species.

2.2.5 DISCUSSION AND CONCLUSION

DETERMINATION: NLAA

COMPENSATION MEASURES
If this species is present, the plant locations will be fenced off and will be allowed to complete their life cycle. Upon coordination with USFWS and DNREC, it will be determined whether if the seed source can be collected and redeposited on the new beach following construction.

3 CRITICAL HABITAT EFFECTS ANALYSIS

No critical habitats intersect with the project action area.

4 SUMMARY DISCUSSION AND CONCLUSION

4.1 SUMMARY DISCUSSION

The proposed action, which includes the offshore dredging and beachfill placement to reconstruct the beach berm and dune will not have an effect on roseate terns because they do not nest south of Long Island, New York (with a noted exception in New Jersey) and are rarely sighted in Delaware. This activity could result in the burial of seaside goldenrod, which is a nectar producing species for the monarch butterfly. It is expected that once the dune construction is completed, the dune areas would be recolonized with seaside goldenrod as it is very common in this area. Seabeach amaranth has historically grown on occasions in Delaware Seashore State Park in locations not far from the affected area, and could potentially be trampled or buried by construction activities. The affected area has some habitat suitable for seabeach amaranth and there is a potential for its presence at the time of construction. Therefore, a preconstruction survey for this plant would occur and if present, it would be avoided until it's life cycle is completed.

4.2 CONCLUSION

The presence of breeding roseate terns is highly unlikely within the project area, therefore a no effect determination of the action is warranted.

Monarch butterflies are likely to be present in the project area during construction activities. The equipment and associated construction activities are not likely to directly affect monarch butterflies; however, the nectar food source (seaside goldenrod) could be affected in some locations by burial of sand. This would not result in a significant loss of seaside goldenrod and it is expected to recolonize rapidly after construction from nearby windblown seed sources. Therefore, for the monarch butterfly, it is concluded that this activity may affect, but is not likely to adversely affect this species.

The seabeach amaranth has historically been present in the vicinity of the affected area. Current conditions with severe erosion make it not likely to be present within the action area. However, based on completion of the Phase 1 prior to initiating Phase 2 (this action), a potential exists that seabeach amaranth could appear in created supratidal locations prior to the start of construction of Phase 2. Therefore, a foot survey to look for the presence of this plant would occur prior to construction. Any found plants would be isolated and avoided. The USFWS and DNREC would be consulted on appropriate actions to conserve this plant from either letting it complete its lifecycle in place and collecting its seed to transplanting it. Therefore, with these measures in place, it is concluded that the activity may affect but is not likely to adversely affect this species.

GARFO ESA Section 7: NLAA Program Verification Form

(Please submit a signed version of this form, together with any project plans, maps, supporting analyses, etc., to nmfs.gar.esa.section7@noaa.gov with "**USACE NLAA Program: [Application Number]**" in the subject line)

Section 1: General Project Details

Application Number:	CENAP-PL-E-25-02 Indian River Inlet North Beach Restoration and Addition of Ebb Shoal Borrow Area
Reinitiation:	Yes
Applicant(s):	U.S. Army Corps of Engineers, Philadelphia District
Permit Type:	Civil Works/Federal Navigation
Anticipated project start date (e.g., 10/1/2020)	8/1/2025
Anticipated project end date (e.g., 12/31/2022 – if there is no permit expiration date, write "N/A")	8/1/2035

Project Type/Category (check all that apply to entire action):

☐	Aquaculture (shellfish) and artificial reef creation	☐	Mitigation (fish/wildlife enhancement or restoration)
☑	Dredging and disposal/beach nourishment	☐	Bank stabilization
☐	Piers, ramps, floats, and other structures	☐	If other, describe project type category:

Town/City:	Rehoboth Beach	Zip:	19971
State:	Delaware	Water body:	Atlantic Ocean/Indian River Inlet

Project/Action Description **and** Purpose (*include relevant permit conditions that are not captured elsewhere on form*):		
This NLAA re-initiation of USACE project CENAP-PL-E-25-02 - Delaware Coast Protection -Indian River Inlet Sand Bypass Plant - for the period of August 1, 2025 to August 1, 2035. This is a re-initiaion for the subject project covered under the Biological Opinion (BiOp) dated June 26, 2014 for "Use of sand borrow areas for beach nourishment and hurricane protection, offshore Delaware and New Jersey NER-2014-10904". The 2014 BiOp covered the activities of sand bypassing at Indian River Inlet and the use of the Indian River Inlet Flood Shoal (interior) see Section 3.11 and Figures 21 and 22 of 2014 BiOp. The purpose of this re-initiation is to add a new offshore sand source, the Indian River Inlet Ebb Shoal, to complete the Phase 2 portion of the North Beach (north side of Indian River Inlet) beachfill project, and to use this site in addition to the existing flood shoal borrow area for as needed when repairs are required for the North Beach following significant storm events or significant erosion and continuing annual operations of the sand bypass plant.		
Type of Bottom Habitat Modified:	Permanent/Temporary:	Area (acres):
Sand (saline)	Temporary	580.00
Sand (saline)	Permanent	30.00
Select Type of Bottom Habitat	Select Permanent or Temporary	
Project Latitude (e.g., 42.625884)	38.608456	
Project Longitude (e.g., -70.646114)	-75.048717	
Mean Low Water (MLW)(m)	-0.69	
Mean High Water (MHW)(m)	0.48	

Width (m) of water body in action area:	Stressor Category (stressor that extends furthest distance into water body – e.g., turbidity plume; sound pressure wave):	Max extent (m) of stressor into the water body:
5,000.00	turbidity plume	500.00

Section 2: ESA-listed species and/or critical habitat in the action area:

✔	Atlantic sturgeon (all DPSs)	✔	Kemp's ridley sea turtle
✔	Atlantic sturgeon critical habitat Indicate which DPS : NYB	✔	Loggerhead sea turtle (NW Atlantic DPS)
✔	Shortnose sturgeon	✔	Leatherback sea turtle
☐	Atlantic salmon (GOM DPS)	✔	North Atlantic right whale
☐	Atlantic salmon critical habitat (GOM DPS)	☐	North Atlantic right whale critical habitat
✔	Green sea turtle (N. Atlantic DPS)	✔	Fin whale

* Please consult GARFO PRD's ESA Section 7 Mapper for ESA-listed species and critical habitat information for your action area at: https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-species-critical-habitat-information-maps-greater.

Section 3: NLAA Determination (check all applicable fields):

If the Project Design Criteria (PDC) is met, select Yes. If the PDC is not applicable (N/A) for your project (e.g., the stressor category is not included for your project activity, or for PDC 2, your project does not occur within the range of the GOM DPS of Atlantic salmon), select N/A. If the PDC is applicable, but is not met, leave both boxes blank and provide a justification for that PDC in Section 4.

a) GENERAL PDC			
Yes	N/A	PDC #	PDC Description
✔	☐	1.	No portion of the proposed action will individually or cumulatively have an adverse effect on ESA-listed species or designated critical habitat.
☐	✔	2.	No portion of the proposed action will occur in the tidally influenced portion of rivers/streams where Atlantic salmon presence is possible from April 10–November 7. **Note**: If the project will occur within the geographic range of the GOM DPS Atlantic salmon but their presence is not expected following the best available commercial scientific data, the work window does not need to be applied (include reference in project description).
✔	☐	3.	No portion of the proposed action that may affect shortnose or Atlantic sturgeon will occur in areas identified as spawning grounds as follows: i. Gulf of Maine: April 1–Aug. 31 ii. Southern New England/New York Bight: Mar. 15–Aug. 31 iii. Chesapeake Bay: March 15–July 1 and Sept. 15–Nov. 1 **Note**: If river specific information exists that provides better or more refined time of year information, those dates may be substituted with NMFS approval (include reference in project description).
✔	☐	4.	No portion of the proposed action that may affect shortnose or Atlantic sturgeon will occur in areas identified as overwintering grounds, where dense aggregations are known to occur, as follows: i. Gulf of Maine: Oct. 15–April 30 ii. Southern New England/ New York Bight: Nov. 1–Mar. 15 iii. Chesapeake Bay: Nov. 1–Mar. 15 **Note**: If river specific information exists that provides better or more refined time of year information, those dates may be substituted with NMFS approval (include reference in project description).
☐	✔	5.	Within designated Atlantic salmon critical habitat, no portion of the proposed action will affect spawning and rearing areas (PBFs 1-7).
✔	☐	6.	Within designated Atlantic sturgeon critical habitat, no work will affect hard bottom substrate (e.g., rock, cobble, gravel, limestone, boulder, etc.) in low salinity waters (i.e., 0.0-0.5 parts per thousand) (PBF 1).

Yes	N/A	PDC #	PDC Description
✔	☐	7.	Work will result in no or only temporary/short-term changes in water temperature, water flow, salinity, or dissolved oxygen levels.
✔	☐	8.	If ESA-listed species are (a) likely to pass through the action area at the time of year when project activities occur; and/or (b) the project will create an obstruction to passage when in-water work is completed, then a zone of passage (~50% of water body) with appropriate habitat for ESA-listed species (e.g., depth, water velocity, etc.) must be maintained (i.e., physical or biological stressors such as turbidity and sound pressure must not create barrier to passage).
☐	✔	9.	Any work in designated North Atlantic right whale critical habitat must have no effect on the physical and biological features (PBFs).
✔	☐	10.	The project will not adversely impact any submerged aquatic vegetation (SAV).
☐	✔	11.	No blasting or use of explosives will occur.

b) The following stressors are applicable to the action (check all that apply – use Stressor Category Table for guidance):	
☐	Sound Pressure
✔	Impingement/Entrapment/Capture
✔	Turbidity/Water Quality
☐	Entanglement (Aquaculture)
✔	Habitat Modification
✔	Vessel Traffic

	Stressor Category					
Activity Category	Sound Pressure	Impingement/ Entrapment/ Capture	Turbidity/ Water Quality	Entanglement	Habitat Mod.	Vessel Traffic
Aquaculture (shellfish) and artificial reef creation	N	N	Y	Y	Y	Y
Dredging and disposal/beach nourishment	N	Y	Y	N	Y	Y

Activity Category	Stressor Category					
	Sound Pressure	Impingement/ Entrapment/ Capture	Turbidity/ Water Quality	Entanglement	Habitat Mod.	Vessel Traffic
Piers, ramps, floats, and other structures	Y	N	Y	N	Y	Y
Transportation and development (e.g., culvert construction, bridge repair)	Y	N	Y	N	Y	Y
Mitigation (fish/wildlife enhancement or restoration)	N	N	Y	N	Y	Y
Bank stabilization and dam maintenance	Y	N	Y	N	Y	Y

c) SOUND PRESSURE PDC

Information for Pile Driving:

If your project includes non-timber piles*, please attach your calculation to this verification form showing that the noise is below the injury thresholds of ESA-listed species in the action area. The GARFO Acoustic Tool is available as one source, should you not have other information:

https://www.fisheries.noaa.gov/new-england-mid-atlantic/consultations/section-7-consultation-technical-guidance-greater-atlantic

*Sound pressure effects from timber and steel sheet piles were analyzed in the NLAA programmatic consultation, so no additional acoustic information is necessary.

	Pile material	Pile diameter/width (inches)	Number of piles	Installation method
a)	Select pile material			Select installation method
b)	Select pile material			Select installation method
c)	Select pile material			Select installation method
d)	Select pile material			Select installation method

Yes	N/A	PDC #	PDC Description
☐	☑	12.	If pile driving is occurring during a time of year when ESA-listed species may be present, and the anticipated noise is above the behavioral noise threshold, a "soft start" is required to allow animals an opportunity to leave the project vicinity before sound pressure levels increase. *In addition to using a soft start at the beginning of the work day for pile driving, one must also be used at any time following cessation of pile driving for a period of 30 minutes or longer.* For impact pile driving: pile driving will commence with an initial set of three strikes by the hammer at 40% energy, followed by a one minute wait period, then two subsequent 3-strike sets at 40% energy, with one-minute waiting periods, before initiating continuous impact driving. For vibratory pile installation: pile driving will be initiated for 15 seconds at reduced energy followed by a one-minute waiting period. This sequence of 15 seconds of reduced energy driving, one-minute waiting period will be repeated two additional times, followed immediately by pile-driving at full rate and energy.
☐	☑	13.	Any new pile supported structure must involve the installation of ≤ 50 piles (below MHW).
☐	☑	14.	All underwater noise (pressure) is below (<) the physiological/injury noise threshold for ESA-species in the action area.

d) IMPINGEMENT/ENTRAINMENT/CAPTURE PDC

Information for Dredging/Disposal:			
Type of dredge:	Hydraulic/Cutterhead		
Maintenance dredging?:	Yes	If "Yes", how many acres?	50.00
If maintenance, when was the last dredge cycle?	2022		
New dredging:	Yes	If "Yes", how many acres?	588.00
Estimated number of dredging events covered by permit:	5		
ESA-species exclusion measures required (e.g., cofferdam, turbidity curtain):	No		
If no exclusion measures required, explain why:	Not operationally feasible		
Information for Intake Structures:			
Mesh screen size (mm) for temporary intake:			

Yes	N/A	PDC #	PDC Description
☑	☐	15.	Only mechanical, cutterhead, and low volume hopper (e.g., CURRITUCK, ~300 cubic yard maximum bin capacity) dredges may be used.
☑	☐	16.	No new dredging in Atlantic sturgeon or Atlantic salmon critical habitat (maintenance dredging still must meet all other PDCs). New dredging outside Atlantic sturgeon or salmon critical habitat is limited to one time dredge events (e.g., burying a utility line) and minor (≤ 2 acres) expansions of areas already subject to maintenance dredging (e.g., marina/harbor expansion).
☐	☐	17.	Work behind cofferdams, turbidity curtains, or other methods to block access of animals to dredge footprint is required when operationally feasible or beneficial and ESA-listed species are likely to be present (if presence is limited to rare, transient individuals, exclusion methods are not necessary).
☐	☑	18.	Temporary intakes related to construction must be equipped with appropriate sized mesh screening (as determined by GARFO section 7 biologist and/or according to Chapter 11 of the NOAA Fisheries Anadromous Salmonid Passage Facility Design) and must not have greater than 0.5 fps intake velocities, to prevent impingement or entrainment of any ESA-listed species life stage.
☐	☑	19.	No new permanent intake structures related to cooling water, or any other inflow at facilities (e.g. water treatment plants, power plants, etc.).

e) TURBIDITY/WATER QUALITY PDC

Information for Turbidity Producing Activity (excluding disposal):	
ESA-species turbidity control measures required (e.g., turbidity curtain):	No
If no turbidity control measures required, explain why:	Not operationally feasible
Information for Dredged Material Disposal:	
Disposal site:	Nearshore placement/nourishment
Estimated number of trips to disposal site:	10
Relevant disposal site permit/special conditions required (NAE: for offshore disposal, include Group A, B, C, or relevant Long Island Sound consultation):	The dredging of > 90% sand and in-water placement within the North Beach intertidal and subtidal for the purpose of restoring the shoreline. Since the material is >90% sand, turbidity at the point of dredging within the ebb shoal, flood shoal and fillet on the south side of the inlet will produce temporary and minimal turbidity. The placement of sand on the North Beach will also produce temporary and minimal turbidity.

Yes	N/A	PDC #	PDC Description
☐	☑	20.	Work behind cofferdams, turbidity curtains, or other methods to control turbidity is required when operationally feasible or beneficial and ESA-listed species are likely to be present (if presence is limited to rare, transient individuals, turbidity control methods are not necessary).
☐	☑	21.	In-water offshore disposal may only occur at designated disposal sites that have been the subject of ESA section 7 consultation with NMFS, where a valid consultation is in place and appropriate permit/special conditions are included.

Yes	N/A	PDC #	PDC Description
☑	☐	22.	Any temporary discharges must meet state water quality standards (e.g., no discharges of substances in concentrations that may cause acute or chronic adverse reactions, as defined by EPA water quality standards criteria).
☐	☑	23.	Only repair, upgrades, relocations and improvements of existing discharge pipes or replacement in-kind are allowed; no new construction of untreated discharges.
	f) ENTANGLEMENT PDC		

Information for Aquaculture Projects:	
Approximate distance from shore (MHW)(m):	
Grow season begins (approximate):	
Grow season ends (approximate):	
Total number of vertical lines:	
Total number of horizontal lines:	
Is any gear seasonally removed from the water? If yes, which parts and when?	

	Aquaculture Gear	Acreage (total permit footprint)	Type of Shellfish Cultivated
a)	Select aquaculture gear		Select type of shellfish cultivated
b)	Select aquaculture gear		Select type of shellfish cultivated
c)	Select aquaculture gear		Select type of shellfish cultivated

Yes	N/A	PDC #	PDC Description
☐	☑	24.	Shell on bottom <50 acres with maximum of 4 corner marker buoys;
☐	☑	25.	Cage on bottom with no loose floating lines <5 acres and minimal vertical lines (1 per string of cages, 4 corner marker buoys);
☐	☑	26.	Floating cages in <3 acres in waters and shallower than -10 feet MLLW with no loose lines and minimal vertical lines (1 per string of cages, 4 corner marker buoys);
☐	☑	27.	Floating upweller docks in >10 feet MLLW.
☐	☑	28.	Any in-water lines, ropes, or chains must be made of materials and installed in a manner to minimize or avoid the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. Lines can be enclosed in a rigid sleeve.
	g) HABITAT MODIFICATION PDC		

Yes	N/A	PDC #	PDC Description
☑	☐	29.	No conversion of habitat type (soft bottom to hard, or vice versa) for aquaculture or reef creation.

	h) VESSEL TRAFFIC PDC	
Information for Vessel Traffic:		
	Temporary Project Vessel Type	Number of Vessels
a)	Tug	1
b)	Crew support vessel	1
c)	Dredge vessel	1
	Type of Non-Commercial or Aquaculture Vessels Added *– only include if there is a net increase directly/indirectly resulting from project*)	Number of Vessels (*if sum > 2, PDC 33 is not met and justification required in Section 4*)
a)	Select type of non-commercial or aquaculture vessels	
b)	Select type of non-commercial or aquaculture vessels	
	Type of Commercial Vessels Added (*only include if there is a net increase directly/indirectly resulting from project*)	Number of Vessels (*if > 0, PDC 33 is not met and justification required in Section 4*)
a)		
b)		
If no temporary/permanent vessel traffic, briefly explain (e.g., all land-based work, no net increase in vessel traffic)	Temporary increase in vessel traffic during dredging/disposal operations. Maintenance dredging will not result in a net increase in vessel traffic.	

Yes	N/A	PDC #	PDC Description
☑	☐	30.	Maintain project vessels operating within the action area to speed limits below 10 knots and dredge vessel speeds of 4 knots maximum, while dredging.
☐	☑	31.	Maintain a 1,500-foot buffer between project vessels and ESA-listed whales and a 150-foot buffer between project vessels and sea turtles unless the vessel is navigating to an in-water disposal site/activity. If the vessel is navigating to an in-water disposal site/activity, refer to and include the conditions contained in the appropriate GARFO-USACE/EPA consultation for the disposal site.
☑	☐	32.	The number of project vessels must be limited to the greatest extent possible, as appropriate to size and scale of project.
☐	☑	33.	The permanent net increase in vessels resulting from a project (e.g., dock/float/pier/boating facility) must not exceed two non-commercial vessels. A project must not result in the permanent net increase of any commercial vessels (e.g., a ferry terminal).

Section 4: Justification for Review under the NLAA Program

If the action is not in compliance with all of the General PDC and appropriate stressor PDC, but you can provide justification and/or special conditions to demonstrate why the project still meets the NLAA determination and is consistent with the aggregate effects considered in the programmatic consultation, you may still certify your project through the NLAA program using this verification form. Please identify which PDC your project does not meet (e.g., PDC 9, PDC 15, PDC 22, etc.) and provide your rationale and justification for why the project is still eligible for the verification form.

To demonstrate that the project is still NLAA, you must explain why the effects on ESA-listed species or critical habitat are **insignificant** (i.e., too small to be meaningfully measured or detected) or **discountable** (i.e., extremely unlikely to occur). **Please use this language in your justification.**

PDC#	Justification
4	Dense aggregations of overwintering Atlantic sturgeon occur for adults and subadults in the lower Delaware estuary and offshore areas. The Atlantic sturgeon are known to spawn within the Delaware River and migrate along the coast of Delaware. Studies have indicated that depth distribution appears seasonal, with sturgeon inhabiting the deepest waters during the winter and the shallowest during summer and early fall. Tagging studies by Fox and Breece (2010) confirm that nearshore waters along the Delaware Atlantic coast are frequently inhabited by Atlantic sturgeon with over 85% of those detected within State waters. Recent telemetry studies suggest that there is a strong seasonal pattern of arrival and departure of Atlantic sturgeon along the Delaware coast. Marine phase Atlantic sturgeon return to Delaware's coastal waters in mid-late March through mid-late May and depart between early September and mid-December. During the summer months, it is reported that these sturgeon may either return to the Delaware River to spawn (mature adults), occupy river/upper estuary foraging areas (mostly sub-adults), or remain
17	Exclusion measures are not operationally feasible. The use of a hydraulic cutter-suction dredge with munitions screening is less likely to entrain or impinge sea turtles or Atlantic or shortnose sturgeon.
PDC #	

PDC #	

Section 5: USACE Verification of Determination

☐	In accordance with the NLAA Program, USACE has determined that the action complies with all applicable PDC and is not likely to adversely affect listed species.
☑	In accordance with the NLAA Program, the USACE has determined that the action is not likely to adversely affect listed species per the justification and/or special conditions provided in Section 4.

USACE Signature:	Date:

Section 6: GARFO Concurrence

☐	In accordance with the NLAA Program, GARFO PRD concurs with USACE's determination that the action complies with all applicable PDC and is not likely to adversely affect listed species or critical habitat.
☐	In accordance with the NLAA Program, GARFO PRD concurs with USACE's determination that the action is not likely to adversely affect listed species or critical habitat per the justification and/or special conditions provided in Section 4.
☐	GARFO PRD does not concur with USACE's determination that the action complies with the applicable PDC (with or without justification), and recommends an individual Section 7 consultation to be completed independent from the NLAA Program.

GARFO Signature:	Date:

APPENDIX-D

ESSENTIAL FISH HABITAT EVALUATION

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NOAA Fisheries Greater Atlantic Regional Fisheries Office
Essential Fish Habitat (EFH) Assessment & Fish and Wildlife Coordination Act (FWCA) Consultation Worksheet
August 2021 rev.

Authorities

The Magnuson Stevens Fishery Conservation and Management Act (MSA) requires federal agencies to consult with NOAA Fisheries on any action or proposed action authorized, funded, or undertaken by such agency that may adversely affect essential fish habitat (EFH) identified under the MSA. This process is guided by the requirements of our EFH regulation at 50 CFR 600.905, which mandates the preparation of EFH assessments and generally outlines each agency's obligations in the consultation process.

The Fish and Wildlife Coordination Act (FWCA) requires that all federal agencies consult with NOAA Fisheries when proposed actions might result in modifications to a natural stream or body of water. The FWCA also requires that federal agencies consider the effects that these projects would have on fish and wildlife and must also provide for improvement of these resources. Under the FWCA, we work to protect, conserve and enhance species and habitats for a wide range of aquatic resources such as shellfish, diadromous species, and other commercially and recreationally important species that are not federally managed and do not have designated EFH.

It is important to note that these consultations take place between NOAA Fisheries and federal action agencies. **As a result, EFH assessments, including this worksheet, must be provided to us by the federal agency, not by permit applicants or consultants.**

Use of the Worksheet

This worksheet can serve as an EFH assessment for **Abbreviated EFH Consultations**, and as a means to provide information on potential effects to other NOAA trust resources considered under the FWCA. An abbreviated consultation allows us to determine quickly whether, and to what degree, a federal action may adversely affect EFH. Abbreviated consultation procedures can be used when federal actions do not have the potential to cause substantial adverse effects on EFH and when adverse effects could be alleviated through minor modifications.

The intent of the EFH worksheet is to provide a guide for determining the information needed to fully assess the effects of a proposed action on EFH. In addition, the worksheet may be used as a tool to assist you in developing a more comprehensive EFH assessment for larger projects that may have more substantial adverse effects to EFH. However, for large, complex projects that have the potential for significant adverse effects, an **Expanded EFH Consultation** may be warranted and the use of this worksheet alone is not appropriate as your EFH assessment.

An **adverse effect** is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

Consultation under the MSA is not required if there is no adverse effect on EFH or if no EFH has been designated in the project area. However, because the definition of "adverse effect" is very broad, most in-water work will result in some level of adverse effect requiring consultation with us, even if the impact is temporary or the overall result of the project is habitat restoration or enhancement. It is important to remember that an adverse effect determination is a trigger to consult with us. It does not mean that a project cannot proceed as proposed, or that project modifications are necessary. An adverse effect determination under the EFH provisions of the MSA simply means that the effects of the proposed action on EFH must be evaluated to determine if there are ways to avoid, minimize, or offset adverse effects. Additional details on EFH consultations, tools, and resources, including frequently asked questions can be found on our website.

Instructions

This worksheet should be used as your EFH assessment for **Abbreviated EFH Consultations** or as a guide to develop your EFH assessment. It is not appropriate to use this worksheet as your EFH assessment for large, complex projects, or those requiring an Expanded EFH Consultation.

When completed fully and with sufficient information to clearly describe the activities proposed, habitats affected, and project impacts, as well as the measures taken to avoid, minimize or offset any unavoidable adverse effects, this worksheet provides us with required components of an EFH assessment including:

1. A description of the proposed action.
2. An analysis of the potential adverse effects on EFH and the federally managed species.
3. The federal agency's conclusions regarding the effects of the action on EFH.
4. Proposed mitigation, if applicable.

When completing this worksheet and submitting information to us, it is important to ensure that sufficient information is provided to clearly describe the proposed project and the activities proposed. At a minimum, this should include the public notice (if applicable) or project application and project plans showing:

- location map of the project site with area of impact.
- existing and proposed conditions.
- all in-water work and the location of all proposed structures and/or fill.
- all waters of the U.S. on the project site with mean low water (MLW), mean high water (MHW), high tide line (HTL), and water depths clearly marked.
- Habitat Areas of Particular Concern (HAPCs).
- sensitive habitats mapped, including special aquatic sites (submerged aquatic vegetation, saltmarsh, mudflats, riffles and pools, coral reefs, and sanctuaries and refuges), hard bottom or natural rocky habitat areas, and shellfish beds.
- site photographs, if available.

Your analysis of effects **should focus on impacts that reduce the quality and/or quantity of the habitat or result in conversion to a different habitat type** for all life stages of species with designated EFH within the action area. Simply stating that fish will move away or that the project will only affect a small percentage of the overall population is not a sufficient analysis of the effects of an action on EFH. Also, since the intent of the EFH consultation is to evaluate the direct, indirect, individual and cumulative effects of a particular federal action on EFH and to identify options to avoid, minimize or offset the adverse effects of that action, is it not appropriate to conclude that an impact is minimal just because the area affected is a small percentage of the total area of EFH designated. The focus of the consultation is to reduce impacts resulting from the activities evaluated in the assessment. Similarly, a large area of distribution or range of the fish species is also not appropriate rationale for concluding the impacts of a particular project are minimal.

Use the information on the our EFH consultation website and NOAA's EFH Mapper to complete this worksheet. The mapper is a useful tool for viewing the spatial distribution of designated EFH and HAPCs. Because summer flounder HAPC (defined as: " all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH") does not have region-wide mapping, local sources and on-site surveys may be needed to identify submerged aquatic vegetation beds within the project area. The full designations for each species may be viewed as PDF links provided for each species within the Mapper, or via our website links to the New England Fishery Management Councils Omnibus Habitat Amendment 2 (Omnibus EFH Amendment), the Mid-Atlantic Fishery Management Councils FMPs (MAMFC - Fish Habitat), or the Highly Migratory Species website. Additional information on species specific life histories can be found in the EFH source documents accessible through the Habitat and Ecosystem Services Division website. This information can be useful in evaluating the effects of a proposed action. Habitat and Ecosystem Services Division (HESD) staff have also developed a technical memorandum *Impacts to Marine Fisheries Habitat from Non-fishing Activities in the Northeastern United States,* NOAA Technical Memorandum NMFS-NE-209 to assist in evaluating the effects of non-fishing activities on EFH. If you have questions, please contact the HESD staff member in your area to assist you.

Federal agencies or their non-federal designated lead agency should email the completed worksheet and necessary attachments to the HESD New England (ME, NH, MA, CT, RI) or Mid- Atlantic (NY, NJ, PA, DE, MD, VA) Branch Chief and the regional biologist listed on the Contact Regional Office Staff section on our EFH consultation website and listed below.

We will provide our EFH conservation recommendations under the MSA, and recommendations under the FWCA, as appropriate, within 30 days of receipt of a **complete** EFH assessment for an abbreviated consultation. Please ensure that the EFH worksheet is completed in full and includes detail to minimize delays in completing the consultation. If we are unable to assess potential impacts based on the information provided, we may request additional information necessary to assess the effects of the proposed action on our trust resources before we can begin a consultation. If the worksheet is not completely filled out, it may be returned to you for completion. **The EFH consultation and our response clock does not begin until we have sufficient information upon which to consult**.

If this worksheet is not used, you should include all the information required to complete this worksheet in your EFH assessment. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. You may need to prepare a more detailed EFH assessment for more substantial or complex projects to fully characterize the effects of the project and the avoidance and minimization of impacts to EFH. The format of the EFH worksheet may not be sufficient to incorporate the extent of detail required for large-scale projects, and a separate EFH assessment may be required.

Regardless of the format, you should include an analysis as outlined in this worksheet for an expanded EFH assessment, along with any additional necessary information including:

- the results of on-site inspections to evaluate habitat and site-specific effects.
- the views of recognized experts on habitat or the species that may be affected.
- a review of pertinent literature and related information.
- an analysis of alternatives that could avoid or minimize adverse effects on EFH.

For these larger scale projects, interagency coordination meetings should be scheduled to discuss the contents of the EFH consultation and the site-specific information that may be needed in order to initiate the consultation.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or threatened and endangered species and the appropriate consultation procedures.

HESD Contacts*

New England - ME, NH, MA, RI, CT	
Chris Boelke, Branch Chief	christopher.boelke@noaa.gov
Mike Johnson - ME, NH	mike.r.johnson@noaa.gov
Kaitlyn Shaw - ME, NH, MA	kaitlyn.shaw@noaa.gov
Sabrina Pereira -RI, CT	sabrina.pereira@noaa
Mid-Atlantic - NY, NJ, PA, MD, VA	
Karen Greene, Branch Chief	karen.greene@noaa.gov
Jessie Murray - NY, Northern NJ (Monmouth Co. and north)	jessie.murray@noaa.gov
Keith Hanson - NJ (Ocean Co. and south), DE and PA, Mid-Altantic wind	keith.hanson@noaa.gov
Maggie Sager - NJ (Ocean Co. and south), DE and PA	lauren.m.sager@noaa.gov
Jonathan Watson - MD, DC	jonathan.watson@noaa.gov
David O'Brien - VA	david.l.obrien@noaa.gov
Ecosystem Management (Wind/Aquaculture)	
Peter Burns, Branch Chief	peter.burns@noaa.gov
Alison Verkade (NE Wind)	alison.verkade@noaa.gov
Susan Tuxbury (wind coordinator)	susan.tuxbury@noaa.gov

***Please check for the most current staffing list on our contact us page prior to submitting your assessment.**

EFH Assessment Worksheet rev. August 2021

Please read and follow all of the directions provided when filling out this form.

1. General Project Information

Date Submitted: 03/17/2025

Project/Application Number: CENAP-PL-E-02

Project Name: Proposal of New Offshore Borrow Area in the Indian River Inlet Ebb Shoal with Placement on the North Beach

Project Sponsor/Applicant: U.S. Army Corps of Engineers (USACE)

Federal Action Agency (or state agency if the federal agency has provided written notice delegating the authority[1]):

Fast-41: Yes ☐ No ☑

Action Agency Contact Name: Steven D. Allen

Contact Phone: (215) 656-6559 Contact Email: Steven.D.Allen@USACE.ARMY.MIL

Address, City/Town, State:

Indian River Inlet North Beach (north of inlet jetty) and Indian River Inlet Ebb Shoal and Flood Shoal Sand Borrow Areas, Sussex County, Delaware

2. Project Description

[2]Latitude: 38.608456 Longitude: -75.048717°

Body of Water (e.g., HUC 6 name): Atlantic Ocean at Indian River Inlet

Project Purpose:

The purpose of the Project is to restore the severely eroded berm and dune system at North Beach using beachfill material (sand) back to the project template dimensions as constructed in 2013 following Hurricane Sandy. This would enhance resiliency and protect critical infrastructure, habitat, and recreation from the effects of coastal erosion.

The northside Indian River Inlet coastline (North Beach) has a long history of erosion due to the interruption of the northward flow of sand caused by the construction of the inlet jetties. This erosion has made critical infrastructure, such as SR-1 and the Indian River Inlet Bridge (currently the Charles W. Cullen Memorial (Inlet) Bridge), more vulnerable to storm damages. To mitigate risk and provide a consistent source of sand to North Beach, a sand bypass facility was constructed in 1990 by USACE and is operated and maintained by the State of Delaware. The sand bypass system mimics the natural flow of sand from south to north by continuously pumping sand from the southside beach fillet, across the inlet to the North Beach. Sand pumping rates are variable and average 100,000 cy of sand per year.

Project Description:

The plan is a combination of the dredging and beachfill plan and sand source alternatives for the restoration of the North Beach shoreline. The Delaware Department of Natural Resources and Environmental Control completed an initial phase of the restoration of the beach by dredging from the interior Indian River Inlet Flood Shoal and placing approximately 480,000 cubic yards of sand on the North Beach shoreline. This phase is identified as "Phase 1", which was constructed to address severe erosion of the North Beach and dune. Phase 1 was completed March 1, 2025. The next phase (Phase 2) is the USACE component, which will complement the Phase 1 portion. For the completion of the Phase 2 berm restoration, approximately 500,000 cubic yards of sand beachfill would be placed along the shoreline of the North Beach extending north from the north Indian River Inlet jetty for approximately 5,000 feet. This will affect approximately 30 acres of intertidal and subtidal Atlantic coast sandy beach shoreline. The construction template will result in a 200 to 250-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of 10H:1V. The berm will have a dune on top with an overall dune crest elevation of +16.0 ft NAVD and width of 25 ft with 3H:1V slopes (Figure 3 through Figure 6) . The installation of dune fencing, crossovers and dune grass plantings would subsequently be conducted. An access and staging area will be needed for the contractor. Access will be gained from the existing Phase 1 construction at Inlet Road along the east side of the parking lot and staging will extend under the SR1 bridge approach through an opening in the dune along the North Beach. The Phase 2 sand would be obtained from the hydraulic dredging of the offshore Indian River Inlet Ebb Shoal (IRI-Ebb A) (Figure 2) to an average depth of 10 feet below existing bathymetry. The Phase 2 dredging will affect approximately 46 acres of sandy bottom within the ebb shoal. This 46-acre portion of the shoal has existing bathymetry between -30 ft. to -40 ft. NAVD. Therefore, post dredging depths would be between -40 ft. to -50 ft. NAVD. The beach and ebb shoal environments are in high energy dynamic areas. The processes that formed the shoal would continue and replenish this area w/sand.

The plan also includes the periodic nourishment of the North Beach on an as needed basis to supplement the Indian River Inlet sand bypass plant operations to maintain the Phase 2 berm and dune template during intense erosion cycles or following significant storm events. The required sand quantities may be variable but could be as high as 800,000 cubic yards. The sand sources include the Indian River Inlet Ebb Shoal (Ebb-A) (192 acres) and the existing Indian River Inlet Flood Shoal Sand Source (50 acres) that was most recently used for the DNREC Phase 1 portion. However, the Flood Shoal would need several years to replenish with sand for future use. Since the flood shoal is in the interior of the inlet, a Time of Year Restriction for migratory fish would be implemented from March 1 to June 30th. Maximum dredging depths of the flood shoal would be to -24 ft. MLLW. Additionally, the portion of the Indian River Inlet Ebb Shoal (Ebb-B) portion including the proposed southern lobe expansion area (Figure 2) is considered for future use but requires supplemental environmental compliance approvals upon further investigations for sediment quality, benthic resources, and cultural resources. Both the flood shoal area and ebb shoal areas are dynamic high energy areas that are expected to replenish/regenerate after their use.
Affected Areas Are as follows:
1. Indian River Inlet North Beach Shoreline (Phase 2 and subsequent placements) - 5,000 l.f. affecting approximately 30 acres (1,306,800 s.f.) of intertidal and subtidal marine habitat with beachfill placement. This habitat would be offset seaward and beach width will vary between erosion cycles.
2. Indian River Inlet Ebb Shoal Sand Borrow Area (IRI Ebb-A) is 192 acres (8,363,520 s.f.) of subtidal offshore sandy marine shoal habitat for completion of Phase 2 and future as needed sand. A smaller 46-acre (2,003,760 s.f.) portion of this site will be required to complete Phase 2 in 2025.
3. Indian River Inlet Flood Shoal - is 50 acres (2,178,000 s.f.) of subtidal estuarine sandy shoal within the interior of the inlet. This borrow area was recently used to complete Phase 1 of the IRI North Beach Restoration. This frequently shoaled area is proposed for future use as needed.
4. Indian River Ebb Shoal Sand Borrow Expansion Area (IRI Ebb-B) is 388 acres (16,901,280 s.f.) of subtidal offshore marine sandy shoal habitat for future as needed.

Anticipated Duration of In-Water Work including planned Start/End Dates and any seasonal restrictions proposed to be included in the schedule:

Work to complete Phase 2 in 2025 would begin approximately sometime between June 30th - December 31st with a duration of approximately 2-3 months. Future use for beach repairs could occur at any time of year for the ebb shoal. Use of the IRI flood shoal for sand dredging would require a TOYR from March 1 to June 30th. .

[1] A federal agency may designate a non-Federal representative to conduct an EFH consultation by giving written notice of such designation to NMFS. If a non-federal representative is used, the Federal action agency remains ultimately responsible for compliance with sections 305(b)(2) and 305(b)(4)(B) of the Magnuson-Stevens Act. [2] Provide the decimal, or the degrees, minutes, seconds values for latitude and longitude using the World Geodetic System 1984 (WGS84) and negative degree values where applicable.

3. Site Description

EFH includes the biological, chemical, and physical components of the habitat. This includes the substrate and associated biological resources (e.g., benthic organisms, submerged aquatic vegetation, shellfish beds, salt marsh wetlands), the water column, and prey species.

Is the project in designated EFH[3]?	☑ Yes	☐ No
Is the project in designated HAPC?	☑ Yes	☑ No
Does the project contain any Special Aquatic Sites[4]?	☐ Yes	☑ No
Is this coordination under FWCA only?	☐ Yes	☑ No

Total area of impact to EFH (indicate sq ft or acres): 630 ac. (subtidal) + 30 ac. intertidal/subtidal

Total area of impact to HAPC (indicate sq ft or acres): 30 ac.(beachfill placement location)

Current range of water depths at MLW	Salinity range (PPT):	Water temperature range (°F):
16 to 39 feet MLLW	24-33 ppt	63-77 F

[3]Use the tables in Sections 5 and 6 to list species within designated EFH or the type of designated HAPC present. See the worksheet instructions to find out where EFH and HAPC designations can be found. [4] Special aquatic sites (SAS) are geographic areas, large or small, possessing special ecological characteristics of productivity, habitat, wildlife protection, or other important easily disrupted ecological values. These areas are generally recognized as significantly influencing or positively contributing to the general overall environmental health or vitality of the entire ecosystem of a region. They include sanctuaries and refuges, wetlands, mudflats, vegetated shallows, coral reefs, and riffle and pool complexes (40 CFR Subpart E). If the project area contains SAS (i.e. sanctuaries and refuges, wetlands, mudflats, vegetated shallows/SAV, coral reefs, and/or riffle and pool complexes, describe the SAS, species or habitat present, and area of impact.

4. Habitat Types

In the table below, select the location and type(s) for each habitat your project overlaps. For each habitat type selected, indicate the total area of expected impacts, then what portion of the total is expected to be temporary (less than 12 months) and what portion is expected to be permanent (habitat conversion), and if the portion of temporary impacts will be actively restored to pre- construction conditions by the project proponent or not. A project may overlap with multiple habitat types.

Habitat Location	Habitat Type	Total impacts ($lf/ft^2/ft^3$)	Temporary impacts ($lf/ft^2/ft^3$)	Permanent impacts ($lf/ft^2/ft^3$)	Restored to pre-existing conditions?*
Marine	Shore (unconsolidated)	5,000 lf		5,000 lf	No
Marine	Shore (unconsolidated)	1,306,800 sf		1,306,800 sf	No
Marine	Substrate (sand/shell)	8,363,520 sf	8,363,520 sf		No
Estuarine	Substrate (sand/shell)	2,178,000 sf	2,178,000 sf		No
Marine	Substrate (sand/shell)	16,901,280 sf	16,901,280 sf		No
Select one	Select One				Select one
Select one	Select One				Select one
Select one	Select One				Select one

*Restored to pre-existing conditions means that as part of the project, the temporary impacts will be actively restored,such as restoring the project elevations to pre-existing conditions and replanting. It does not include natural restoration or compensatory mitigation.

Submerged Aquatic Vegetation (SAV) Present?:

Yes: ☐ No: ☑

If the project area contains SAV, or has historically contained SAV, list SAV species and provide survey results including plans showing its location, years present and densities if available. Refer to Section 12 below to determine if local SAV mapping resources are available for your project area.

Sediment Characteristics:

The level of detail required is dependent on your project – e.g., a grain size analysis may be necessary for dredging. In addition, if the project area contains rocky/hard bottom habitat [6](pebble, cobble, boulder, bedrock outcrop/ledge) identified as Rocky (coral/rock), Substrate (cobble/gravel), or Substrate (rock) above, describe the composition of the habitat using the following table.

Substrate Type* (grain size)	Present at Site? (Y/N)	Approximate Percentage of Total Substrate on Site
Silt/Mud (<0.063mm)	Yes	1.4%
Sand (0.063-2mm)	Yes	98.2%
Rocky: Pebble/Gravel /Cobble(2-256mm)**	Yes	0.4%
Rocky: Boulder (256-4096mm)**	Select one	
Rocky: Coral	Select one	
Bedrock**	Select one	

[6]The type(s) of rocky habitat will help you determine if the area is cod HAPC.

* Grain sizes are based on Wentworth grain size classification scale for granules, pebbles, cobbles, and boulders.

** Sediment samples with a content of 10% or more of pebble-gravel-cobble and/or boulder in the top layer (6-12 inches) should be delineated and material with epifauna/macroalgae should be differentiated from bare pebble-gravel-cobble and boulder.

If no grain size analysis has been conducted, please provide a general description of the composition of the sediment. If available please attach images of the substrate.

N/A

Diadromous Fish (migratory or spawning habitat- identify species under Section 10 below):

Yes: ☐ No: ☑

5. EFH and HAPC Designations

Within the Greater Atlantic Region, EFH has been designated by the New England, Mid-Atlantic, and South Atlantic Fisheries Management Councils and NOAA Fisheries. Use the EFH mapper to determine if EFH may be present in the project area and enter all species and life stages that have designated EFH. Optionally, you may review the EFH text descriptions linked to each species in the EFH mapper and use them to determine if the described habitat is present at your project site. If the habitat characteristics described in the text descriptions do not exist at your site, you may be able to exclude some species or life stages from additional consideration. For example, the water depths at your site are shallower that those described in the text description for a particular species or life stage. We recommend this for larger projects to help you determine what your impacts are.

Species Present	EFH is designated/mapped for: Indian River Inlet Proposed Borrow Area and North Beach				What is the source of the EFH information included?
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/ spawning adults	
albacore tuna	☐	☐	☑	☐	EFH Mapper c
Atlantic angel shark	☑	☑	☑	☑	EFH Mapper c
Atlantic butterfish	☐	☐	☑	☑	EFH Mapper c
Atlantic herring	☐	☐	☑	☐	EFH Mapper c
Atlantic sharpnose shark (Atlantic st	☐	☐	☐	☑	EFH Mapper c
Black sea bass	☐	☐	☑	☑	EFH Mapper c
bluefin tuna	☐	☐	☑	☐	EFH Mapper c
bluefish	☐	☐	☑	☑	EFH Mapper c
clearnose skate	☐	☐	☑	☑	EFH Mapper c
common thresher shark	☑	☑	☑	☑	EFH Mapper c
dusky shark	☐	☐	☑	☐	EFH Mapper c

*See *EFH Designations Continued* Document

Species	EFH is designated/mapped for:				Habitat present based on text description (optional)
	EFH: eggs	EFH: larvae	EFH: juvenile	EFH: adults/ spawning adults	
little skate	☐	☐	☑	☑	☑
long-finned squid	☑	☐	☐	☐	☑
red hake	☑	☑	☑	☑	☑
sandbar shark	☐	☑	☑	☑	☑
sand tiger shark	☐	☑	☑	☑	☑
scup	☐	☐	☑	☑	☑
skipjack tuna	☐	☐	☐	☑	☑
smoothhound shark (Atlantic stock)	☐	☐	☑	☑	☑
spiny dogfish	☐	☐	☐	☑	☑
summer flounder	☐	☑	☑	☑	☑
windowpane flounder	☑	☑	☑	☑	☑
winter skate	☐	☐	☑	☑	☑
yellowfin tuna	☐	☐	☑	☐	☑
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

6. Habitat Areas of Particular Concern (HAPCs)

HAPCs are subsets of EFH that are important for long-term productivity of federally managed species. HAPCs merit special consideration based their ecological function (current or historic), sensitivity to human-induced degradation, stresses from development, and/or rarity of the habitat.While many HAPC designations have geographic boundaries, there are also habitat specific HAPC designations for certain species, see note below. Use the EFH mapper to identify HAPCs within your project area. Select all that apply.

☑	Summer flounder: SAV[7]	☐	Alvin & Atlantis Canyons
☐	Sandbar shark	☐	Baltimore Canyon
☑	Sand Tiger Shark (Delaware Bay)	☐	Bear Seamount
☐	Sand Tiger Shark (Plymouth-Duxbury-Kingston Bay)	☐	Heezen Canyon
☐	Inshore 20m Juvenile Cod[8]	☐	Hudson Canyon
☐	Great South Channel Juvenile Cod	☐	Hydrographer Canyon
☐	Northern Edge Juvenile Cod	☐	Jeffreys & Stellwagen
☐	Lydonia Canyon	☐	Lydonia, Gilbert & Oceanographer Canyons
☐	Norfolk Canyon (Mid-Atlantic)	☐	Norfolk Canyon (New England)
☐	Oceanographer Canyon	☐	Retriever Seamount
☐	Veatch Canyon (Mid-Atlantic)	☐	Toms, Middle Toms & Hendrickson Canyons
☐	Veatch Canyon (New England)	☐	Washington Canyon
☐	Cashes Ledge	☐	Wilmington Canyon
☐	Atlantic Salmon		

[7] Summer flounder HAPC is defined as all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH. In locations where native species have been eliminated from an area, then exotic species are included. Use local information to determine the locations of HAPC.

[8] The purpose of this HAPC is to recognize the importance of inshore areas to juvenile Atlantic cod. The coastal areas of the Gulf of Maine and Southern New England contain structurally complex rocky-bottom habitat that supports a wide variety of emergent epifauna and benthic invertebrates. Although this habitat type is not rare in the coastal Gulf of Maine, it provides two key ecological functions for juvenile cod: protection from predation, and readily available prey. See EFH mapper for links to text descriptions for HAPCs.

7. Activity Details

Select all that apply	**Project Type/Category**
☐	Agriculture
☐	Aquaculture - List species here:
☐	Bank/shoreline stabilization (e.g., living shoreline, groin, breakwater, bulkhead)
☑	Beach renourishment Approximately 5,000 linear feet along the North Beach extended from the north jetty.
☑	Dredging/excavation Approximately 500,000 cy from the proposed offshore borrow area (Ebb Shoal) for Phase 2 completion in 2025. Up to 800,00 cy may be required on as needed for repairs afte
☐	Energy development/use e.g., hydropower, oil and gas, pipeline, transmission line, tidal or wave power, wind
☑	Fill >90% sand; dredged material to be used for beach nourishment along the North Beach.
☐	Forestry
☐	Infrastructure/transportation (e.g., culvert construction, bridge repair, highway, port, railroad)
☐	Intake/outfall
☐	Military (e.g., acoustic testing, training exercises)
☐	Mining (e.g., sand, gravel)
☐	Overboard dredged material placement
☐	Piers, ramps, floats, and other structures
☐	Restoration or fish/wildlife enhancement (e.g., fish passage, wetlands, mitigation bank/ILF creation)
☐	Survey (e.g., geotechnical, geophysical, habitat, fisheries)
☐	Water quality (e.g., storm water drainage, NPDES, TMDL, wastewater, sediment remediation)
☐	Other:

8. Effects Evaluation

Select all that apply	Potential Stressors Caused by the Activity
✔	Underwater noise Dredge engines and pumps
✔	Water quality/turbidity/ contaminant release
☐	Vessel traffic/barge grounding
✔	Impingement/entrainment Hydraulic cutterhead or dragarm on demersal fish
✔	Prevent fish passage/spawning Dredging the flood shoal within the interior inlet would require a TOYR from 3/1 to 6/30
✔	Benthic community disturbance
✔	Impacts to prey species Benthic invertebrates and small fish entrained

Select all that apply and if temporary[9] or permanent		Habitat alterations caused by the activity
Temp	Perm	
✔	☐	Water depth change -10 ft. cut. Area expected to infill returning bathymetric feature to pre-dredge conditoin
☐	☐	Tidal flow change
☐	✔	Fill Beachfill placed within intertidal/nearshore along North Beach
☐	☐	Habitat type conversion
☐	☐	Other:
☐	☐	Other:

[9] Temporary in this instance means during construction. [10] Entrainment is the voluntary or involuntary movement of aquatic organisms from a water body into a surface diversion or through, under, or around screens and results in the loss of the organisms from the population. Impingement is the involuntary contact and entrapment of aquatic organisms on the surface of intake screens caused when the approach velocity exceeds the swimming capability of the organism.

Details - project impacts and mitigation

Briefly describe how the project would impact each of the habitat types selected above and the amount (i.e., acreage or sf) of each habitat impacted. Include temporary and permanent impact descriptions and direct and indirect impacts. For example, dredging has a direct impact on bottom sediments and associated benthic communities. The turbidity generated can result in a temporary impact to water quality which may have an indirect effect on some species and habitats such as winter flounder eggs, SAV or rocky habitats. The level of detail that you provide should be commensurate with the magnitude of impacts associated with the proposed project. Attach supplemental information if necessary.

The proposed borrow areas (IRI Ebb Shoal/Flood Shoal) contain EFH for both highly migratory and New England/ Mid-Atlantic species that may be adversely affected during dredging and placement activities. The proposed Ebb Shoal borrow area (IRI Ebb-A) is approximately 192 acres, IRI Ebb-B expansion area is 388 acres and the interior inlet flood shoal is 50 acres. Dredging will change the water depths by approximately 10 feet, but expected to infill w/ sand after construction. Underwater noise and the disturbance of bottom sediments due to dredging could interfere with feeding and predation of nearby organisms as well as generate turbidity in the water column. Beach nourishment can disturb invertebrate species that use the beach and cover potential food sources for fish. These adverse impacts are expected to be temporary and localized to the project area during construction. Mobile species are expected to disperse and avoid the dredging/placement sites. Beachfill placement would occur with a pipeline delivery to the shoreline. A sand slurry will be pumped along the shoreline and partially enclosed with training berms to maximize sand settlement to retain on the beach. Approximately 30 acres of intertidal and subtidal marine habitat would be converted/filled, but the same amount of habitat would be displaced towards the marine offshore.

What specific measures will be used to avoid and minimize impacts, including project design, turbidity controls, acoustic controls, and time of year restrictions? If impacts cannot be avoided or minimized, why not?

TOYRs are not required for beachfill placement or dredging from the offshore IRI Ebb Shoal sand borrow area. A TOYR is recommended for the inshore IRI Flood Shoal Borrow Area dredging from March 1 to June 30.
A pipeline delivery system and semi-enclosed training berms on the beach will maximize sediment retention on the beach area.

Is compensatory mitigation proposed? Yes ☐ No ☑

If compensatory mitigation is not proposed, why not? If yes, describe plans for compensatory mitigation (e.g. permittee responsible, mitigation bank, in-lieu fee) and how this will offset impacts to EFH and other aquatic resources. Include a proposed compensatory mitigation and monitoring plan as applicable.

Compensatory mitigation is not proposed as any adverse impacts are expected to be temporary and localized to the project area.

9. Effects of Climate Change

Effects of climate change should be included in the EFH assessment if the effects of climate change may amplify or exacerbate the adverse effects of the proposed action on EFH. Use the Intergovernmental Panel on Climate Change (IPCC) Representative Concentration Pathways (RCP) 8.5/high greenhouse gas emission scenario (IPCC 2014), at a minimum, to evaluate the future effects of climate change on the proposed projections. For sea level rise effects, use the intermediate-high and extreme scenario projections as defined in Sweet et al. (2017). For more information on climate change effects to species and habitats relative to NMFS trust resources, see Guidance for Integrating Climate Change Information in Greater Atlantic Region Habitat Conservation Division Consultation Processes.

1. Could species or habitats be adversely affected by the proposed action due to projected changes in the climate?If yes, please describe how:

   No effect, the Project will increase habitat and coastal resiliency to the North Beach.

2. Is the expected lifespan of the action greater than 10 years? If yes, please describe project lifespan:

   The proposed borrow areas will likely need to used again in the future.

3. Is climate change currently affecting vulnerable species or habitats, and would the effects of a proposed action be amplified by climate change? If yes, please describe how:

   No effect.

4. Do the results of the assessment indicate the effects of the action on habitats and species will be amplified by climate change? If yes, please describe how:

   No effect.

5. Can adaptive management strategies (AMS) be integrated into the action to avoid or minimize adverse effects of the proposed action as a result of climate? If yes, please describe how:

   N/A

10. Federal Agency Determination

Federal Action Agency's EFH determination (select one)	
☐	There is no adverse effect[7] on EFH or EFH is not designated at the project site. EFH Consultation is not required. This is a FWCA only request.
☑	The adverse effect[7] on EFH is not substantial. This means that the adverse effects are no more than minimal, temporary, or can be alleviated with minor project modifications or conservation recommendations. This is a request for an abbreviated EFH consultation.
☐	The adverse effect[7] on EFH is substantial. This is a request for an expanded EFH consultation. We will provide more detailed information, including an alternatives analysis and NEPA documents, if applicable.

[7] An adverse effect is any impact that reduces the quality and/or quantity of EFH. Adverse effects may include direct or indirect physical, chemical, or biological alterations of the waters or substrate and loss of, or injury to, benthic organisms, prey species and their habitat, and other ecosystem components. Adverse effects to EFH may result from actions occurring within EFH or outside of EFH and may include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

11. Fish and Wildlife Coordination Act

Under the FWCA, federal agencies are required to consult with us if actions that the authorize, fund, or undertake will result in modifications to a natural stream or body of water. Federal agencies are required to consider the effects these modifications may have on fish and wildlife resources, as well as provide for the improvement of those resources. Under this authority, we consider the effects of actions on NOAA-trust resources, such as anadromous fish, shellfish, crustaceans, or their habitats, that are not managed under a federal fisheries management plan. Some examples of other NOAA-trust resources are listed below. Some of these species, including diadromous fishes, serve as prey for a number of federally-managed species and are therefore considered a component of EFH pursuant to the MSA. We will be considering the effects of your project on these species and their habitats as part of the EFH/FWCA consultation process and may make recommendations to avoid, minimize or offset and adverse effects concurrently with our EFH conservation recommendations.

Please contact our Greater Atlantic Regional Fisheries Office, Protected Resources Division regarding potential impacts to marine mammals or species listed under the Endangered Species Act and the appropriate consultation procedures.

Fish and Wildlife Coordination Act Resources

Species known to occur at site (list others that may apply)	Describe habitat impact type (i.e., physical, chemical, or biological disruption of spawning and/or egg development habitat, juvenile nursery and/or adult feeding or migration habitat). Please note, impacts to federally listed species of fish, sea turtles, and marine mammals must be coordinated with the GARFO Protected Resources Division.
alewife	Alewife migrate through Indian River Inlet. Offshore borrow area (IRI Ebb Shoal) is sufficiently offshore to not impede migration. TOYR recommended for inshore
American eel	American eel migrate through Indian River Inlet. Offshore borrow area (IRI Ebb Shoal) is sufficiently offshore to not impede migration. TOYR recommended for
American shad	American shad migrate through Indian River Inlet. Offshore borrow area (IRI Ebb Shoal) is sufficiently offshore to not impede migration. TOYR recommended for
Atlantic menhaden	Atlantic menhaden migrate through Indian River Inlet. Offshore borrow area (IRI Ebb Shoal) is sufficiently offshore to not impede migration. TOYR recommended
blue crab	Wintering blue crabs are known to bury themselves into deeper waters near the mouth of estuaries, and would likely concentrate in "basin" habitat more so than
blue mussel	
blueback herring	Blueback herring migrate through Indian River Inlet. Offshore borrow area (IRI Ebb Shoal) is sufficiently offshore to not impede migration. TOYR recommended
Eastern oyster	
horseshoe crab	Horseshoe crabs may be present within borrow area but not highly concentrated. Atlantic ocean coast beach is not a spawning location.
quahog	
soft-shell clams	
striped bass	
other species:	Summer Flounder SAV: No SAV in dredging or placement area when dredging/placement would occur.
other species:	Sand Tiger Shark (Delaware Bay): HAPC for beachfill placement. No permanent habitat impacts or changes resulting from beachfill placement.
other species:	

12. Useful Links

National Wetland Inventory Maps
EPA's National Estuary Program (NEP)
Northeast Regional Ocean Council (NROC) Data Portal
Mid-Atlantic Regional Council on the Ocean (MARCO) Data Portal

Resources by State

Maine
Maine Office of GIS Data Catalog
Town shellfish information including shellfish conservation area maps
State of Maine Shellfish Sanitation and Management
Eelgrass maps
Casco Bay Estuary Partnership
Maine GIS Stream Habitat Viewer

New Hampshire
NH Statewide GIS Clearinghouse, NH GRANIT
NH Coastal Viewer
State of NH Shellfish Program

Massachusetts
MA DMF Shellfish Sanitation and Management Program
MassGIS Data (Including Eelgrass Maps)
MA DMF Recommended TOY Restrictions Document Massachusetts
Bays National Estuary Program
Buzzards Bay National Estuary Program
Massachusetts Division of Marine Fisheries
Massachusetts Office of Coastal Zone Management

Rhode Island
RI Shellfish and Aquaculture
RI Shellfish Management Plan
RI Eelgrass Maps
Narragansett Bay Estuary Program
Rhode Island Division of Marine Fisheries
Rhode Island Coastal Resources Management Council

Connecticut

CT Bureau of Aquaculture

Natural Shellfish Beds in CT

Eelgrass Maps

Long Island Sound Study

CT GIS Resources

CT DEEP Office of Long Island Sound Programs and Fisheries

CT River Watershed Council

New York

Eelgrass Report

Peconic Estuary Program

NY/NJ Harbor Estuary Program

New York GIS Clearinghouse

New Jersey

Submerged Aquatic Vegetation Mapping

Barnegat Bay Partnership

NJ GeoWeb

NJ DEP Shellfish Maps

Pennsylvania

Delaware River Management Plan

PA DEP Coastal Resources Management Program

PA DEP GIS Mapping Tools

Delaware

Partnership for the Delaware Estuary

Center for Delaware Inland Bays

Delaware FirstMap

Maryland

Submerged Aquatic Vegetation Mapping

MERLIN (Maryland's Environmental Resources and Land Information Network)

Maryland Coastal Atlas

Maryland Coastal Bays Program

Virginia

VMRC Habitat Management Division

Submerged Aquatic Vegetation mapping

APPENDIX-E

DELAWARE COASTAL ZONE MANAGEMENT FEDERAL CONSISTENCY FORM

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Delaware Department of Natural Resources and
Environmental Control
Delaware Coastal Management Program

Initial Review: ________
Updated On: ________
Complete: ________
Official Use Only

Coastal Zone Management Act
Federal Consistency Form

This document provides the Delaware Coastal Management Program (DCMP) with a Federal Consistency Determination or Certification for activities regulated under the Coastal Zone Management Act of 1972, as amended, and NOAA's Federal Consistency Regulations, 15 C.F.R. Part 930. Federal agencies and other applicants for federal consistency are not required to use this form; it is provided to applicants to facilitate the submission of a Consistency Determination or Consistency Certification. In addition, federal agencies and applicants are only required to provide the information required by NOAA's Federal Consistency Regulations.

Project/Activity Name:	Delaware Coast Protection - Indian River Inlet Sand Bypass - North Beach Supplemental Sand Nourishment

I. Federal Agency or Non-Federal Applicant Contact Information:

Contact Name/Title: Steven D. Allen/Supervisory Biologist

Federal Agency Contractor Name (if applicable): ________

Federal Agency: U.S. Army Corps of Engineers - Philadelphia District
(either the federal agency proposing an action or the federal agency issuing a federal license/permit or financial assistance to a non-federal applicant)

Mailing Address: 1650 Arch Street

City: Philadelphia State: PA Zip Code: 19103-2004

E-mail: Steven.D.Allen@usace.army.mil Telephone #: 215-656-6559

II. Federal Consistency Category:

- (●) Federal Activity or Development Project (15 C.F.R. Part 930, Subpart C)
- ( ) Outer Continental Shelf Activity (15 C.F.R. Part 930, Subpart E)
- ( ) Federal Financial Assistance (15 C.F.R. Part 930, Subpart F)
- ( ) Federal License or Permit Activity (15 C.F.R. Part 930, Subpart D)
- ( ) Federal License or Permit Activity which occurs wholly in another state (interstate consistency activities identified in DCMP's Policy document)

III. Detailed Project Description (attach additional sheets if necessary)**:**

The plan is a combination of the dredging and beachfill plan and sand source alternatives for the restoration of the North Beach shoreline. The Delaware Department of Natural Resources and Environmental Control completed an initial phase of the restoration of the beach by dredging from the interior Indian River Inlet Flood Shoal and placing approximately 480,000 cubic yards of sand on the North Beach shoreline. This phase is identified as "Phase 1" in the document, which was constructed to address severe erosion of the North Beach and dune. Phase 1 was completed March 1, 2025. The next phase (Phase 2) is the USACE component, which will complement the Phase 1 portion. For the completion of the Phase 2 berm restoration, approximately 500,000 cubic yards of sand beachfill would be placed along the shoreline of the North Beach extending north from the north Indian River Inlet jetty for approximately 5,000 feet. The construction template will result in a 200 to 250-ft wide berm with an elevation of +9.0 ft NAVD and a foreshore slope of

IV. **General Analysis of Coastal Effects** (attach additional sheets if necessary):

The proposed action will provide significant benefits by protecting critical infrastructure State Route 1 and the approach to the Charles W. Cullen Bridge on the north side of the Indian River Inlet from erosion and overwash caused by a deficit of sand on the north side of the inlet. This project will have short term adverse effects on recreation by limiting beach access during construction, but would provide long-term benefits to recreation by providing a wider recreational beach. Environmental effects include living resources such as a temporary loss of benthic community in areas to be dredged and burial of benthic community in the beachfill placement area. Temporary adverse effects on fisheries through loss of food sources (benthic community). Fish passage impacts would be minimized by implementing a Time of Year Restriction for the Flood Shoal borrow area in the interior of the inlet. Temporary adverse effects on water quality from increases in turbidity during dredging and beachfill placement. Temporary adverse effects on air quality from emissions of NOx, VOCs, and other pollutants from the operation of diesel engines during construction.

V. **Detailed Analysis of Consistency with DCMP Enforceable Policies** (attach additional sheets if necessary):

Policy 5.1: Wetlands Management

N/A No wetlands would be affected by the proposed action.

Policy 5.2: Beach Management

The proposed action will restore and maintain the North Beach side of the inlet and is compatible with this policy.

Policy 5.3: Coastal Waters Management (includes wells, water supply, and stormwater management. Attach additional sheets if necessary)

The proposed action will have temporary increases in turbidity from dredging and beachfill placement activities, which will be localized and minor.

Policy 5.4: Subaqueous Land and Coastal Strip Management

The dredging of the Indian River Inlet Ebb and Flood Shoals and beachfill placement along the North Beach would occur within Subaqueous Lands in Delaware waters. Section 401 Water Quality Certification will be requested from DNREC upon review of the submitted application materials.

Policy 5.5: Public Lands Management

The beachfill placement would occur along the North Beach area, which is within the Delaware Seashore State Park. The proposed action is consistent with this use and would protect, preserve and enhance this resource.

Policy 5.6: Natural Lands Management

The Indian River Inlet flood shoal borrow area is within the Inland Bays Watershed. Dredging in this area will have temporary effects on turbidity, which would subside upon completion of the construction.

Policy 5.7: Flood Hazard Areas Management

The affected area of the North Beach is predominantly a high-risk coastal area that carry an additional hazard associated with storm waves and is designated by Zone VE. The proposed action will benefit this area by protecting a natural buffer by a wider beach and dune upon completion.

Policy 5.8: Port of Wilmington

N/A

Policy 5.9: Woodlands and Agricultural Lands Management

N/A

Policy 5.10: Historic and Cultural Areas Management

The dredging of the Indian River Inlet Flood Shoal and beachfill placement along the North Beach was previously evaluated in accordance with Section 106 of the National Historic Preservation Act, and the Delaware State Historic Preservation Office (SHPO) concurred with a "no effect" determination on historic and cultural resources (SHPO letter dated 4/18/2013). A 192-acre portion of the Indian River Inlet Ebb Shoal (IRI Ebb-A) was surveyed for submerged cultural resources and no No potentially significant targets suggestive of submerged cultural resources were identified. Therefore, the Philadelphia District made a determination of "no effect" for use of this site. A concurrence of this determination from the SHPO is being requested prior to utilization of this site for sand. The proposed use of the Indian River Inlet Ebb Shoal (IRI Ebb-B) will require a submerged cultural resources survey prior to any further reviews including the SHPO for this portion of the site.

Policy 5.11: Living Resources

The dredging of the Indian River Inlet Flood and Ebb Shoals would periodically remove the benthic community within the affected areas of these sites. This effect is temporary as the benthic community is expected to recover between dredging intervals. The dredging and beachfill discharges would affect finfish either through entrainment into the dredge or through turbidity generated from the dredging/beachfill placements. To avoid or minimize effects to migratory fish, a time of year restriction (TOYR) would be in place from March 1 to June 30th during peak migration period for the IRI flood shoal. A TOYR is not proposed for the ebb shoal area or at the beachfill placement location within the Atlantic Ocean. The affected areas are inhabited by several federal and state listed threatened and endangered species including the Atlantic sturgeon, shortnose sturgeon, loggerhead sea turtle, Kemp's Ridley sea turtle, hawksbill turtle, green sea turtle, seabeach amaranth plant, and proposed threatened monarch butterfly. Informal consultation is being conducted with the NOAA Fisheries and U.S. Fish and Wildlife Service. The EA preliminary conclusion is that the activities may affect, but are not likely to adversely affect these species.

Policy 5.12 Mineral Resources Management

N/A

Policy 5.13: State Owned Coastal Recreation and Conservation

The proposed action is compatible with this policy, which "would maintain important recreational areas and wildlife habitat, or would maintain or enhance the conservation of natural, cultural or historic resources shall be managed, preserved, and protected, for conservation and recreational use."

Policy 5.14: Public Trust Doctrine

The public would be temporarily prohibited from entering work areas such as dredging locations, pipelines, and discharge points at the beachfill placement locations until work is completed.

Policy 5.15: Energy Facilities

N/A

Policy 5.16: Public Investment

N/A

Policy 5.17: Recreation and Tourism

The proposed action would have short-term adverse effects on recreation during construction, but would have long-term benefits on recreation and tourism.

Policy 5.18: National Defense and Aerospace Facilities

N/A

Policy 5.19: Transportation Facilities

N/A

Policy 5.20: Air Quality Management

All dredging and beachfill placement activities will result in temporary and localized increases in emissions associated with diesel powered equipment. Based on the size of the operation and duration, air emissions are expected to be below the de minimus threshold for a marginal ozone non attainment area.

Policy 5.21: Water Supply Management

N/A

Policy 5.22: Waste Disposal Management

N/A

Policy 5.23: Development

N/A

Policy 5.24: Pollution Prevention

The proposed actions will be conducted in a manner that complies with pollution prevention policies in accordance with waste management and spill prevention and abatement practices.

Policy 5.25: Coastal Management Coordination

The proposed action will be reviewed concurrently under the National Environmental Policy Act as a draft Environmental Assessment made available for public and agency review. Section 401 Water Quality Certification review and a Federal Coastal Zone Consistency Determination will be requested from DNREC. The EA and other documents such as Essential Fish Habitat Evaluation and Endangered Species reviews will be provided to NOAA Fisheries and the U.S. Fish and Wildlife Service.

VI. JPP and RAS Review (Check all that apply)**:**

Has the project been reviewed in a monthly Joint Permit Processing and/or Regulatory Advisory Service meeting?

☐ JPP ☐ RAS ☒ None

*If yes, provide the date of the meeting(s): ______________________________

VII. Statement of Certification/Determination and Signature (Check one and sign below)**:**

☒ **FEDERAL AGENCY CONSISTENCY DETERMINATION.** Based upon the information, data, and analysis included herein, the federal agency, or its contracted agent, listed in (I) above, finds that this proposed activity is consistent to the maximum extent practicable with the enforceable policies of the Delaware Coastal Management Program.

OR

☐ **FEDERAL AGENCY NEGATIVE DETERMINATION.** Based upon the information, data, and analysis included herein, the federal agency, or its contracted agent, listed in (I) above, finds that this proposed activity will not have any reasonably foreseeable effects on Delaware's coastal uses or resources (Negative Determination) and is therefore consistent with the enforceable policies of the Delaware Coastal Management Program.

OR

☐ **NON-FEDERAL APPLICANT'S CONSISTENCY CERTIFICATION.** Based upon the information, data, and analysis included herein, the non-federal applicant for a federal license or permit, or state or local government agency applying for federal funding, listed in (I) above, finds that this proposed activity complies with the enforceable policies of the Delaware Coastal Management Program and will be conducted in a manner consistent with such program.

Signature:	[signature]		
Printed Name:	Steven D. Allen	Date:	3/18/2025

Pursuant to 15 C.F.R. Part 930, the Delaware Coastal Management Program must provide its concurrence with or objection to this consistency determination or consistency certification in accordance with the deadlines listed below. Concurrence will be presumed if the state's response is not received within the allowable timeframe.

Federal Consistency Review Deadlines:

Federal Activity or Development Project (15 C.F.R. Part 930, Subpart C)	60 days with option to extend an additional 15 days or stay review (15 C.F.R. § 930.41)
Federal License or Permit (15 C.F.R. Part 930, Subpart D)	Six months, with a status letter at three months. The six month review period can be stayed by mutual agreement. (15 C.F.R. § 930.63)
Outer Continental Shelf Activity (15 C.F.R. Part 930, Subpart E)	Six months, with a status letter at three months. If three month status letter not issued, then concurrence presumed. The six month review period can be stayed by mutual agreement. (15 C.F.R. § 930.78)
Federal Financial Assistance to State or Local Governments (15 C.F.R. Part 930, Subpart F)	State Clearinghouse schedule

OFFICIAL USE ONLY:

Reviewed By:	Fed Con ID:	Date Received:
Public notice dates: to	Comments Received: ☐ NO ☐ YES *[attach comments]*	
Decision type: *(objections or conditions attach details)*	_ Decision Date:	

APPENDIX-D

ESSENTIAL FISH HABITAT EVALUATION

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APPENDIX-E

DELAWARE COASTAL ZONE MANAGEMENT FEDERAL CONSISTENCY FORM

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