# WOLF TRAP ALTERNATE OPEN WATER PLACEMENT SITE NORTHERN EXTENSION ESSENTIAL FISH HABITAT IMPACT ASSESSMENT

**U.S. Army Corps of Engineers, Baltimore District**
**Draft – July 2019**

## TABLE OF CONTENTS



## FIGURES



## TABLES

**WOLF TRAP ALTERNATE OPEN WATER PLACEMENT SITE**
**NORTHERN EXTENSION**
**ESSENTIAL FISH HABITAT IMPACT ASSESSMENT**

**U.S. Army Corps of Engineers, Baltimore District**
**Draft – July 2019**

# 1 PROJECT DESCRIPTION

The Wolf Trap Alternate Open Water Placement Site (WTAPS)[1] is currently used as a placement site for sediments dredged during routine maintenance dredging of the York Spit Channel. The proposed action would establish an extension of the existing WTAPS site to the north, increasing the size of the placement site by approximately 3,900 acres, and is herein referred to as the "WTAPS Northern Extension" (WTAPSNE, Figure 1). WTAPSNE would serve as an open water placement site for dredged material primarily from the York Spit Channel, but may also be used as a placement site for other dredging projects in the lower Chesapeake Bay pending evaluation. The purpose of the proposed action is to provide a cost-effective, environmentally-acceptable placement site for dredged material in response to a recommendation by agencies of the Commonwealth of Virginia, to minimize adverse impacts to blue crabs. WTAPSNE has been recommended by agencies of the Commonwealth of Virginia as an alternative to the currently-used WTAPS due to the potential for a high abundance of female blue crabs to overwinter in the southern portion of WTAPS. Blue crab winter dredge survey data collected by the Virginia Institute of Marine Science (VIMS) between 2009 and 2016 indicate that WTAPSNE provides less suitable habitat for overwintering female blue crabs than WTAPS (Lipcius & Knick, 2016). Placement of dredged material into WTAPS while female crabs are not overwintering (generally from early April to mid-November) is not feasible due to higher costs to dredge in the summer and potential adverse impacts to sea turtles.

For the purposes of this assessment, the "no action" alternative would be the continued *status quo* use of the WTAPS site to receive materials dredged to maintain the York Spit Channel. That maintenance dredging typically occurs once every four years and generates an average of 1.5 million cubic yards (mcy) of material per cycle. To minimize adverse impacts to sea turtles, dredging in the York Spit Channel does not occur from September 1 through November 14, and dredging typically occurs during the winter and early spring, subject to contractor availability. No new or altered dredging activities are proposed as part of this project. The proposed action does not include any changes to or consideration of the ongoing maintenance dredging activities or any other actions beyond the establishment of the placement site extension itself. Impacts from maintenance dredging were evaluated in the Environmental Impact Statement for the 2005 Baltimore Harbor and Channels (Maryland and Virginia) Dredged Material Management Plan (DMMP) and other previous National Environmental Policy Act documents.

The capacity of the site is over 30 mcy, which assumes placement of dredged material within the site boundaries up to an approximate depth of -30 feet mean lower low water (MLLW).

[1] As a point of clarification, the *existing* dredged material placement is termed "alternate" because it superseded a historical placement site further to the east, closer to the main channel within the Bay. That original site is shown on NOAA navigation charts, but has been inactive for decades and is not relevant to the proposed action.

Approximately 2.6 million cubic yards (mcy) of dredged material from operation and maintenance (O&M) of the York Spit Channel would be placed into quadrant 1 of cell NE-6 in the WTAPSNE (Figure 2) during the initial placement event that is expected to occur in late fall of 2019. After initial placement into the WTAPSNE, it is anticipated that approximately 1.5 mcy of dredged material from the York Spit Channel would be placed into the site approximately every 4 years or until another alternate placement site or method is identified, approved and implemented. Each dredging cycle and associated placement activities (mobilization to demobilization of the dredging operation) lasts for approximately 4½ months. Open water placement activities would occur 24 hours per day and seven days a week during any maintenance dredging period. Placement into the WTAPSNE would not occur during the dredge closure period for sea turtles, from September 1 through November 14.

Dredged material would be placed into WTAPSNE using a hopper dredge because they are better suited than other types of dredge vessels for maintaining the York Spit Channel. The volume and frequency of dredged material placement events during maintenance dredging is a function of the rate of dredging production, the number of hopper vessels in use, and their size, speed and capacity. Based on previous maintenance dredging actions for the York Spit Channel, it is expected that dredging would generate roughly 15,000 cubic yards (cy) of material, per day. Hopper dredge capacity is expected to range from 3,600 to 8,600 cy depending on the dredge contractor used. Depending on the size and types of vessels used, this would require the placement of two to five loads of dredged material at the WTAPSNE site, per day, during maintenance dredging periods. Operation of these vessels, including movement to and from the WTAPSNE site, is not expected to be a significant source of turbidity due to the depth of the Chesapeake Bay in these areas, relative to vessel draft. Depending on the amount of material dredged from the York Spit Channel during one maintenance dredging cycle, the thickness of the material that would be deposited in one cycle would range from 2 inches to 2 ft thick.

In FY 2020, NAB plans to begin a comprehensive evaluation of alternatives to WTAPS through a DMMP for the portion of the Baltimore Harbor and Channels Project located in Virginia.

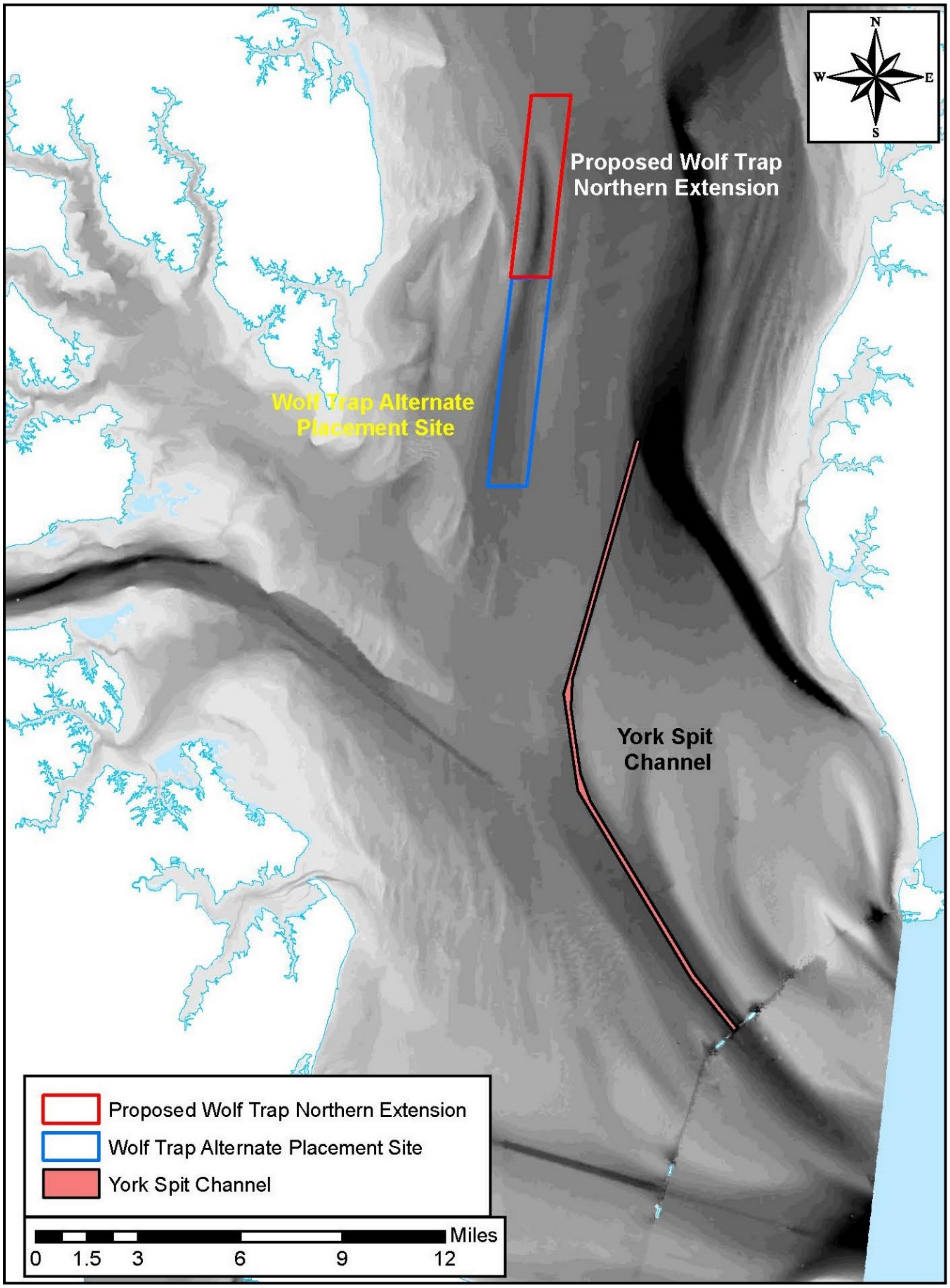
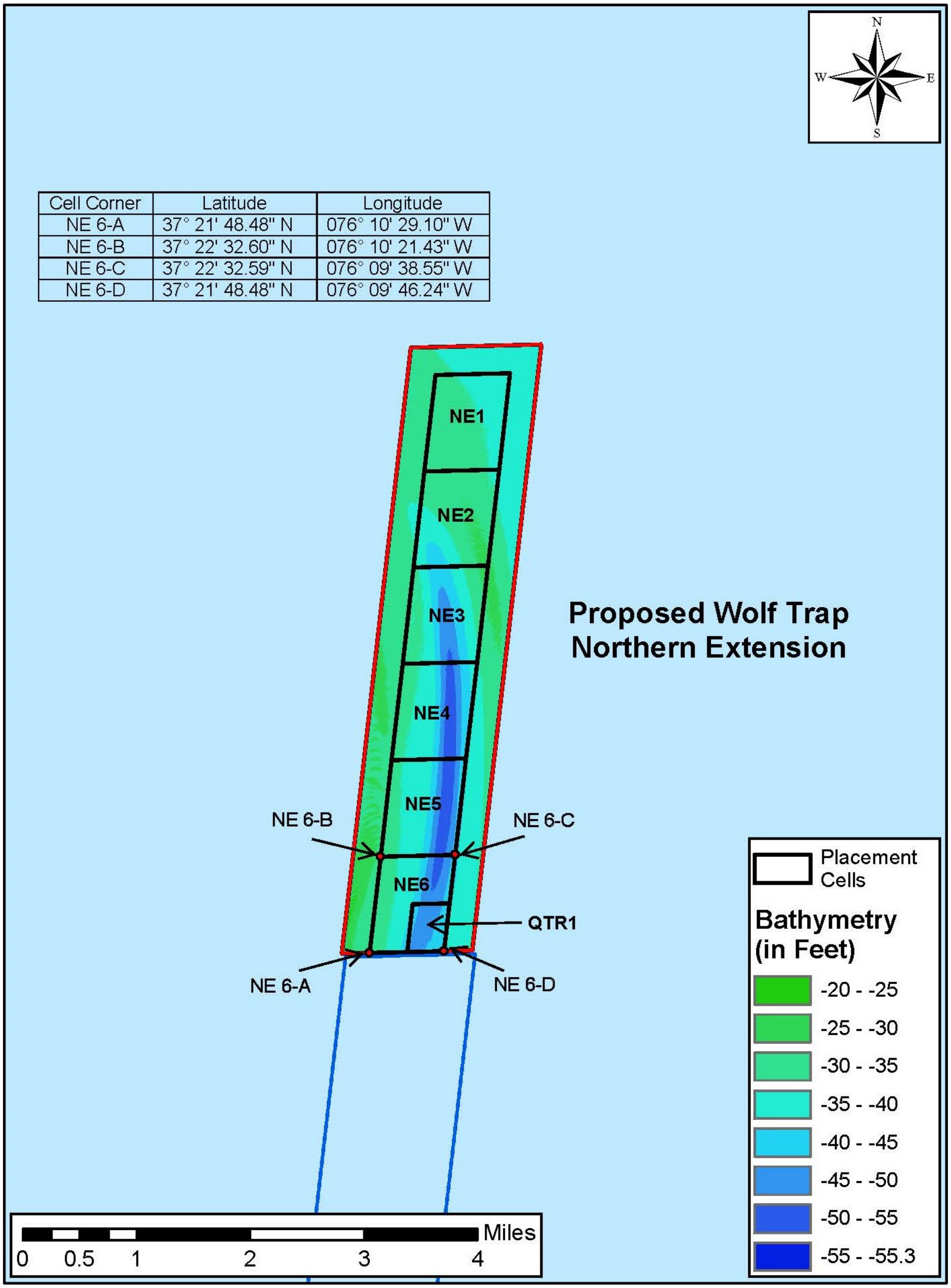



**Figure 1. Map of the Wolf Trap Alternate Open Water Placement Site Northern Extension**




| Cell Corner | Latitude | Longitude |
|---|---|---|
| NE 6-A | 37° 21' 48.48" N | 076° 10' 29.10" W |
| NE 6-B | 37° 22' 32.60" N | 076° 10' 21.43" W |
| NE 6-C | 37° 22' 32.59" N | 076° 09' 38.55" W |
| NE 6-D | 37° 21' 48.48" N | 076° 09' 46.24" W |

**Figure 2. Placement Cells of the Proposed Wolf Trap Alternate Open Water Placement Site Northern Extension.**

## 2 DESCRIPTION OF PROJECT AREA

The proposed WTAPSNE project encompasses a rectangular area measuring roughly 6,060 by 28,340 feet (3,900 acres), extending north-northeast from the northern end of the existing WTAPS site. Based on bathymetric surveys conducted by USACE Baltimore District in April, July and August 2017, water depths in the WTAPSNE site range from 23 feet to 55 feet mean lower low water (MLLW), with an average depth of 36 feet MLLW (Figure 3). The typical tidal range in the action area is approximately 2.85 feet, although this varies significantly with time of the month (spring and neap tides) as well as storm activity, which can create significant storm surges well beyond the normal tidal range. Tides are (semi)diurnal in the Chesapeake Bay, with two high and low tides per day (NMFS Biological Opinion, 2018).

The WTAPSNE site is characterized as a flat, relatively featureless plain (termed as bay-stem plains by Wright et al., 1987) with a deep, natural channel or relict channel (termed bay-stem channel by Wright et al., 1987) running roughly north-to-south through the site. Both bottom types are typically composed of mud or fine sand with silt and clay filling interstices, and experience relatively strong near-bottom tidal currents. Bay stem plains are characterized by high densities of tube dwellers including the annelid, *Euclymene zonalis*, the anemone, *Ceriantheopsis sp.* and the amphipod crustacean, *Ampelisca abdita*. The tubes of *Chaetopterus variopedatus* extend 2 to 3 centimeters into the water column. Sediment reworking by *Euclymene zonalis*, a "conveyor-belt" species, produces a hummocky bed surface. Bay-stem channels generally share similar roughness features (Wright et al., 1987), although benthic communities may differ. The trough at WTAPSNE is somewhat bathymetrically isolated by shallower depths at either end, which may limit near-bottom water exchange, and lead to greater seasonal oxygen stress. Virginia Marine Resources Commission (VMRC) identifies no submerged aquatic vegetation (SAV) or shellfish beds located within the footprint or adjacent to the WTAPSNE (VMRC, 2019). SAV is typically limited to depths of less than 2 m, and oysters to depths less than 8 m in the Bay (VIMS, 2019 Coastal). The area is of significant seasonal importance to female blue crabs (see blue crab discussion below).

Water temperatures in the Chesapeake Bay within the project area fluctuate widely throughout the year, ranging from 1° Celsius (C) in the winter to 29°C in the summer. Changes in water temperature influence where SAV can grow, and when fish and crabs feed, reproduce and migrate (CBP, 2019). Salinity in the Chesapeake Bay varies from season to season and year to year depending largely on the amount of freshwater flowing into the bay. Generally, salinity in the lower Chesapeake Bay is characterized as polyhaline (between 18 and 30 parts per thousand (ppt)) (The Center for Conservation Biology, 2010). Long-term water quality data for the WTAPSNE site was obtained from the VECOS website (VIMS, 2019). Data were used for monitoring station "CB6.3 – Lower West Central Chesapeake Bay", which is adjacent to the WTAPSNE site. Normal surface salinities within the WTAPSNE site vary from 10 to 24 ppt, with an average of 17.9 ppt. Normal bottom salinities vary from 14 to 28 ppt, with an average of 22.2 ppt.

The project area is within an open bay segment "CB6PH", which has been identified by the Virginia Department of Environmental Quality (VADEQ) as meeting state water quality standards for dissolved oxygen (30-day), during the summer months, but lacks sufficient information for shorter periods, and is therefore remains classified as "impaired", as it was during the 2016

Integrated Report. In the 2016 Integrated Report, VADEQ listed the area as not impaired for benthic life (VADEQ, 2018). The proposed placement area does, however, lie within about 16 km of waters that have been shown to experience periodic hypoxia (Dauer et al., 1992), and likely remains susceptible to occasional hypoxic conditions at depth during years with high water temperatures.

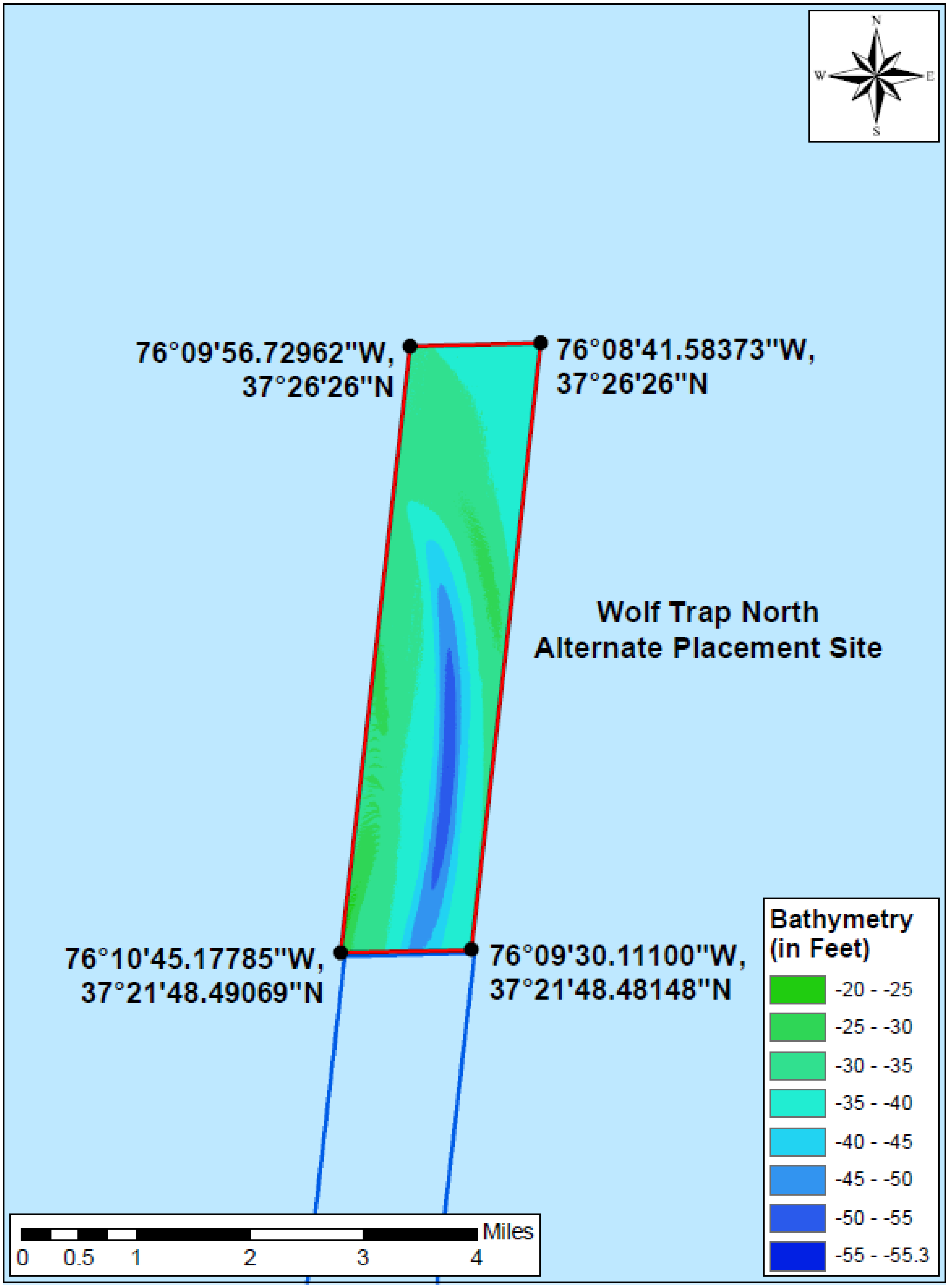



**Figure 3. Bathymetry (in feet) in the Wolf Trap Alternate Open Water Placement Site**

# 3 POTENTIAL PROJECT EFFECTS

## Turbidity and Water Quality Effects

Temporary water quality effects to managed fish species and their EFH due to project activities would most likely be limited to short-term increases in turbidity levels and suspended solids in the dredged material placement areas and downcurrent areas.

Direct effects from sedimentation and turbidity would result in deposition of suspended sediments on demersal eggs, larvae, immobile prey species, etc. Extremely elevated levels of turbidity may cause physical asphyxiation of aquatic organisms and cause localized, acute oxygen stress due to chemical oxygen demand. These factors would primarily affect eggs, larvae and small prey species that lack the physical swimming ability to evade the concentrated turbidity plume. Such effects would be spatially confined to only a very small portion of the turbidity plume and would persist less than one hour after a placement event. Water column turbidity may induce avoidance behavior in some species and may interfere with species' ability to hunt prey or avoid predators. (https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/turbiditytablenew.html).

During open water placement activities via hopper dredge, suspended sediment levels may be as high as 500 milligrams/liter (mg/L) within 250 feet of the dredge, decreasing to background levels (i.e., 15 to 100 mg/L depending on location and water conditions) within 1,000 to 6,500 feet of the dredge. Total suspended solids (TSS) concentrations near the center of the plume created by the placement of dredged material have been observed to reach near background levels in 35 to 45 minutes (NOAA Turbidity and Total Suspended Sediment Effects Table, 2017). The published field data support the theoretical description of the transport phases in typical open-water disposal operations. The short term effects resulting from suspended sediment are confined to a well-defined layer above the bottom equal to 15 to 20 percent of the total water depth (Truitt, 1988).

## Effects on the Benthic Community in the Project Area

Environmental monitoring was performed to assess the potential effects of late-winter/early-spring 2015 placement of dredged material at the existing Wolf Trap Alternate Placement Site (WTAPS) on blue crabs, finfish, and benthic macrofauna, which are prey for blue crabs and bottom-feeding fish. Monitoring included bottom trawl and benthic macrofaunal sampling conducted before (November 2014), immediately after (June 2015), and five months after (November 2015) dredged material placement in Cell-1 and Cell-3 within the WTAPS. Identical monitoring was also conducted in Cell-6, which did not receive dredged material in 2015. The findings indicated that the sediment composition in the site (approximately 41 percent silt, 51 percent clays, and 8 percent sands) varied spatially, but did not change significantly between the pre- and post-placement time periods (USACE Norfolk District, 2016).

Benthic macrofaunal biomass and taxonomic richness did not differ between the placement site versus reference areas or pre- versus post-placement time periods to a degree that adversely affected the environment. Spatial and temporal differences in benthic macrofaunal assemblages tended to reflect higher faunal abundances at the placement areas and higher abundances in the post-placement time period. Taxa included opportunistic (e.g., Spionid polychaetes) and equilibrium (e.g., Nephytid polychaetes) species. Abundances of tube building polychaetes (Maldanidae and Chaetopteridae) varied spatially, but did not differ significantly between pre- and post-placement periods. Mature female blue crabs were most abundant with increasing proximity to the Bay mouth in both the winter dredge survey (January 2015) and fall trawl surveys (November 2014 and 2015). Mature blue crab catch-per-unit-effort was higher during the post-placement time period in both placement cells and did not differ between placement references areas. Fish assemblages did not differ between the pre- and post-placement time periods and placement versus reference areas in a pattern consistent with a detrimental effect from dredged material placement. Significant differences in fish assemblage composition typically resulted from high catches of a schooling species in an area during one sampling event (USACE Norfolk District, 2016).

It is also expected that the benthic community would recolonize within approximately one season, or at most 1.5 years (Schaffner, 2010). It is expected that the project would have minimal effect on the benthic communities. Many organisms would be able to burrow back to the surface, and recolonization would occur due to immigration from adjacent and nearby locations. Materials from the York Spit channels consist primarily of silt, with significant amounts of clay, and minor amounts of sand, comparable to sediments found at the project site, and blue crabs would be capable of burrowing within the substrate.

During the anticipated life of the project, successive dredged material placement events will raise the average bottom elevation within the project area from the current average of -36 feet MLLW, up to a maximum of -30 feet MLLW. The actual magnitude of this change over time would be subject to rates of sedimentation within the York Spit Channel, as well as prevailing currents, major storms and other factors which affect the movement of sediments in the area. The relative change in depth would be greatest within the deep "trough" portion of the current WTAPSNE site. The cumulative effects of this bathymetric change are not expected to constitute a substantially adverse effect on benthic communities or EFH. These depth changes may cause minor changes in the relative abundances of benthic taxa, but are not expected to fundamentally alter the benthic community type. The expected average depth changes would not cross any "threshold" depths that would cause such areas to cease to provide EFH functions. Given that the deepest waters in the general vicinity of the project area are subject to seasonal hypoxia, it is possible that decreasing these depths, particularly within the trough, may reduce the frequency and severity of summer oxygen stress experienced by benthic organisms in those areas. The estimated decrease in average depths is based on current bathymetry and expected rates of dredging, and does not consider relative sea level changes. Recent climate models predict a relative rise in sea levels within the region which, regardless of magnitude, would have the effect at least partially offsetting the changes in depth caused by the project.

**Species with Potential EFH in Project Area**

A summary of those species for which potential EFH has been indicated within the project area are shown in the table below. These designations are based on the NOAA Estuarine Living Marine Resource (ELMR) program, the EFH habitat mapper tool, and NOAA EFH source documents. Based on salinity information presented in Section 2 of this document, the project area is generally in the mixed/brackish ("M") zone, but occasionally rises past the 25 ppt threshold into seawater ("S") salinity zone. Whether or not the species and their life history stages identified below actually do have EFH in the project area is assessed in the subsequent species-specific assessments.

**Table 1. Summary of Federally-Managed Species with EFH in the Project Vicinity**

| Species | Life Stage | | | |
|---|---|---|---|---|
| | **Eggs** | **Larvae** | **Juveniles** | **Adults** |
| Red hake (*Urophycis chuss*) | | | S | S |
| Windowpane flounder (*Scopthalmus aquosus*) | | | M,S | M,S |
| Summer flounder (*Paralicthys dentatus*) | | M,S | M,S | M,S |
| Bluefish (*Pomatomus saltatrix*) | | | M,S | M,S |
| Atlantic butterfish (*Peprilus triacanthus*) | M,S | M,S | M,S | M,S |
| Scup (*Stenotomus chrysops*) | | | S | S |
| Black sea bass (*Centropristus striata*) | | | M,S | M,S |
| Atlantic sea herring *(Clupea harengus)* | | | | S |
| Sand tiger shark *(Carcharias taurus*)* | | | S | S |
| Sandbar shark *(Carcharhimus plumbeus*) | | | S | S |
| Dusky shark *(Carcharhinus obscurus)** | | | | S |
| Clearnose skate (*Raja eglanteria*) | | | M,S | M,S |
| Little skate (*Leucoraja erinacea*) | | | M,S | M,S |
| Winter skate (*Leucoraja ocellata*) | | | M,S | M,S |
| S = Includes the seawater salinity zone (salinity ≥ 25.0‰).<br>M = Includes the mixing water/brackish salinity zone (0.5‰ < salinity < 25.0‰).<br>X = EFH has been designated for a given species and life stage. | | | | |

* The project area is not mapped as potential EFH for the sand tiger or dusky sharks, however, both species are included in this assessment because they are NOAA Species of Concern, and have potential EFH mapped in the lower Chesapeake Bay, a few miles south of the project location

# 4 EFH ASSESSMENT

As shown in the table above, 12 species have been identified as having EFH in the project area, including the sandbar shark, which has Habitat Areas of Particular Concern[2] (HAPC) within the project area. The sand tiger and dusky sharks *do not* have EFH within the project area, but are Species of Concern with potential EFH in the lower Chesapeake Bay, in the vicinity of the project, and so have been included in this assessment. The EFH assessments for the 14 identified species are based on the potential direct, indirect and cumulative impacts resulting from both short and long-term changes to aquatic habitats as a result of the proposed project described above. Considerations of effects on prey of these EFH species are provided in this document. Analysis of effect on other important species are provided in the separate "Other Trust Resources" subsection of this EA.

## 4.1 BONY FISH

### RED HAKE (*Urophycis chuss*)

Red hake are a cold-temperate coastal species that undertake inshore-offshore seasonal migrations to remain in their preferred temperature range (5 to 12°C). From late spring until early summer, red hake move from deep to shallow waters. As waters warm during the summer, red hake migrate to deeper water offshore and stay offshore until the following spring (Murdy and Musick, 2013). During warmer months, red hake are commonly found in depths < 100 m (< 328 ft); during colder months, they are commonly found in depths > 100 m (> 328 ft) (Steele et al., 1999). During Virginia Institute of Marine Science (VIMS) trawl surveys conducted between 1988 and 1999 in the Virginia waters of the Chesapeake Bay, an overwhelming proportion of red hake occurred in the deeper channel waters of the Chesapeake Bay Mainstem (VIMS, 2002).

**Juveniles**
EFH for juvenile red hake includes intertidal and sub-tidal benthic habitats throughout the region on mud and sand substrates, to a maximum depth of 80 meters, including bays and estuaries. Bottom habitats providing shelter are essential for juvenile red hake, including: mud substrates with biogenic depressions, substrates providing biogenic complexity (e.g., eelgrass, macroalgae, shells, anemone and polychaete tubes), and artificial reefs. Newly settled juveniles occur in depressions on the open seabed. Older juveniles are commonly associated with shelter or structure and often inside live bivalves (NEFMC and NMFS, 2017).

Juvenile red hake remain pelagic until they reach 25-30 millimeters (mm) total length (TL) in about two months. They gradually descend to the bottom at a size of about 35-40 mm TL between September and December. Shelter is a critical habitat requirement for juvenile red hake. Newly settled juveniles occur in depressions on the open seabed. Older juveniles commonly associate

[2] EFH that is judged to be particularly important to the long-term productivity of populations of one or more managed species, or to be particularly vulnerable to degradation may also be identified by Fisheries Management Councils and NOAA Fisheries as HAPC. Areas of EFH considered HAPC must be proven to be important to the ecological function provided by the habitat for the managed species. The extent to which the habitat is sensitive to human-induced environmental degradation, including development activities that stress the habitat and the rarity of the habitat are considered.

with shelter or structure. They leave shelter at night and commonly prey on small benthic and pelagic crustaceans, including shrimp, crabs, mysids, euphausiids, and amphipods. Juveniles maintain this association until they are about 10 to 13 centimeters (cm) TL (Steimle et al., 1999). Juvenile red hake are regular visitors to the lower Chesapeake Bay in late winter and spring, but less so in the summer. They can tolerate salinities as low as 21 ppt and occasionally move into the middle Bay, extending as far north as the Patuxent River (Murdy and Musick, 2013). Juvenile red hake are generally found in water temperatures < 16°C, water depths < 100 m (328 ft), and salinities ranging from 31 to 33 ppt (https://www.greateratlantic.fisheries.noaa.gov/hcd/red-hake.pdf).

**Adults**

EFH for the adult red hake includes benthic habitats in the Gulf of Maine and the outer continental shelf and slope in depths of 50 – 750 meters and as shallow as 20 meters in a number of inshore estuaries and embayments as far south as Chesapeake Bay. Shell beds, soft sediments (mud and sand), and artificial reefs provide essential habitats for adult red hake. They are usually found in depressions in softer sediments or in shell beds and not on open sandy bottom. In the Gulf of Maine, they are much less common on gravel or hard bottom, but they are reported to be abundant on hard bottoms in temperate reef areas of Maryland and northern Virginia (NEFMC and NMFS, 2017).

Adults are usually found in depressions in soft sediments, but can also be found in the water column (Steimle et al., 1999). Adult red hake generally are found in water temperatures < 12°C, water depths ranging from 10 to 130 m (33 to 427 ft), and salinities ranging from 33 to 34 ppt (https://www.greateratlantic.fisheries.noaa.gov/hcd/red-hake.pdf). Adult red hake, like juveniles, prey upon crustaceans, but also consume a variety of demersal and pelagic fish and squid (Steimle et al., 1999).

**Potential Impacts to Red Hake EFH**

The project area meets the requirements for juvenile red hake EFH identified above, particularly bottom waters with high salinity. The site does not meet the requirements for adult red hake EFH, because even the deepwater trough portion of the site is too shallow.

Temporary adverse impacts to juvenile red hake EFH would primarily consist of disruptions of juvenile bottom habitats and benthic prey species due to placement of dredged material in the project area. Turbidity generated during placement would result in suspended particulates within the water column and may temporarily degrade ambient water quality for nutrients, dissolved oxygen content, and other constituents. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by red hake and may reduce survivorship of some prey species. The spatial extent of impacts to juvenile red hake EFH would be limited to the sites of direct placement of dredged material and adjacent habitats. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term.

Dredged material placement would cause the displacement and temporary loss of benthic invertebrates preferred as prey by the juvenile red hake. Benthic invertebrates would be impacted through burial from settling of suspended sediments, alteration of habitat structure, and disruption of egg settlement rate and early stage development of prey species, within and adjacent to the project. Juvenile red hake would be forced to seek other benthic foraging habitat within the lower Chesapeake Bay during and immediately following dredged material placement events, until the benthic community has reestablished in the disturbed areas. Recolonization of impacted areas would likely be initially dominated by opportunistic species which are typical of the area. Recolonization by equilibrium benthic organisms would be complete within approximately 1.5 years or less (USACE Norfolk District, 2016; Schaffner, 2010). There is abundant habitat throughout the lower Chesapeake Bay from which juvenile red hake may forage during periods of active dredged material placement.

Potential permanent impacts to juvenile red hake EFH would be related to the long-term availability and suitability of muddy, depressional habitats. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. Placement activities would create an uneven, mounded bottom profile that provides numerous depressional areas suitable for hake. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present, and would be similarly suitable for foraging by juvenile red hake. Impacted areas would continue to satisfy the requirements for juvenile red hake EFH, even if the bathymetry, and therefore the benthic prey communities are somewhat altered, over time. These impacts are therefore not expected to be substantially adverse.

In summary, the project area contains EFH only for juvenile stage red hake. Potential adverse impacts to juvenile red hake EFH would primarily consist of seasonal and temporary effects on benthic forage and shelter habitats during periods of maintenance dredging. Juveniles present during placement activities would be forced to seek other suitable habitat, and such habitats are abundant throughout the lower Chesapeake Bay. Benthic organisms would begin recolonizing impacted areas relatively quickly and would be fully re-established within approximately 1.5 years. Juvenile red hake are expected to return to impacted areas because a similar habitat, including depressions between and among placement mounds, would be available for their return. Long-term impacts to red hake EFH would be limited to gradual decrease in average depth over the WTAPSE site, which may slightly alter benthic community structure, but is not expected to be substantially adverse to hake.

**WINDOWPANE FLOUNDER (*Scopthalmus aquosus*)**

EFH is designated for the juvenile and adult windowpane flounder in both estuarine (0.5 < salinity < 25.0 ppt) and marine waters (salinity ≥ 25.0 ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). Windowpane flounder are typically found on sand, silty sand or mud bottoms at depths ranging from 1 to 2 m to < 56 m (3 ft to < 184 ft). (Chang et al., 1999). Windowpane flounder are year-round residents of Chesapeake Bay. They common to abundant in the lower bay. They can be found as far north as the Choptank River (Murdy and Musick, 2013). During VIMS trawl surveys conducted between 1988 and 1999 in the Virginia waters of the Chesapeake Bay, approximately 72 percent of trawl catches were juveniles within the months of April to June representing peak abundance, with adults peaking in

November. Both juvenile and adult catches were concentrated in the Bay mouth and Eastern Shore during the spring and summer months. Windowpane flounder appear to prefer higher salinities (> 22 ppt) and lower temperatures (< 16°C) (VIMS, 2002).

**Juveniles**

EFH for the juvenile windowpane flounder includes intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to northern Florida, including mixed and high salinity zones in bays and estuaries. Essential fish habitat for juvenile windowpane flounder is found on mud and sand substrates and extends from the intertidal zone to a maximum depth of 60 meters. Young-of-the-year juveniles prefer sand over mud (NEFMC and NMFS, 2017). Juveniles generally occur in water temperatures < 25°C, water depths ranging from 1 to 100 m (3 to 328 ft), and salinities ranging from 5.5 to 36 ppt (https://www.greateratlantic.fisheries.noaa.gov/hcd/windowpane.pdf). Juvenile windowpane flounder prey on small crustaceans, such as mysids and decapod shrimp, and tomcod and hake larvae (Chang et al., 1999).

**Adults**

EFH for the adult windowpane flounder includes intertidal and sub-tidal benthic habitats in estuarine, coastal marine, and continental shelf waters from the Gulf of Maine to Cape Hatteras, including mixed and high salinity zones in bays and estuaries. Essential fish habitat for juvenile windowpane flounder is found on mud and sand substrates and extends from the intertidal zone to a maximum depth of 70 meters. (NEFMC and NMFS, 2017). Adults generally occur in water temperatures < 26.8°C, water depths ranging from 1 to 75 m (3 to 246 ft), and salinities ranging from 5.5 to 36 ppt (https://www.greateratlantic.fisheries.noaa.gov/hcd/windowpane.pdf). Like the juveniles, adult windowpane flounder prey on small crustaceans, such as mysids and decapod shrimp, and gadid larvae (Chang et al., 1999).

**Potential Impacts to Windowpane Flounder EFH**

EFH for the juvenile and adult life stages of windowpane flounder is present within the project area.

Temporary adverse impacts to juvenile and adult windowpane flounder EFH would primarily consist of disruptions of bottom habitats and benthic prey species due to placement of dredged material in the project area. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality for nutrients, dissolved oxygen content, and other constituents. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by flounder and may reduce survivorship of some prey species. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term.

Dredged material placement would cause the displacement and temporary loss of benthic invertebrates and larval fish preferred as prey by the juvenile and adult windowpane flounder. Benthic invertebrates would be impacted through burial from settling of suspended sediments, alteration of habitat structure, and disruption of egg settlement rate and early stage development of prey species, within and adjacent to the project. Flounder would be forced to seek other benthic foraging habitat within the lower Chesapeake Bay during and immediately following dredged material placement events, until the benthic community has reestablished in the disturbed areas. Recolonization of impacted areas would likely be dominated by opportunistic species which are typical of the area. Recolonization by benthic organisms is expected to begin quickly, and be complete within approximately 1.5 years or less (Schaffner, 2010). There is abundant suitable habitat throughout the lower Chesapeake Bay from which juvenile and adult windowpane flounder may forage during periods of active dredged material placement.

Potential permanent impacts to juvenile and adult windowpane flounder EFH would be related to the long-term suitability of available habitats within the WTAPSNE site. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. This infilling would gradually eliminate the trough as a distinctively deepwater feature. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present. Impacted areas would continue to satisfy the substrate requirements of juvenile and adult windowpane flounder EFH, even if benthic prey communities are temporarily altered. These long-term impacts are therefore not expected to be substantially adverse.

In summary, the project area contains EFH only for juvenile and adult stage windowpane flounder. While some individual flounder may be killed via rapid burial by sediments, turbidity and sedimentation in general are not expected to cause substantially adverse direct effects to juvenile or adult flounder, which are well adapted to temporarily turbid conditions, and frequently bury themselves in sediments to avoid detection by predators. Potential adverse impacts to windowpane flounder EFH would primarily consist of seasonal and temporary effects on benthic forage and shelter habitats during periods of maintenance dredging, which would occur roughly every four years. Individuals present during periods of active placement would be forced to seek other suitable habitat, and such habitats are abundant throughout the lower Chesapeake Bay. Benthic organisms would begin recolonizing impacted areas relatively quickly and would be fully re-established within approximately 1.5 years. Juvenile and adult windowpane flounder are expected to return to impacted areas because a similar habitat would be available for their return. Long-term impacts to windowpane flounder EFH would be limited to bathymetric changes, which may slightly alter benthic community structure, but such impacts are not expected to be substantially adverse.

**SUMMER FLOUNDER (*Paralicthys dentatus*)**

Potential EFH is designated for larvae, juvenile and adult summer flounder in both estuarine ($0.5 < \text{salinity} < 25$ ppt) and marine waters (salinity $\geq 25.0$ ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). Summer flounder exhibit strong seasonal inshore-offshore movements, although their movements are often not as extensive as compared to other highly-migratory species. Adult and juvenile summer flounder normally inhabit shallow coastal and estuarine waters during the warmer months of the year and remain offshore during the fall and winter. In warmer winters, some summer flounder may remain in deep water in the lower Chesapeake Bay. However, the VIMS 1995 juvenile finfish survey showed that juvenile (as well as some adult) summer flounder occurred throughout most of the Chesapeake Bay Mainstem over most of the year (Packer et al. 1999). There appears to be very little difference in habitat preference between juvenile and adult summer flounder. Distribution appears to occur at depths primarily between 4 and 14 m (3 and 46 ft), salinities > 15 ppt and bottom temperatures >10°C. Adults appear to be more tolerant of colder waters than juveniles (VIMS, 2002).

Submerged Aquatic Vegetation (SAV) is important for the juvenile and adult life cycles of the summer flounder and is designated as HAPC for this species. Since there is no SAV within the footprint or adjacent to the open water placement sites due to insufficient light penetration, there would be no impacts to summer flounder HAPC (VIMS, 2019).

**Larvae**

Inshore EFH for summer flounder larvae includes all estuaries where summer flounder larvae were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the "mixing" (defined in ELMR as 0.5 to 25.0 ppt) and "seawater" (defined in ELMR as > 25 ppt) salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/summerflounder.htm). In general, summer flounder larvae are most abundant nearshore (12 to 50 miles from shore) at depths ranging from 9 to 70 m (30 to 230 ft). Summer flounder larvae are pelagic, and are most frequently found in the Atlantic Ocean within the southern part of the Mid-Atlantic Bight (MAB) from November to May. From October to May, larvae and post-larvae migrate inshore, entering coastal and estuarine nursery areas to complete transformation. Larvae have been found in water temperatures ranging from 0 to 23°C, but are most abundant in temperatures ranging from 9 to 18°C. Transforming larvae and juveniles are most often captured in the higher salinity portions of estuaries. Post-larvae in the Chesapeake Bay prey on mysids (*Neomysis americana)* (Packer et al., 1999).

**Juveniles**

Inshore EFH for juvenile summer flounder includes all of the estuaries where juvenile summer flounder were identified as being present (rare, common, abundant, or highly abundant) in the ELMR database for the mixing and seawater salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/summerflounder.htm). In general, juveniles use several estuarine habitats as nursery areas, including salt marsh creeks, seagrass beds, mudflats, and open bay areas in water temperatures > 2°C and salinities ranging from 10-30 ppt. Juveniles are distributed inshore and in many estuaries throughout the range of the species during spring, summer, and fall. During the colder months in the north, there is some movement to deeper waters offshore with the adults, although many juvenile summer flounder would remain inshore through the winter months; some juveniles in southern waters may overwinter in bays and sounds. Offshore juveniles return to the coast and bays in the spring and generally stay the entire summer. The presence, distribution, and abundance of juveniles nearshore and in estuaries has been documented by both fishery dependent and independent data and each State's flounder experts. In the lower Chesapeake Bay, juveniles enter the Bay from March through April, are present in the Bay from April through September, and leave the Bay from October through November. Limited numbers of juvenile summer flounder are found from December through February. Juveniles found in the lower Chesapeake Bay prey on juvenile spot (*Leiostomus xanthurus*), pipefish (*Syngnathus fuscus*), mysid *Neomysis americana*, and shrimps (*P. vulgaris*, *C. septemspinosa*) (Packer et al., 1999).

**Adults**

Inshore EFH for adult summer flounder includes all of the estuaries where adult summer flounder were identified as being common, abundant, or highly abundant in the ELMR database for the mixing and seawater salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/summerflounder.htm). Generally, adult summer flounder inhabit shallow coastal and estuarine waters during warmer months and move offshore to the outer continental shelf to depths of 152 m (500 ft) during colder months. Some evidence suggests that older adults may remain offshore all year. However, due to overfishing, most of the adults are < 3 years of age and return to the inner continental shelf and estuaries during the summer. The presence, distribution, and abundance of adults nearshore and in estuaries has been documented by both fishery dependent and independent data. In the lower Chesapeake Bay, found that adults enter the Bay in April, are present in the Bay from April through September, and leave the Bay in mid-September. Adults have often been reported as preferring sandy habitats. However, adults can camouflage themselves via pigment changes to reflect the substrate. Thus, they can be found in a variety of habitats with both mud and sand substrates, including marsh creeks, seagrass beds, and sand flats. Laboratory studies on summer flounder in the lower Chesapeake Bay suggest that in patchy seagrass/sand habitats, flounder may avoid predation by staying in the sand near the seagrass beds, rather than in the grass beds themselves. Adult summer flounder are opportunistic feeders with fish and crustaceans making up a significant portion of their diet (Packer et al., 1999).

**Potential Impacts to Summer Flounder EFH**

EFH requirements are met throughout the entire project area for larval, juvenile and adult life stages of summer flounder.

Short-term adverse impacts to larval summer flounder would include direct mortality associated with dredged material placement as a result of burial or asphyxiation, and may include adverse impact to larval EFH. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality for nutrients, dissolved oxygen content, and other constituents. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume. Anoxic dredged materials may also contain chemically-reduced sediments which, at least in some circumstances, produce significant chemical oxygen demand (COD) within ambient waters at the site of disposal. In practice, however, this effect is generally mitigated by the entrainment of oxygen-rich surficial waters during overboard placement and by tidal mixing. Due to their small size and weak swimming ability, larval summer flounder present in the immediate area of dredged material placement would be vulnerable to mortality by asphyxiation and oxygen stress. These impacts would only be likely within the most concentrated portion of a turbidity plume and would persist only for brief durations (e.g. 30-60 min following each placement event). Physical burial during placement of dredged material is not expected to be a significant source of mortality of larval or post larval summer flounder. Larvae are not demersal, and would not be expected to be concentrated in placement locations. Mysids and other invertebrate prey would be similarly affected by the project, which would constitute a temporary, adverse impact to larval summer flounder EFH.

Temporary adverse impacts to EFH for both juvenile and adult summer flounder would be short-term disruptions of bottom habitats and prey species due to placement of dredged material in the project area. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality, to include nutrients, dissolved oxygen content, etc. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by flounder and may reduce survivorship of some prey species. The direct impacts to EFH would be limited to the sites of direct placement of dredged material and adjacent habitats. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term. Avoidance behavior due to increased turbidity and degradation or temporary loss of benthic habitat for prey species is the most likely temporary impact for juvenile and adult summer flounder. The project is not expected to cause significant mortality of juvenile or adult summer flounder.

Dredged material placement would cause the displacement and temporary loss of benthic invertebrates and larval fish preferred as prey by the juvenile and adult summer flounder. Benthic invertebrates would be impacted through burial from settling of suspended sediments, alteration of habitat structure, and disruption of egg settlement rate and early stage development of prey species, within and adjacent to the project. Flounder would be forced to seek other benthic foraging habitat within the lower Chesapeake Bay during and immediately following dredged material placement events, until the benthic community has reestablished in the disturbed areas. Recolonization of impacted areas would likely be initially dominated by opportunistic species which are typical of the area. Recolonization by equilibrium benthic organisms is expected to be complete within approximately 1.5 years or less (USACE Norfolk District, 2016; Schaffner, 2010). There is abundant habitat throughout the lower Chesapeake Bay from which juvenile and adult summer flounder may forage during periods of active dredged material placement.

Potential permanent impacts to juvenile and adult summer flounder EFH would be related to the long-term suitability of available habitats within the WTAPSNE site. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. This infilling would gradually eliminate the trough as a distinctively deepwater feature. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present. Impacted areas would continue to satisfy the requirements of juvenile and adult summer flounder EFH, even if benthic prey communities experience periodic, temporary disturbance. These effects are therefore not expected to be substantially adverse.

In summary, the project area contains EFH for larval, juvenile and adult stage summer flounder. Turbidity and sedimentation in general are not expected to cause substantially adverse direct effects to juvenile or adult flounder, which are well adapted to temporarily turbid conditions, and frequently bury themselves in sediments to avoid detection by predators. Larval flounder in the immediate area would be vulnerable to mortality from smothering and asphyxiation for a short period after dredged material placement, but this is not expected to affect significant numbers or constitute a substantially adverse effect on the species within the Chesapeake Bay. Potential adverse effects to summer flounder EFH would primarily consist of seasonal and temporary effects on benthic forage habitats and prey species, during periods of dredged material placement.

Juvenile and adult summer flounder would be forced to seek other suitable habitat during periods of active placement, and such habitats are abundant throughout the lower Chesapeake Bay. Larval, juvenile and adult EFH would undergo temporary, adverse impacts due to disruption and loss of benthic and demersal prey species and their habitats. Benthic organisms would begin recolonizing impacted areas relatively quickly and would be fully re-established within approximately 1.5 years. Long-term effects to summer flounder EFH would be limited to bathymetric changes, but such effects are not expected to be substantially adverse.

**BLUEFISH (*Pomatomus saltatrix*)**

EFH is designated for the juvenile and adult bluefish in both estuarine (0.5 < salinity < 25 ppt) and marine waters (salinity ≥ 25.0 ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). Bluefish travel in schools of like-sized individuals and undertake seasonal migrations, moving into the MAB during spring and south or farther offshore in the fall. Bluefish are schooling, pelagic predators that feed primarily upon smaller, schooling baitfishes like anchovies, menhaden and river herring. While bluefish prey primarily upon small planktivorous baitfishes, they are opportunistic and may also prey upon other types of fishes and invertebrates such as shrimp and crabs. Within the MAB, they occur in large bays and estuaries as well as across the entire continental shelf. Bluefish are generally found in estuaries during the juvenile phase and in larger bays and open oceans as adults (Fahay et al., 1999). Bluefish occur in the Chesapeake Bay from spring to autumn and are abundant in the lower Bay. In early autumn, bluefish begin to migrate out of the Bay and move south along the coast. Peak abundances near the Bay mouth occur from April to July and again in October and November (Murdy and Musick, 2013). Bluefish prefer salinities > 16 ppt and water depths between 8 and 10 m (26 and 33 ft) (VIMS, 2002).

**Juveniles**

EFH for the juvenile bluefish includes all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida (https://www.greateratlantic.fisheries.noaa.gov/hcd/bluefish.htm). Generally juvenile bluefish occur in Mid-Atlantic estuaries from May through October, within the mixing and salinity zones. Distribution of juveniles by temperature, salinity, and water depth over the continental shelf is undescribed (Fahay et al., 1999). Juvenile bluefish enter the Chesapeake Bay during the spring and summer and leave the Bay in late fall (Lippson, 1973).

**Adults**

EFH for adult bluefish includes all major estuaries between Penobscot Bay, Maine and St. Johns River, Florida (https://www.greateratlantic.fisheries.noaa.gov/hcd/bluefish.htm). Adult bluefish are found in North Atlantic estuaries from June through October, Mid-Atlantic estuaries from April through October, and in South Atlantic estuaries. Adult bluefish are highly migratory and distribution varies seasonally and according to the size of the individuals comprising the schools. Adult bluefish enter the Chesapeake Bay during the spring and summer and leave the Bay in late fall (Murdy and Musick, 2013).

**Potential Effects to Bluefish EFH**
EFH requirements for juvenile and adult bluefish are met throughout the project area. EFH for other life stages is not present within the project area.

Temporary effects to juvenile and adult bluefish EFH would consist primarily of turbidity generated within the water column due to placement of dredged material in the project area. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality, to include nutrients, dissolved oxygen content, etc. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by bluefish and may reduce survivorship of some prey species. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term. While pelagic predators like bluefish may be unable to effectively hunt prey within the turbidity plume immediately following placement of dredged material, they are sometimes drawn towards dredging and disposal activities, which displace and expose potential prey along the periphery of the turbidity plume. Temporary turbidity during dredged material placement activities, although disruptive, is therefore not expected to constitute a substantially adverse effect.

Potential indirect effects to juvenile and adult bluefish EFH may result from the temporary loss of benthic organisms and disruption of their habitats. Small benthic invertebrates may be prey items for small fish that are, in turn, potential prey for juvenile or adult bluefish. Disturbance to benthic habitats and temporary loss of forage for bluefish prey species could, therefore, at least potentially impact bluefish EFH. Abundant suitable habitats for prey are available throughout the lower Chesapeake Bay, and this is not expected to constitute a substantially adverse impact to bluefish populations. The project is not expected to cause permanent effects to EFH for juvenile or adult bluefish. Gradual infilling of the deepwater trough would actually bring that area within the optimum depth range for bluefish (26 to 34 feet).

In summary, potential effects to juvenile and adult bluefish EFH would be temporary, minor and indirect, and are not expected to be substantially adverse. Bluefish are a schooling, pelagic species that is not generally associated with bottom habitats. Indirect effects due to the temporary loss or degradation of benthic habitats of potential prey species would be negligible, as benthic prey are a minor component of bluefish diets and there are abundant other prey throughout the area upon which the bluefish can feed. Given the above factors, no substantially adverse effects to bluefish EFH are expected to occur.

**ATLANTIC BUTTERFISH (*Peprilus triacanthus*)**

EFH is designated for eggs, larvae, juvenile and adult Atlantic butterfish in both estuarine (0.5 < salinity < 25.0 ppt) and marine waters (salinity ≥ 25.0 ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). Butterfish form large schools in inshore and offshore waters often near the surface. Butterfish are pelagic and typically found over sand, mud and mixed substrates (Murdy and Musick, 2013; Cross et al., 1999). Butterfish have a seasonal inshore-offshore, north-south migration in response to changing water temperatures. They winter near the edge of the continental shelf in the MAB and migrate inshore in the spring to feed on planktonic fish, squid, crustaceans, and jellyfish, and to reproduce. They remain near the surface at water depths of 22 to 55 m (72 to 180 ft) and often come close inshore; schools are frequently seen on shallow flats and in sheltered bays and estuaries. During the summer, butterfish occur over the entire Mid-Atlantic shelf from sheltered bays and estuaries out to about 200 m (656 ft). In late fall, butterfish move southward and offshore in response to falling water temperatures (Cross et al., 1999). Butterfish occur in the Chesapeake Bay from March through November and are common to abundant in the lower Bay and occasional in the upper Bay, extending as far north as the Patapsco River. Within the Bay, butterfish move northward in the spring, first appearing in Virginia waters in March, but they are not found above the Rappahannock River before May. All butterfish leave the Chesapeake Bay by December and overwinter offshore in deeper water (Murdy and Musick, 2013). Butterfish are preyed on by many species including haddock, silver hake, goosefish, weakfish, bluefish, swordfish, sharks (hammerhead), and longfin inshore squid (Cross et al., 1999).

**Eggs**
Inshore EFH for butterfish eggs is the "mixing" and/or "seawater" portions of all the estuaries where butterfish eggs are "common," "abundant," or "highly abundant" on the Atlantic coast (https://www.greateratlantic.fisheries.noaa.gov/hcd/butterfish.htm). Butterfish eggs are buoyant, pelagic and occur from the outer continental shelf to the high-salinity, lower parts of estuaries in the MAB. Eggs have been collected at water temperatures ranging from 12 to 23ºC and at salinities ranging from 25 to 33 ppt (Cross et al., 1999).

**Larvae**
Inshore EFH for butterfish larvae is the "mixing" and/or "seawater" portions of all the estuaries where butterfish larvae are "common," "abundant," or "highly abundant" on the Atlantic coast (https://www.greateratlantic.fisheries.noaa.gov/hcd/butterfish.htm). Butterfish larvae are pelagic and occur from the outer continental shelf to the lower, high salinity parts of estuaries in the MAB. Larvae have been collected at water temperatures ranging from 7 to 26ºC (most abundantly found at temperatures ranging from 9 to 19ºC) and salinities ranging from 6.4 to 37.4 ppt, and water depths ranging from 10 to 1,750 m (33 to 5,741 ft). Larger larvae and pelagic juveniles (< 30 mm) often associate with jellyfish, *Sargassum*, and other flotsam (Cross et al., 1999).

**Juveniles**
Inshore EFH for butterfish juveniles is the "mixing" and/or "seawater" portions of all the estuaries where butterfish juveniles are "common," "abundant," or "highly abundant" on the Atlantic coast (https://www.greateratlantic.fisheries.noaa.gov/hcd/butterfish.htm). Butterfish juveniles reside on the continental shelf, inshore bays and estuaries and are common in inshore areas. Smaller juveniles have been found under floating objects, while larger juveniles aggregate over sandy to muddy substrates. Larger juveniles may congregate near the bottom during the day and move upward at night. Juvenile butterfish prefer water temperatures ranging from 4.4 to 29.7ºC and prefer salinities ranging from 3 to 37.4 ppt. Juvenile butterfish diet is similar to adult feeding habits, where diet is dominated by planktonic prey (Cross et al., 1999).

**Adults**
Inshore EFH for butterfish adults is the "mixing" and/or "seawater" portions of all the estuaries where butterfish adults are "common," "abundant," or "highly abundant" on the Atlantic coast (https://www.greateratlantic.fisheries.noaa.gov/hcd/butterfish.htm). Adult butterfish occur in

water temperatures ranging from 4.4 to 21.6ºC and in salinities ranging from 5 to 32 ppt and are frequently found over sand, mud, and mixed substrates. During the summer, adult butterfish occur inshore where they remain near the surface; schools are frequently seen on shallow flats and in sheltered bays, estuaries, and the surf zone. Adult butterfish feed mainly on planktonic prey including thaliaceans (primarily *Larvacea* and *Hemimyaria*), mollusks (primarily squids), crustaceans (copepods, amphipods, and decapods), coelenterates (primarily hydrozoans), polychaetes (primarily *Tomopteridae* and *Goniadidae*), small fishes, and ctenophores (Cross et al., 1999).

**Potential Effects to Atlantic Butterfish EFH**

EFH requirements are met for egg, larval, juvenile and adult life stages of butterfish, throughout the project area.

Atlantic butterfish eggs occur in salinities greater than the range of 11 to 24 ppt found within the project area, and the project is therefore not expected to have any meaningful effect on butterfish eggs or egg EFH. Potential adverse effects to Atlantic butterfish larvae, if present during dredged material placement activities, would include direct mortality associated with dredged material placement, as a result of burial or asphyxiation. Dredged material placement would be concurrent with maintenance dredging of the York Spit Channel, which can occur any time from November 15th through August 31st depending on dredge availability, but typically occurs between November 15th and early spring. Butterfish larvae are present within the lower Chesapeake in the spring and summer, therefore adverse effects to butterfish larvae are only anticipated in years when dredging cannot be conducted during winter. Atlantic butterfish larvae are planktonic and planktivorous, and the project will not meaningfully affect the availability of planktonic prey upon which butterfish larvae rely. The project would thus have no discernable effect on Atlantic butterfish larval EFH.

Juvenile and adult Atlantic butterfish are pelagic feeders and do not rely upon benthic prey. Potential temporary adverse effects to EFH for both juvenile and adult butterfish would be due to increased turbidity and interference with water column foraging. Juveniles, which may seek refuge near the bottom during the day, may be displaced during dredged material placement activities, but would likely shift to adjacent areas. Adult Atlantic butterfish occur within the lower Chesapeake Bay in the spring through fall, and overwinter in coastal shelf waters, whereas juveniles are present during the summer and fall. Temporary effects to juvenile and adult Atlantic butterfish and their EFH are only anticipated in years when dredging occurs during the late spring, summer or fall. Such effects are not expected to be substantially adverse. The project is not expected to cause significant mortality of juvenile or adult butterfish. The project is not expected to cause any substantially adverse permanent effects to butterfish EFH.

In summary, the project may cause direct mortality of larval Atlantic butterfish and temporary adverse effects to larval EFH, but only if maintenance dredging of the York Spit Channel occurs outside of the preferred winter timeframe due to contractor availability. The project may likewise cause temporary effects to juvenile and adult Atlantic butterfish EFH if maintenance dredging occurs during the late spring, summer or fall, although such effects are not expected to be substantially adverse.

**SCUP (*Stenotomus chrysops*)**

EFH is designated for the juvenile and adult scup in the marine waters (salinity ≥ 25.0 ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). Scup are a temperate, demersal species that use several benthic habitats from open water to structured areas for feeding and possibly for shelter. Scup are commonly found during the summer in larger estuaries and in coastal waters; during the winter, they occur along the outer continental shelf to about 200 m (656 ft) and occasionally deeper. During the summer and early fall, juveniles and adults are common in larger estuaries and coastal areas in open and structured habitats where they feed on a variety of small benthic invertebrates. Scup distribution changes seasonally as fish migrate from estuaries to the edge of the continental shelf as water temperatures decline in the winter and return from the edge of the continental shelf to inshore areas as water temperatures rise in the spring. In the summer, juvenile and adult scup prefer waters with a salinity > 15 ppt and in the winter > 30 ppt (Steimle et al., 1999). Scup are common to abundant visitors to the lower Chesapeake Bay from spring to autumn, extending as far north as the York River, and they migrate offshore to deeper waters during the winter (Murdy and Musick, 2013).

**Juveniles**
EFH for the juvenile scup includes the estuaries where scup are identified as being common, abundant, or highly abundant in the ELMR database for the mixing and seawater salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/scup.htm). Juvenile scup are generally found in estuaries and bays between Virginia and Massachusetts in the spring and summer on sand, mud, mussel and eelgrass substrates and in water temperatures > 7°C and salinities > 15 ppt. Although formerly relatively abundant, juvenile scup have become less common in the lower Chesapeake Bay. However, in the fall, they are still collected in relatively large numbers at the mouth of the Bay. Juvenile scup feed during the day, principally on polychaetes (e.g., maldanids, nephthids, nereids, and flabelligerids), epibenthic amphipods and other small crustaceans, mollusks, and fish eggs and larvae. Copepods and mysids are important to post-larvae and early juveniles, while bivalve mollusks are more commonly eaten by larger fish (Steimle et al., 1999).

**Adults**
EFH for the adult scup includes the estuaries where scup were identified as being common, abundant, or highly abundant in the ELMR database for the mixing and seawater salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/scup.htm). Adult habitats are similar to those used by juveniles, including soft, sandy bottoms, on or near structures, such as rocky ledges, wrecks, artificial reefs, and mussel beds in euryhaline areas. Adult scup generally occur at bottom water temperatures ranging from 6 to 27°C. Wintering adults are usually found offshore between November and April, south of New York to North Carolina, in waters > 7ºC. Adult scup are also benthic feeders and forage on a variety of prey, including small crustaceans, zooplankton, polychaetes, mollusks, small squid, vegetable detritus, insect larvae, hydroids, sand dollars, and small fish (Steimle et al., 1999).

**Potential Effects to Scup EFH**
EFH requirements for the juvenile and adult scup are met for the project area. However, Murdy and Musick (2013) reported that scup only extend as far north as the York River, which is just south of the project area.

Potential temporary effects to juvenile and adult scup EFH would consist primarily of short-term turbidity generated within the water column and disruptions of bottom habitats and prey species due to placement of dredged material in the project area. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality, to include nutrients, dissolved oxygen content, etc. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by scup and may reduce survivorship of some prey species. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term. Avoidance behavior due to increased turbidity and degradation or temporary loss of benthic habitat for prey species is the most likely temporary effect for juvenile and adult scup. However, it is unlikely that scup would be present within the project area during placement activities, as scup are only present in the lower Chesapeake Bay during the spring through fall during which dredging and associated placement is unlikely to occur, and because the project is upstream of the normal range of scup occurrence within the Bay.

Potential temporary, indirect effects to scup EFH could occur due to the displacement and temporary loss of habitat for benthic invertebrates and larval fish prey. Benthic invertebrates would be impacted through burial from settling of suspended sediments, alteration of habitat structure, and disruption of egg settlement rate and early stage development of prey species, within and adjacent to the project. Scup would be forced to seek other benthic foraging habitat until the benthic community has reestablished in the disturbed areas. Recolonization of affected areas would likely be initially dominated by opportunistic species which are typical of the area. Recolonization by equilibrium benthic organisms is expected to be complete within approximately 1.5 years or less (USACE Norfolk District, 2016; Schaffner, 2010).

Potential permanent effects to juvenile and adult scup EFH would be related to the long-term suitability of available habitats within the WTAPSNE site. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present. Affected areas would continue to satisfy the requirements of juvenile and adult scup EFH, even if benthic prey communities are somewhat altered, over time. Moreover the project area may only be occasionally utilized by scup. These effects are therefore not expected to be substantially adverse.

In summary, substantially adverse effects are not expected to occur for juvenile or adult scup or its EFH. According to some recent investigation (Murdy & Musick, 2013), the project area is at the northern, upstream limit of scup occurrence within the Bay, likely due to scup's preference for higher salinities. Dredged material placement would be concurrent with maintenance dredging of the York Spit Channel, which can occur any time from November 15$^{th}$ through August 31$^{st}$ depending on dredge availability, but typically occurs between November 15$^{th}$ and early spring. Adult and young-of-year juvenile scup are likely only present in the Chesapeake Bay during the late spring, summer and early fall. For these reasons, the project is expected to have minimal effect to any life stages of scup or its EFH.

**BLACK SEA BASS (*Centropristus striata*)**

EFH is designated for the juvenile and adult black sea bass in both estuarine (0.5 < salinity < 25.0 ppt) and marine waters (salinity ≥ 25.0 ppt) of the Chesapeake Bay Mainstem (https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html/). This species can be found from the Gulf of Maine to as far south as the Florida Keys. In the MAB, juvenile and adult black sea bass move inshore and north in the summer and offshore and south in the winter. Black sea bass are strongly associated with structurally-complex habitats such as reefs and shipwrecks (Drohan et al. 2007). Black sea bass are common in the Chesapeake Bay from spring to late autumn, extending as far north as the Chester River. In the winter, they migrate offshore and south. Large fish are more common offshore than in the Bay (Murdy and Musick, 2013).

**Juveniles**
Inshore, juvenile black sea bass EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/blackseabass.htm). Juveniles are found on vegetated flats and in channels (Murdy and Musick, 2013). Juveniles migrate in the fall from nearshore summer habitats to overwintering habitats on the outer continental shelf. During warmer winters, juveniles may overwinter in deeper waters of lower Chesapeake Bay. Juveniles return to nearshore and estuarine habitats in the spring and are collected as early as March in the Chesapeake Bay region. In the spring, juveniles are found in waters with salinities ranging from 28 to 36 ppt, with the majority spread in 33 to 35 ppt, and in the fall, juveniles are found in waters with salinities ranging from 29 to 36 ppt, with the majority spread in 31 to 33 ppt (Drohan et al., 2007). Juveniles prey on shrimp, isopods, and amphipods (Murdy and Musick, 2013).

**Adults**
Inshore, adult black sea bass EFH is the estuaries where black sea bass are identified as being common, abundant, or highly abundant in the ELMR database for the "mixing" and "seawater" salinity zones (https://www.greateratlantic.fisheries.noaa.gov/hcd/blackseabass.htm). Habitats used by adult black sea bass include rocky reefs, cobble and rock fields, stone coral patches, exposed stiff clay, and mussel beds. The VIMS trawl and beach seine surveys from 1988-1999 of Chesapeake Bay and tributaries show that adults were more common during the latter part of the summer and into the fall on the eastern side of the Bay. In the spring, adults are found in waters with salinities ranging from 32 to 36 ppt, with the majority spread in 34 to 35 ppt, and in the fall, adults are found in waters with salinities ranging from 30 to 36 ppt, with the majority spread in 31 to 32 ppt (Drohan et al., 2007). Black sea bass are visual feeders during daylight hours. Adults feed chiefly on crabs, mussels, razor clams, and fishes (Murdy and Musick, 2013). In lower Chesapeake Bay eelgrass beds, black sea bass consume juvenile blue crabs and pipefish (*Syngnathus* sp.), as well as isopods, caprellid amphipods, and shrimp.

**Potential Effects to Black Sea Bass EFH**
While within the geographic range of potential EFH for juvenile and adult black sea bass, the project area does not satisfy the EFH requirements for either life stage. Juveniles prefer vegetated

flats, which are absent from the project area, and channels. The trough within the WTAPSNE site is a relict channel, and may retain some channel-like characteristics, it does not have a deepwater bathymetric connection to the mainstem Chesapeake Bay channel downstream. Adult black sea bass prefer hardbottom and habitats with complex physical structure (e.g. steep slopes, rock, shellfish beds, etc.), which are not known within the project area. Furthermore, the normal salinity ranges within the project area are below the preferred salinity ranges for both life stages. Temporary impacts to bottom habitats and benthic species due to placement of dredged material in the project area are not expected to have any significant effect on the availability of prey for black sea bass. In summary, juvenile and adult black sea bass may occasionally occur within the project vicinity, but they prefer different structural habitats (structured bottoms, roughed bottoms, and shallow waters) and higher salinities than those found within the project area. For these reasons, potential effects to black adult and juvenile sea bass and their EFH are expected to be insignificant.

**ATLANTIC SEA HERRING *(Clupea harengus)***

Atlantic sea herring occur in the western Northern Atlantic from Labrador to Cape Hatteras. This pelagic species migrate in schools to areas where they feed, spawn, and spend winter, with spawning occurring from October through November in the southern Gulf of Maine, Georges Bank, and Nantucket Shoals. The Atlantic sea herring deposits eggs on rock, gravel or sand ocean bottom. In late spring, the larvae grow into juveniles and form schools and travel into coastal waters during summer months. This species' eggs are fed upon by a variety of bottom dwelling fish, and juveniles are preyed upon by fish, sharks, skates and seabirds. The Atlantic sea herring feeds on zooplankton, fish larvae, and krill, which feed on phytoplankton and zooplankton (https://www.fisheries.noaa.gov/species/atlantic-herring). The EFH designation for the Atlantic sea herring associated with this project includes the seawater salinity zone of >25 ppt within the waters of the Chesapeake Bay. The water temperature where this species generally occurs is below 10°C, and the depth range is from approximately 20 to 130 m (66 to 427 ft) (https://www.greateratlantic.fisheries.noaa.gov/hcd/herring.pdf).

**Potential Effects to Atlantic Sea Herring EFH**

Potential EFH for adult Atlantic sea herring is located in the Virginia waters of the Chesapeake Bay where salinity is >25 ppt. They generally avoid water temperatures above 10°C and low salinities (NEFMC and NMFS 2017). Average bottom salinities within the project area are roughly 22 ppt. VECOS data show that bottom salinities within the WTAPSNE site may rise above 25 ppt in some years, but that typically occurs only during mid-summer to early fall, when water temperatures exceed 20°C, which is well above the preferred range for the species. Moreover, the depths within the project area much shallower than the preferred depth ranges for the species. For these reasons, the project is not expected to have any demonstrable effect on Atlantic Sea Herring or its EFH.

## 4.2 SHARKS

### SANDBAR SHARK (*Carcharhinus plumbeus*)

The sandbar shark is a bottom-dwelling, shallow coastal water species that is seldom seen at the water's surface. It is believed that the sandbar shark favors a smooth substrate over muddy or sandy bottoms and would avoid coral reefs and other rough-bottom areas (Florida Museum 2019). It spends most of the time in water depths ranging from 20 to 55 m (66 to 180 ft), but are occasionally found at depths of 200 m (656 ft). Typical water conditions for the sandbar shark is salinity > 22 ppt and water temperatures > 21°C.

Sandbar sharks are common summer residents in the lower Chesapeake Bay, which serves as the principal pupping and nursery ground for the northwest Atlantic population. Sandbar sharks undertake seasonal migrations into temperate waters in the summer, and return to subtropical areas in the winter. Females give birth in late May and June and then migrate offshore and north along the coast. Newborn sharks remain in the nursery ground, which is defined as the 20 ppt salinity line. Thus, these sharks are mostly absent from lower-salinity areas of the Bay. The nursery area expands during dry summers and contracts toward the Bay mouth in rainy years. As day length shortens and Bay water temperatures drop, the young sharks leave the Bay and migrate south of Cape Hatteras to coastal wintering areas near the Gulf Stream off of North Carolina. In the spring as surface waters warm to about 18°C, juvenile sandbar sharks return north to the Chesapeake Bay and other nearshore areas in the MAB. Juveniles have been found in depths ranging from 0.8 m to 23 m (2.625 to 75.459 ft); in water temperatures ranging from 15 to 30°C; and in sand, mud, shell and rocky habitats from Massachusetts to North Carolina (NOAA, 2017). As juveniles grow older, their fall migrations become longer, extending to wintering areas off of Florida and the Gulf of Mexico. Females return to pup every other summer. Young sandbar sharks feed heavily on crustaceans such as juvenile blue crabs and mantis shrimp, but transition to a predominantly fish diet with age. Adults prey on mostly bottom fishes such as croakers, small sharks, and skates (Murdy and Musick, 2013).

The Cooperative Atlantic States Shark Pupping and Nursery (COASTSPAN) Survey conducted in 2015 in the lower Chesapeake Bay and in coastal inlets and lagoon habitats along the eastern shore of Virginia, showed that juvenile sandbar sharks dominated the catch in bay, lagoon, and inlet habitats, and the majority of sandbar sharks caught were young-of-year. The study concluded that Virginia’s estuarine waters continue to provide important nursery habitat for sandbar sharks (NMFS SAFE Report, 2016).

**Potential Effects to Sandbar Shark EFH and HAPC**
EFH is designated for the neonate and juvenile life stages of the sandbar shark in the project area. The project area is designated HAPC for the neonate, juvenile and adult life stages of the sandbar shark.

Potential direct, temporary effects to EFH & HAPC for neonatal and juvenile sandbar sharks would consist primarily of short-term disruptions of bottom habitats and the water column. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality, to include nutrients, dissolved oxygen content, etc. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume, and may induce avoidance behavior by sandbar sharks and may reduce survivorship of some prey species. Conversely, young sandbar sharks may be drawn towards disposal activities, which could displace and expose potential prey along the periphery of the turbidity plume. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term. Temporary turbidity generated during dredged material placement activities, although disruptive to sandbar sharks, is not expected to constitute a substantially adverse effect.

Potential indirect, temporary effects to EFH & HAPC for sandbar sharks would be those resulting from disturbance or temporary loss or alteration of prey habitat related to the proposed dredged material placement. Blue crabs, shrimp and other benthic invertebrates and fishes are potential prey for neonate and juvenile sandbar sharks. Adult sandbar sharks feed on mostly bottom fishes such as croakers, small sharks, and skates. Disturbance to benthic habitats and temporary loss of forage for these prey species could potentially impact neonate and juvenile sandbar shark EFH. However, recolonization is expected to occur fairly quickly, possibly within one season, or approximately 1.5 years, of the proposed open water placement activities (Schaffner, 2010). Given the relative abundance of other undisturbed habitats and potential prey throughout the lower Chesapeake Bay, the project is not expected to constitute a substantially adverse effect to neonatal or juvenile sandbar shark EFH.

Potential permanent effects to sandbar shark EFH and HAPC would be related to the long-term suitability of available habitats within the WTAPSNE site. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present. Affected areas would continue to support benthic communities and potential prey for sharks, and these effects to neonate and juvenile sandbar shark EFH are therefore not expected to be substantially adverse. Adult sandbar sharks are not known to use the project area, and the project is expected to have no significant effect on adult sandbar shark EFH.

In summary, adult sandbar sharks prefer deeper waters than found in the project area, and are not expected to be significantly impacted by the project. There would be some potential for effects on EFH and HAPC of neonate pups and juveniles due to temporary degradation of benthic habitat and prey species following dredged material placement events. However, it is not likely to result in adverse cumulative effects to the species given the abundant adjacent similar habitat. Potential effects to sandbar shark EFH and HAPC would be seasonal and temporary. No long-term detrimental effects to sandbar shark EFH and HAPC are expected to occur. Based on this evaluation, we have determined that no TOY restriction is needed.

## 4.3 SKATES

### CLEARNOSE SKATE (*Raja eglanteria*)

This species may occur along the east coast from the Gulf of Maine south. The clearnose skate is the most abundant inshore skate in the mid-Atlantic inshore waters from late spring to early fall (Robins et al., 1986). North of Cape Hatteras, it moves inshore and northward along the continental shelf during the spring and early summer, and offshore and southward during autumn and early winter when water temperatures cool to 13-16°C. Clearnose skates are demersal and occur within habitat consisting of soft, sandy bottoms, but may also occur within habitats consisting of rocky or gravelly bottoms (Packer et al. 2003. The salinity range is between approximately 12 to 35 ppt. The depth range for this species within the mid-Atlantic is between approximately 1 and 33 m (3 to 108 ft), with most occurring between 7 to 15 m (23 to 49 ft).

According to the 1988-1999 VIMS trawl surveys of Chesapeake Bay, most juvenile and adult clearnose skate appear within the Chesapeake Bay waters between April and December with peak presence between May and August. The findings of the trawl surveys identified that this species was most abundant near the Bay mouth during spring and summer months; however, the species did appear through the Bay during all four seasons. (Packer et al., 2003). The clearnose skate feeds on prey including polychaetes, amphipods, shrimp, crabs, bivalves, squids, and small fish such as soles, weakfish, butterfish, and scup. It is regularly preyed upon by sharks, such as the sand tiger.

**Juveniles**
The habitat for juvenile clearnose skates consists of a substrate of soft, sandy bottom, but may also include rocky or gravelly bottom. Juveniles move inshore and northward during the spring and early summer and offshore and southward during autumn and early winter. Most juveniles are found in salinities of 32 to 35 ppt in the spring, and 31 to 32 ppt in the fall (Packer et al., 2003). The VIMS trawl and beach seine surveys from 1988-1999 of Chesapeake Bay and tributaries indicate that juvenile clearnose skates in the Chesapeake Bay are present for all but the coldest months. Juveniles prey on shrimp, isopods, and amphipods.

**Adults**
The preferred habitat substrate of adult clearnose skates is similar to that of juveniles. The VIMS trawl and beach seine surveys from 1988-1999 of Chesapeake Bay and tributaries indicate that adult clearnose skates in the Chesapeake Bay are present for all but the coldest months. Most adults are found in salinities ranging from 25 to 27 ppt in the spring, and 26 to 30 ppt in the fall (Packer et al., 2003). Like the juveniles, adults prey on shrimp, isopods, and amphipods, but also on larger crustaceans, bivalves and bony fishes.

**Potential Effects to Clearnose Skate EFH**
The project area is designated as potential EFH for juvenile and adult clearnose skate.

Juvenile and adult clearnose skate would potentially be directly impacted via mortality due to burial during placement of dredged material in the project area. This would only occur to skates that were in the direct path of the dense, central mass of descending sediment, and is not likely to affect large numbers of individuals. Given the relative size and open character of the Chesapeake Bay where work would occur and the rapid settling and dilution of suspended sediments, the potential effects to turbidity, dissolved oxygen, nutrient concentrations, and other water quality parameters are expected to be very short-term. While turbidity and sedimentation may cause juveniles and adults to avoid the area for a short period of time, it is unlikely to significantly affect clearnose skates. Skates in general are well adapted to temporarily turbid conditions, as their own benthic feeding behavior generates significant turbidity and partially bury themselves in sediments to avoid detection by predators. Benthic and infaunal feeders like skates may be drawn towards the disposal areas after the initial placement, as this activity may displace and expose potential prey along the edge of the activity and amongst the deposited material.

Potential indirect, temporary effects to juvenile and adult clearnose skate EFH would be those resulting from disturbance or temporary loss or alteration of prey habitat related to the proposed dredged material placement. Both juvenile and adult clearnose skates feed on mostly benthic and infaunal invertebrates, although adults may also prey on squid and bony fishes. Disturbance to benthic habitats and temporary loss of forage for these prey species could potentially impact clearnose skate EFH. However, recolonization is expected to occur fairly quickly, possibly within one season, or approximately 1.5 years, of the proposed open water placement activities (Schaffner, 2010). Maximum bottom salinities within the project area are near the lower limit of the preferred salinity range for the clearnose skate, so the project area probably provides suboptimal habitat value. Given the abundance of other undisturbed habitats and potential prey species throughout the lower Chesapeake Bay, and the marginal nature of the project area relative to clearnose skate habitat preferences, the project is not expected to constitute a substantially adverse effect to juvenile or adult clearnose skate EFH.

Potential permanent effects to juvenile and adult clearnose skate would be related to the long-term suitability of available habitats within the WTAPSNE site. Deepwater areas within the WTAPSNE site would be incrementally filled in by successive placement events over a period of decades, eventually reaching a depth of roughly 30 feet MLLW. Material to be dredged from within the York Spit Channel and placed at the proposed site is generally characterized as silts and clays, and would be comparable in composition to the soft, fine surficial sediments currently present. Affected areas would continue to support benthic communities and potential prey for juvenile and adult clearnose skate, and therefore any effects to EFH are not expected to be substantially adverse.

**WINTER SKATE (*Leucoraja ocellata*)**

The winter skate occurs from the south coast of Newfoundland and the southern Gulf of St. Lawrence to Cape Hatteras. In the MAB, juvenile and adult winter skates have been identified both inshore and offshore throughout the year. The information provided by the NEFSC bottom trawl surveys indicates that juvenile winter skates were captured year round, and in the Chesapeake Bay area, winter skates have been identified during the timeframe of December to April (Packer et al., 2003). Winter skates may remain buried within the substrate during the daytime hours and be more active at night. The temperature range for this species may range from -1.2°C to 21°C and it is found from the shoreline to approximately 400 m (1,312 ft) (https://www.habitat.noaa.gov/protection/efh/pdf/Winter_Skate_EFH.pdf). Winter skates are demersal and occur within habitat consisting of soft, sandy bottoms; however, the species may also occur within habitats consisting of rocky or gravelly bottoms (Packer et al., 2003). This species prefers salinities of 28 to 35 ppt. Winter skates are carnivorous and feed on polychaetes, amphipods, decapods, isopods, bivalves, and fishes. Bony fish prey may include smaller skates, alewives, blueback herring, smelt, eels, and butterfish (Packer et al., 2003).

**Juveniles**
The habitat for juvenile winter skates consists of a substrate of soft, sandy bottom; however, juvenile habitat may also contain rocky or gravelly bottom. Juvenile abundance is greatest at 13 to 15°C (https://www.habitat.noaa.gov/protection/efh/pdf/Winter_Skate_EFH.pdf). Juveniles are most often found in depths between 21 to 80 m (69 to 262 ft), and within salinities ranging between 31 to 35 ppt, with the majority being between 32 to 33 ppt (Packer et al., 2003).

**Adults**
The habitat of adult winter skates is similar to the juveniles, and consists of soft, sandy bottom but also may include rocky or gravely bottom. Adults generally occur in salinities of 30 to 36 ppt, being most abundant at 33 ppt. Adult abundance during the fall is greatest in waters between 11 to 15°C. The average depth range was identified to be between approximately 21 to 70 m (69 to 230 ft). The fall salinity range was identified as being between 31 to 34 ppt, (Packer et al., 2003). The feeding habits of adults are similar to juveniles and include polychaetes, amphipods, decapods, isopods, bivalves, and fishes.

**Potential Effects to Winter Skate EFH**
The project area is mapped as potential EFH for the juvenile and adult winter skate. However, the observed salinity ranges within the project area are well below the preferred salinity ranges for both life stages. Temporary effects to bottom habitats and benthic species due to placement of dredged material in the project area are not expected to have any demonstrable indirect effect on the offsite availability of prey for juvenile or adult winter skate. In summary, due to the winter skate's preference for euhaline habitats that not found at the project site, potential project effects to juvenile and adult winter skate and their EFH are unlikely and are considered insignificant.

**LITTLE SKATE (*Leucoraja erinacea*)**

The little skate occurs from Nova Scotia to Cape Hatteras and is abundant in the northern section of the Mid-Atlantic bight (MAB) and Georges Bank. Little skate habitat consists of sandy or gravelly bottoms, but the species may also occur on mud bottom. The little skate may be found year-round across a range of temperatures. Along the inshore portion of its range, this species moves onshore and offshore during seasonal temperature changes. In spring months, this species generally occurs in shallow waters and moves into deeper waters during winter months. The depth range is from shoreline to approximately 137 m (449 ft) (https: //www.habitat.noaa.gov/protection/efh/pdf/Little_Skate_EFH.pdf.). According to the 1963-2002 NEFSC bottom trawl surveys within the MAB, adults and juveniles were found nearshore in abundance during the winter and infrequently during the summer months (Packer et al., 2003). The temperature range for this species ranges from 1°C to 21°C. Little skates are demersal and occur within habitat consisting of sandy or gravelly bottoms, but this species may also occur within areas of muddy substrate (Packer et al., 2003). This species may occur within waters with salinities of 28 to 35 ppt. Little skates are carnivorous and generally feed on invertebrates such as decapod crustaceans and amphipods. However, additional food sources include isopods, bivalves, and fishes. (Packer et al., 2003).

**Juveniles**
The habitat for juvenile little skates consists of a substrate of soft, sandy bottom; however, juvenile habitat may also contain rocky or gravelly bottom. The feeding habits of adults are similar to juveniles. The full depth range for juveniles is from shore to approximately 137 m (449 ft), with the greatest abundance being within between 73 to 91 m (240 to 299 ft) (https://www.habitat.noaa.gov/protection/efh/pdf/Little_Skate_EFH.pdf). Juveniles occur in salinities from 28 to 35 ppt, and are most common in 32 to 33 ppt. The temperature range in the fall for juveniles was identified to be between 5 to 22°C, with the greatest abundance occurring from 8 to 16°C (Packer et al., 2003).

**Adults**
The habitat of adult little skates is similar to the juveniles, and consists of soft, sandy bottom but also may include rocky or gravely bottom. The full depth range is from shore to approximately 137 m (449 ft), with the most abundance from 73 to 91 m (240 to 299 ft) ((https://www.habitat.noaa.gov/protection/efh/pdf/Little_Skate_EFH.pdf). Adults occur in salinities from 30 to 36 ppt, and are most common at 33 ppt (Packer et al., 2003).

**Potential Effects to Little Skate EFH**
The project area is mapped as potential EFH for the juvenile and adult little skate. However, the observed salinity ranges within the project area are well below the preferred salinity ranges for both life stages. Temporary effects to bottom habitats and benthic species due to placement of dredged material in the project area are not expected to have any demonstrable indirect effect on the offsite availability of prey for juvenile or adult little skate. In summary, due to the little skate's preference for euhaline habitats that not found at the project site, potential project effects to juvenile and adult little skate and their EFH are unlikely and are considered insignificant.

## 4.4 NOAA SPECIES OF CONCERN AND OTHER TRUST RESOURCES

### SAND TIGER SHARK *(Carcharias taurus)*

The sand tiger shark is a NMFS species of concern throughout its range (http://www.fisheries.noaa.gov/pr/species/fish/sand-tiger-shark.html). Species of concern are those species that NMFS has concerns regarding status and threats, but for which insufficient information is available to indicate a need to list the species under the Endangered Species Act (ESA) (http://www.nmfs.noaa.gov/pr/species/concern/). Sand tiger sharks are found in the surf zone, in shallow bays and around coral and rocky reefs down to depths as great as 190 m. They are most often found near the bottom, but are also found throughout the water column. Sand tiger sharks are migratory, moving poleward during the summer while making equatorial movements during the fall and winter months. Prey items include bony fishes, small sharks, rays, squid, crab and lobsters (http://www.fisheries.noaa.gov/pr/species/fish/sand-tiger-shark.html).

**Potential Effects to Sand Tiger Shark EFH**

Sand tiger shark EFH is not mapped within the project area and would not be impacted by the project. However, potential EFH is designated for the juvenile sand tiger shark in the marine waters of the lower portion of the Chesapeake Bay, where salinity is >25 ppt. Average bottom salinities within the project area are roughly 22 ppt. VECOS data show that bottom salinities within the WTAPSNE site may rise above 25 ppt in some years, but that typically occurs only during mid-summer to early fall. Juvenile sand tiger sharks may occasionally occur within the project area, but they are not expected to depend upon the area for significant habitats.

Potential temporary, indirect effects to juvenile sand tiger shark could occur due to the displacement and temporary loss of habitat for benthic invertebrates and fish prey. Benthic invertebrates would be impacted through burial from settling of suspended sediments, alteration of habitat structure, and disruption of the development of prey species, within and adjacent to the project. Potential permanent, indirect effects to juvenile sand tiger sharks would be related to the long-term suitability of available habitats for prey within the WTAPSNE site. However, because the project area is not mapped as potential EFH for any life stage, and because any habitat value provided by the project area to sand tiger sharks is speculative, the project is expected to have no significant effect on the sand tiger shark.

**DUSKY SHARK (*Carcharhinus obscurus*)**

The dusky shark is a NMFS species of concern in the western Atlantic, and occurs from southern Massachusetts and Georges Bank to Florida, Bahamas and Cuba (http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_detailed.pdf). Dusky sharks occur in inshore (surf zone) and offshore waters to depths of approximately 400 m (1,300 ft). This species undergoes long temperature-related migrations along the U.S. East Coast, traveling north as water temperatures increase in spring and return south in the fall as waters cool. Adults are more common offshore, and juveniles are common along seaside shoals of the Virginia barrier islands (http://www.vims.edu/research/departments/fisheries/programs/sharks/species/dusky.php). This species occasionally enters the Chesapeake Bay but avoids low salinity waters and is not common to estuaries (http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_detailed.pdf). The diet of dusky sharks consists of cartilaginous and bony fishes, as well as squid. This species reproduces every 3 years, between December and January, or between June and July (http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_highlights.pdf).

**Potential Effects to Dusky Shark EFH**

Dusky shark EFH is not mapped within the project area and would not be impacted by the project. However, potential EFH is designated for the adult dusky shark in the marine waters of the lower portion of the Chesapeake Bay, where salinity is >25 ppt. Average bottom salinities within the project area are roughly 22 ppt. VECOS data show that bottom salinities within the WTAPSNE site may rise above 25 ppt in some years, but that typically occurs only during mid-summer to early fall. Adult dusky sharks may rarely occur within the project area, but they are not known to be dependent upon such habitats. Because the project area is not mapped as potential EFH for any life stage, and because the species seldom enters the Bay, the project is expected to have no discernable effect on the dusky shark or its EFH.

**BLUE CRAB (*Callinectes sapidus*)**

Blue crab are not federally-managed or listed, but they are a NOAA trust resource species because of their ecological and economic significance. They are the most valuable commercial fishery in the Chesapeake Bay, and are important prey for many finfish species that have EFH in the project area. Cobia and red drum prey on adult and larger juvenile blue crabs while summer flounder and sandbar shark prey on young juvenile blue crabs (Maryland Sea Grant, 2011).

Blue crab habitat includes shallow and brackish waters, eelgrass beds, and muddy bottoms. In the Chesapeake Bay, mating occurs within shallow tributaries between May and October. After mating, female blue crabs migrate from sub-estuaries to spawning areas in the lower Chesapeake Bay. When water temperatures fall below 10°C, blue crab activity ceases (e.g., movement and foraging) and the crabs begin a period of overwintering dormancy. In the Chesapeake Bay, most females go through an overwintering stage and produce broods of eggs the following spring (USACE, 2017). In the tidal waters of Virginia, commercial harvest of crabs by crab pot is not allowed from December 1 through March 16 (beginning in 2018), and the commercial harvest of crabs using commercial gear is prohibited from November 1 through March 30 (VMRC, 2017). Juvenile blue crabs utilize grass beds for nursery areas, and throughout the life stages of blue crabs, grass beds are utilized for foraging.

The VMRC has previously raised concerns regarding potential effects to overwintering female blue crabs due to usage of the existing Wolf Trap Alternate Placement Site (WTAPS), which is located to the south of the project area. Lipcius and Knick (2016) analyzed data from the blue crab winter dredge survey conducted from 2009-2016 in the Wolf Trap and Rappahannock Shoal Placement Sites. Lipcius and Knick (2016) reported a high abundance of overwintering female blue crabs in the southern portion of the WTAPS, moderate abundance in the north portion of the site, and low abundance in the middle of the site (Figure 3, note that actual densities are exaggerated by factor of 1,000 for visual clarity). They also reported considerable annual variability in female blue crab density at the WTAPS, with low densities in 2012 and 2014 and high densities in 2013 and 2016.

The effects of dredged material placement upon blue crab survival was studied by the USACE Norfolk District and Engineer Research and Development Center (ERDC), using a controlled mesocosm study. Burial of mature female blue crabs at depths of 5 and 10 cm increased mortality, whereas few crabs survived burial depths of 30 cm. There did not appear to be an effect of burial duration, i.e., mortality rates did not increase over time. Although water temperatures reached lows of -2°C, the high survival rates of control crabs suggest low temperatures alone did not cause mortality. In addition, because survivors were recovered at the sediment surface, it appears that an inability to ascend through the sediment overburden was the cause of death, with a burial depth of 30 cm most associated with having very few crabs recovered at the sediment surface (ERDC, 2018).

Many factors influence fluctuations in blue crab abundances, including larval success, prey availability, predator abundance, habitat degradation, and disease. Overwintering mortality is another important factor affecting the variability in population size and can be especially influential for crab species near their range limit. Overwintering studies have found that smaller blue crabs are more likely to survive intense cold winters and mature females are more susceptible to mortality. Overwintering blue crab survival is highest in warmer, saline waters (ERDC, 2018).

Placement of dredged material into WTAPS while female crabs are not overwintering (generally from early April to mid-November) is not feasible due to higher costs to dredge in the summer and potential adverse impacts to sea turtles. A hopper dredge is the preferred dredge method because it is more cost efficient and generally performs better than other dredge types in rough sea conditions. A hopper dredge removes material from the bottom of the channel in thin layers with hydraulic pressure. Sea turtles are generally present in the lower Chesapeake Bay from April through November. Sea turtles are vulnerable to entrainment in the draghead of the hopper dredge when they are likely to be feeding or resting on the bay bottom. Measures can be taken to minimize adverse impacts to sea turtles including the use of a mechanical dredge instead of a hopper dredge. Mechanical dredging entails removing material by scooping it from the channel bottom using an open bucket or clamshell and then placing it on a barge. It is unlikely that sea turtles would be captured in the mechanical dredge, presumably because they are able to avoid the dredge bucket. However, it is more cost effective to use a hopper dredge than a mechanical dredge. Therefore, because a hopper dredge is more cost effective and to minimize adverse impacts to sea turtles that may be entrained in a hopper dredge, dredging and placement is conducted in the winter months.

Short-term project effects to blue crabs would consist primarily of direct mortality, by burial or asphyxiation, of overwintering female crabs, when these crabs are present within the dredged material placement area. Turbidity would result in suspended particulates within the water column and may temporarily degrade ambient water quality for nutrients, dissolved oxygen content, and other constituents. Turbidity may also clog the gills of fishes and invertebrates within the turbidity plume. Anoxic dredged materials may also contain chemically-reduced sediments which, at least in some circumstances, produce significant chemical oxygen demand (COD) within ambient waters at the site of disposal. In practice, however, this effect is generally mitigated by the entrainment of oxygen-rich surficial waters during overboard placement and by tidal mixing. Cold temperatures reduce the crabs' locomotor ability, and would make overwintering females susceptible to mortality by burial, especially in overburden thicknesses greater than 10cm. When assessing the significance of this effect, however, it must be remembered that the WTAPSNE site is believed to support fewer overwintering female crabs than the currently-used WTAPS site. As previously discussed, a deep muddy channel runs through the center of WTAPSNE. According to the Dredge Disposal Effects on Blue Crab Report provided by VIMS (Appendix F), crab density will almost always be low in muddy habitats. It is likely that within the deeper, muddy channel, crab density will almost always be low due to the muddy habitat, which is usually avoided as an overwintering habitat by blue crabs (Lipcius and Knick, 2016).

If, due to placement of dredged material at WTAPSNE, crab habitat becomes more suitable in the area, USACE will reevaluate the use of individual WTAPSNE cells (Figure 4). If habitat alteration occurs, it may take multiple maintenance dredging cycles to alter habitat suitability over the entire WTAPSNE site. In FY 2020, NAB plans to begin a comprehensive evaluation of alternative placement sites and methods through a DMMP for the portion of the Baltimore Harbor and Channels Project located in Virginia.

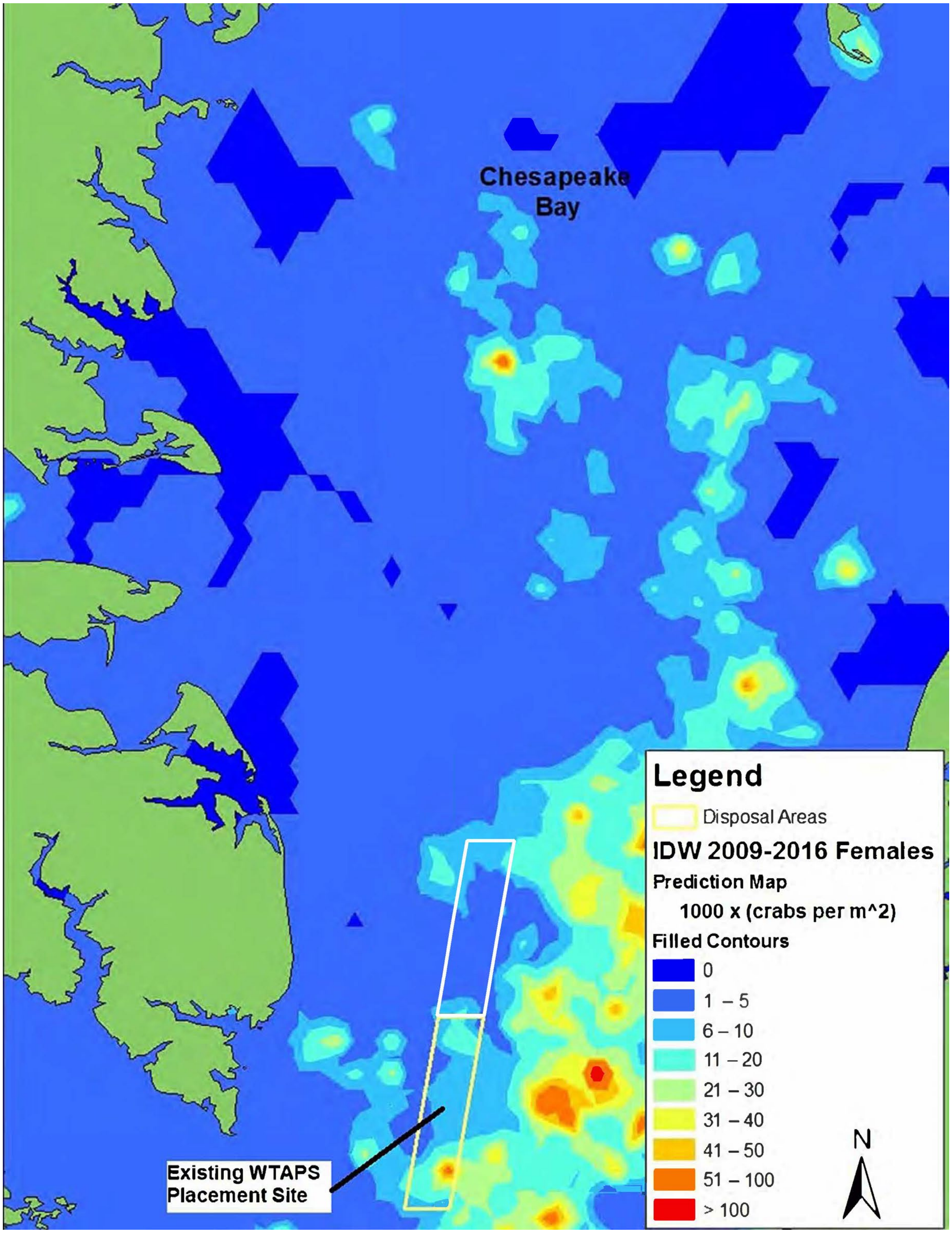



**Figure 4. Relative Density of Female Blue Crabs 2009-2016 composite, density multiplied by factor of 1,000 for clarity (Modified from Lipcius and Knick 2016)**

# 5 CUMULATIVE EFFECTS TO EFH

For the purpose of this EFH assessment, cumulative effects are considered to be those effects on the habitat of the 16 designated species resulting from other federal, state, and privately sponsored projects that may occur in the project vicinity.

In Virginia, port growth is anticipated to increase throughout the next 50 years, and upon completion of the Craney Island Eastward Expansion Project, a new port facility is planned. Deepening and maintenance of the Atlantic Ocean Channel, Thimble Shoals Channel, Norfolk Harbor Channels and Anchorage F, and Elizabeth River and Southern Branch Channels, as well as sand borrow activities for the Virginia Beach Hurricane Protection Project and Willoughby Spit and Vicinity Hurricane Protection Project is also planned. Additional development, including the construction of the Third Crossing, expansion of the Chesapeake Bay Bridge Tunnel, and construction of the in-water features for the Norfolk Coastal Storm Risk Management Project are planned for the future.

In Maryland, the Department of Transportation may construct a third Bay Bridge span. Baltimore Gas and Electric (BGE) may relocate submerged power cables to overhead in-water pylons at Key Bridge. The USACE plans to continue restoration of Paul S. Sarbanes Ecosystem Restoration at Poplar Island and plans for future Mid Chesapeake Bay Island Ecosystem Restoration; and lastly, Maryland Department of Natural Resources plans the dredging of oyster shell from the Man O'War Shoal for future oyster reef restoration.

Throughout the Chesapeake Bay, ecosystem restoration projects are being implemented by government agencies, nongovernmental organizations, and private entities to restore and/or augment submerged aquatic vegetation, reef, and wetland habitats. These projects revitalize and enhance EFH throughout the bay and its tributaries.

Global climate change also has the potential to affect EFH, managed species, and their prey. Sea level rise may cause an increase in salinity in upstream areas that could affect spawning locations and survivability of early life stages (eggs, larvae, and young-of-the-year). Shifts in breeding habitat could affect the availability or timing of spawning events, though the effects of this change on EFH is uncertain at this time. Shifts in salinity, temperature, and sea level all may result in shifts in forage and forage habitat, which could impact managed species. While such changes in climatic conditions would likely affect EFH, implementation of the WTAPSNE Project is not expected to significantly contribute to those climate-related effects, either cumulatively or synergistically.

The proposed action would establish alternative locations for the ongoing open-water placement activities associated with maintenance dredging of the York Spit Channel, but would not alter the frequency or intensity of those activities. This change does not present any substantially adverse cumulative effects, relative to the "no project" alternative. It would, however, have a substantially beneficial effect upon blue crab populations by reducing adverse effects on overwintering female crabs.

# 6 FEDERAL AGENCY’S OPINION ON PROJECT EFFECTS TO EFH

In summary:

1. Potential adverse effects to EFH of the 16 species described in this assessment would be periodic, concurrent with maintenance dredging of the York Spit Channel roughly every four years. Potential adverse effects due to turbidity and sedimentation would be temporary. The proposed dredged material placement would potentially disturb motile life stages of managed fish species, at least temporarily, which may cause them to seek alternative habitats elsewhere. This avoidance would occur only in when dredged material placement activities are underway. The proposed placement sites comprise a small proportion of the suitable area within the lower Bay. There would be plentiful habitat available throughout the Bay, to include adjacent waters, from which fishes can forage during project activities. In-water work would occur over several months, and once completed, the local habitats would again be available to all managed fish species and their prey.

2. Existing sediments in the open water placement sites support a benthic community living in the substrate (infauna), including segmented and unsegmented worms, flatworms, bristle worms, and aquatic earthworms, and a variety of amphipods, crabs, and snails living on the surface of the substrate (epifauna). This community is an important food source for fish, particularly the epifauna. This community is characterized by opportunistic (“weedy”) and equilibrium (climax) species that are adapted to and tolerant of bottom-disturbing events such as major storms and flows. The existing community is also probably exposed to episodic oxygen stress and hypoxia, at least during some summers. Effects to the benthic community would be short-term, since natural sedimentation and subsequent recolonization of benthic invertebrates is expected to occur rapidly, within months following project activities. Because of its widespread occurrence and rapid expected recovery after disturbance, the short-term loss of the benthic community to dredged material placement activities is not expected to be a substantially adverse, long-term effect to EFH of designated species.

3. Blue crabs are an important prey for many finfish species that have EFH in the project area. A high abundance of overwintering female blue crabs have been reported in the southern portion of the existing Wolf Trap Alternate Placement Site. The purpose of the proposed project is to expand the placement site to include areas that have been shown to not support such significant populations of overwintering female crabs. Therefore, no substantially adverse effects to overwintering female blue crabs are expected to occur as a result of the proposed project, and the overall survivorship of blue crabs within the Chesapeake Bay would be improved, relative to continued use of the existing placement site under the “no project” alternative. Mitigation undertaken to benefit blue crab is inherently beneficial to numerous species for which blue crab is an important prey item, including managed species.

4. Dredged material placement would occur approximately every four years. WTAPSNE would reach capacity (be full) after approximately 20 cycles of maintenance of the York

Spit Channel in about the year 2100. Significant effects, both direct and indirect, would be temporary and limited to areas undergoing placement activities. Direct impacts from the proposed project primarily affects the EFH of demersal species. Impacts to EFH for pelagic species in the proposed project area consists of primarily impacts to prey. Sequencing of the activities would result in the effects moving from one placement site to another, within the overall WTAPSNE site, as the project progresses. The next dredge contract requires material to be placed within the southeast quadrant of the southernmost cell ("NE6") of WTAPSNE, with mound heights not to exceed an elevation of -30 feet MLLW. Dredged material placement is closely monitored and recorded by GPS, in accordance with USACE Dredge Quality Management requirements. All material placement contracts require pre- and post-placement bathymetric surveys of the placement sites to ensure compliance. Previously disturbed areas would be available for use by managed species for the majority of the time the project is underway. No substantially adverse, long-term effects to EFH are expected to occur as a result of the proposed project.

5. Although other federal, state and private sponsored projects occur in the project vicinity, these projects do not significantly affect the 16 species in this assessment and their associated EFH is expected to fully recover. It is expected that the dredged material placement locations would return to pre-placement conditions following the project activities, with an approximation that the benthic community would become recolonized within 1.5 years. SAV and shellfish beds would not be impacted by this project. Placement activities would occur in accordance with the anticipated York Spit Channel maintenance schedule, or as necessary as a result of shoaling from storm events and other environmental factors. The benthic community would have an opportunity to fully recover following each dredged material placement event and prior to the subsequent such event. Given the above factors, no substantially adverse cumulative effects to EFH are expected to result from this project.

In conclusion, the Baltimore District, after reviewing relevant fisheries information and analyzing potential project effects, has determined that the project would have a temporary adverse impact on EFH. However, the project would not have a substantial cumulative or long-term adverse effect on EFH, species with designated EFH in the project area, or their prey.

# 7 MITIGATION

For this proposal, a number of mitigation measures/best management practices are being implemented by USACE, to minimize effects to EFH, managed species, and their prey.

Disposal of dredged material would occur within the limits of the Wolf Trap Alternate Placement Site. No unconfined disposal of contaminated sediments would occur with implementation of the project.

The purpose of the proposed project is to provide additional dredged material placement area to minimize effects to female blue crab overwintering grounds. Available data indicate that the existing WTAPS placement site, particularly the southern portion, supports a significant fraction of the population of overwintering female blue crabs within the lower Chesapeake Bay. By proceeding with the proposed action, adverse effects to these overwintering female crabs would be greatly reduced, relative to the “no project” alternative. Although blue crab is not managed under the Magnuson-Stevens Act, minimizing impacts to blue crabs mitigates EFH impacts for those managed fish species evaluated in this document for which blue crab is an important prey item.

To avoid/minimize adverse effects to ESA-listed sea turtles, USACE has implemented a TOY restriction from September 1 through November 14, of any year, on the dredging of the York Spit Channel. Therefore dredged material placement would not occur at the project site during this period. Furthermore, USACE generally seeks to perform this work in the winter and early spring, subject to availability of dredging contractors. This TOY would also help to avoid and minimize effects to sandbar shark HAPC used for pupping and nursery activities (occurring from May 1 to October 30).

Bottom-dump placement of dredged material typically produces mounded deposits on the bay bottom, and the thickness of such mounds and the force of impacting sediment will be lethal to benthic organisms within the footprint of the deposit. USACE considered requiring the contractor to smooth the deposits out to a roughly uniform thickness, but reworking the sediments in this way would be extremely costly, time consuming and likely ineffective. It would extend the duration of project disturbance, increase vessel traffic and emissions, and exacerbate turbidity. Moreover, distributing the sediments after placement would merely spread adverse effects over a much larger greater area. While it might result in somewhat-reduced mortality within the deposit footprint, it would greatly increase mortality and sublethal stress on benthic communities over a much larger area, and would result in delayed post-disturbance recovery and greater temporal loss of functions. If deposited “mounds” are left in place, natural tidal currents will gradually redistribute sediments, but this process would occur at a rate similar to that of natural sediment movements within the area, to which native benthic communities can acclimate with minimal risk of harm. For these reasons, USACE believes that spreading deposited material is not a viable measure to reduce project impacts, and would likely increase adverse effects to the benthic community.

## 8 REFERENCES

Anchor Environmental. 2003. Literature review of effects of re-suspended sediments due to dredging. 140 pp.

Chang, S., Berrien, P.L., Johnson, D.L., and W.W. Morse. 1999. Essential Fish Habitat Source Document: *Windowpane, Scophthalmus aquosus, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-137.

Chesapeake Bay Program (CBP). 2019. Discover the Chesapeake, Ecosystem, Physical Characteristics. Available online at: http://www.chesapeakebay.net/discover/ecosystem/physical_characteristics Accessed March 2019.

Chittenden, M.E., Jr., L.R. Barbieri, and C. M. Jones. 1993. *Spatial and temporal occurrence of Spanish mackerel Scomberomorus maculatus in Chesapeake Bay.* Fishery Bulletin Volume 91: 151-158.

Clarke, D., K. Reine, C. Dickerson, S. Zappala, R. Pinzon and J. Gallo. 2015. Suspended Sediment Plumes Associated with Navigation Dredging in the Arthur Kill Waterway, New Jersey.

Collette, B.B. and C.E. Nauen. 1983. FAO Species Catalog. Vol. 2. Scombrids of the World. An annotated and illustrated catalogue of tunas, mackerels, bonitos and related species known to date. FAO Fish. Synop. 125(2). 137 pp.

Cross, J.N., Zetlin, C.A., Berrien, P.L., Johnson, D.L., and C. McBride. 1999. Essential Fish Habitat Source Document: *Butterfish, Peprilus triacanthus, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-145.

Dauer, D.M., A.J. Rodi, and J.A. Ransinghe. 1992. Effects of low dissolved oxygen events on the macrobenthos of the lower Chesapeake Bay. Estuaries, 15(3): 384-391.

Drohan, A.F., Manderson, J.P., and D.B Packer. 2007. Essential Fish Habitat Source Document: *Black Sea Bass, Centropristis striata, Life History and Habitat Characteristics.* Second Edition. NOAA Technical Memorandum NMFS-NE-200.

Fahay, M.P, P.L. Berrien, D.L. Johnson and W.W. Morse. 1999. Essential Fish Habitat Source Document: *Bluefish, Pomatomus saltatrix, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-144.

Florida Museum. Ichthyology, Discover Fishes & Sharks, Sandbar Shark (*Carcharhinus plumbeus*). Available online at: https://www.floridamuseum.ufl.edu/fish/discover/species-profiles/carcharhinus-plumbeus/. Accessed March 2019.

Godcharles, M.F. and M.D. Murphy. 1986. Species Profiles: Life histories and environmental requirements of coastal fishes and invertebrates (South Florida) King mackerel and Spanish mackerel. U.S. Fish and Wildlife Service Biological Reports. 82(11.58). U.S Army Corps of Engineers, TR EL-82-4. 18 pp.

Grubbs, R.D., Musick, J.A., Conrath, C.L. and J.G. Romine. 2007. Long-Term Movements, Migration, and Temporal Delineation of a Summer Nursery for Juvenile Sandbar Sharks in the Chesapeake Bay Region. American Fisheries Society Symposium 50: 87-107.

Hurley, L.M. 1990. *Field Guide to the Submerged Aquatic Vegetation of Chesapeake Bay.* U.S. Fish and Wildlife Service, Chesapeake Bay Estuary Program, Annapolis, Maryland.

Lee, G. Fred & R.A. Jones. 1999. Oxygen Demand of US Waterway Sediments.

Lipcius, R.N. and K.E. Knick. 2016. Dredge Disposal Effects on Blue Crab. Virginia Institute of Marine Science.

Lippson, Alice Jane., and College Park. 1973. Natural Resources Institute University of Maryland. *The Chesapeake Bay in Maryland: An Atlas of Natural Resources*. Johns Hopkins University Press, Baltimore, MD.

Lippson, Alice Jane., and R.L. Lippson. 2006. *Life in the Chesapeake Bay*. Third edition. John Hopkins University Press, Baltimore, MD.

Maryland Sea Grant. 2011. Ecosystem-Based Fisheries Management in Chesapeake Bay: A Summary Brief from the Blue Crab Species Team. A Maryland Sea Grant Publication, Publication Number UM-SG-TS-2011-04, College Park, Maryland.

Murdy, E.O., R.S. Birdsong, and J.A. Musick. 1997. Fishes of Chesapeake Bay. Smithsonian Institution Press, Washington, D.C.

Murdy, E.O. and J.A. Musick. 2013. Field Guide to Fishes of the Chesapeake Bay. The John Hopkins University Press, Baltimore, MD.

NMFS websites:

- https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/turbiditytablenew.html
- https://www.greateratlantic.fisheries.noaa.gov/hcd/herring.pdf
- https://www.greateratlantic.fisheries.noaa.gov/hcd/md1.html
- http://www.habitat.noaa.gov/protection/efh/habitatmapper.html
- https://www.greateratlantic.fisheries.noaa.gov/hcd/summerflounder.htm
- https://www.greateratlantic.fisheries.noaa.gov/hcd/list.htm
- http://www.nmfs.noaa.gov/sfa/hms/documents/fmp/am10/index.html
- http://www.fisheries.noaa.gov/sfa/hms/documents/safe_reports/2016/2016_safe_report_final_web.pdf

- http://www.nmfs.noaa.gov/pr/pdfs/species/sandtigershark_detailed.pdf
- https://www.nefsc.noaa.gov/nefsc/Narragansett/sharks/sharpnose.html
- https://www.greateratlantic.fisheries.noaa.gov/hcd/skateefhmaps.htm
- https://chesapeakebay.noaa.gov/fish-facts/blue-crab
- https://chesapeakebay.noaa.gov/submerged-aquatic-vegetation/submerged-aquatic-vegetation
- https://www.habitat.noaa.gov/protection/efh/pdf/Clearnose_Skate_EFH.pdf
- https://www.habitat.noaa.gov/protection/efh/pdf/Winter_Skate_EFH.pdf
- https://www.habitat.noaa.gov/protection/efh/pdf/Little_Skate_EFH
- http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_detailed.pdf
- http://www.nmfs.noaa.gov/pr/pdfs/species/duskyshark_highlights.pd

NMFS, Office of Sustainable Fisheries, Atlantic Highly Migratory Species Management Division. 2017. Final Amendment 10 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery management Plan: Essential Fish Habitat and Environmental Assessment.

NEFMC and NMFS, Omnibus Essential Fish Habitat Amendment 2, Volume 2: EFH and HAPC Designation Alternatives and Environmental Impacts. 2017

Packer, D.B., Griesbach, S.J., Berrien, P.L., Zetlin, C.A., Johnson, D.L., and W.W. Morse. 1999. Essential Fish Habitat Source Document: *Summer Flounder, Paralichthys dentatus, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-151.

Packer, D.B., Zetlin, C.A., and J.J. Vitaliano. 2003. Essential Fish Habitat Source Document: *Clearnose Skate, Raja eglanteria, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-174.

Packer, D.B., Zetlin, C.A. and J.J. Vitaliano. 2003. Essential Fish Habitat Source Document: *Winter Skate, Leucoraja ocellata, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-179.

Packer, D.B., Zetlin, C.A., and J.J. Vitaliano. 2003. Essential Fish Habitat Source Document: *Little Skate, Leucoraja erinacea, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-175.

Reid, R.N., L.M. Cargnelli, S.J. Griesbach, D.B. Packer, D.L. Johnson, C.A. Zetlin, W.W. Morse and P.L. Berrien. 1999. Essential Fish Habitat Source Document: *Atlantic Herring, Clupea harengus, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-126.

Robins, C.R., G.C. Ray, J. Douglas, and R. Freud. 1986. Atlantic coast fishes. Peterson Field Guides 32. Houghton Mifflin Company, N.Y. 354 p.

Schaffner, L. 2010. Patterns and Rates of Recovery of Macrobenthic Communities in a Polyhaline Temperate Estuary Following Sediment Disturbance: Effects of Disturbance Severity and Potential Importance of Non-local Processes. Estuaries and Coasts, 2010 33: 1300

Shepherd, G.R. and D.B. Packer. 2006. Essential Fish Habitat Source Document: *Bluefish, Pomatomus saltatrix, Life History and Habitat Characteristics.* Second Edition. NOAA Technical Memorandum NMFS-NE-198.

Steimle, F.W., Morse, W.W., Berrien, P.L. and D.L. Johnson. 1999. Essential Fish Habitat Source Document: *Red Hake, Urophycis chuss, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-133.

Steimle, F.W., Zetlin, C.A., Berrien, P.L., Johnson, D.L., and S. Chang. 1999. Essential Fish Habitat Source Document: *Scup, Stenotomus chrysops, Life History and Habitat Characteristics.* NOAA Technical Memorandum NMFS-NE-149.

Stevenson, D.K. and M.L. Scott. 2005. Essential Fish Habitat Source Document: *Atlantic Herring, Clupea harengus, Life History and Habitat Characteristics.* Second Edition. NOAA Technical Memorandum NMFS-NE-192.

The Center for Conservation Biology. 2010. Chesapeake Bay Salinity Zones. Available online at: http://www.ccbbirds.org/2010/03/10/investigation-into-the-ecology-of-tidal-freshwater-marsh-birds/. Accessed March 2019.

Truitt, C.L., 1988. Dredged material behavior during open-water disposal. Journal of Coastal Research, 4(3), 389-397. Charlottesville (Virginia) ISSN 0749·0208.

USACE. 1981. Baltimore Harbor and Channels, Maryland and Virginia Combined Phase I and Phase II General Design Memorandum, Appendix B, Foundation Exploration (Geophysical).

USACE. 1983. Dredging and Dredging Material Disposal. U.S. Department Army Engineer Manual 111 0-2-5025.

USACE. Norfolk District. 2016. A Characterization of Finfish, Blue Crabs and Benthic Invertebrates Before, During and After Dredged Material Placement, Final Report.

USACE. ERDC. 2018. Effects of Dredged Material Burial on Blue Crab Survival, Final Report.

VADEQ. 2018. Water Quality Assessment, 2018 Integrated Report. Available online at: https://www.deq.virginia.gov/programs/Water/WaterQualityInformationTMDLs/WaterQualityAssessments/2018305(b)303(d)IntegratedReport.aspx. Accessed March 2019.

VIMS. 2002. Summary of Essential Fish Habitat Description and Identification for Federally Managed Species Inhabiting the Virginia Waters of Chesapeake Bay 1988 – 1999.

VIMS. 2019 (SAV). SAV in Chesapeake Bay and Coastal Bays Monitoring Program Interactive Map. Available online at: http://web.vims.edu/bio/sav/maps.html. Accessed March 2019.

VIMS. 2019 (ECOS). Virginia Estuarine and Coastal Observing System Interactive Map. Available online at: http://web2.vims.edu/vecos/ .Accessed March 2019.

VIMS. 2019 (Coastal). Coastal habitats. Center for Coastal Resources Management. Available online at: https://www.vims.edu/ccrm/research/ecology/coastal%20habitats/index.php. Accessed April 2019.

VMRC. Chapter 4 VAC 20-270-10 ET SEQ. Available online at: http://www.mrc.state.va.us/regulations/fr270.shtm. Accessed March 2019.

VMRC. Chesapeake Bay Map. Available online at: https://webapps.mrc.virginia.gov/public/maps/chesapeakebay_map.php. Accessed March 2019.

Wright, L.D., D.B. Prior, C.H. Hobbs, R.J. Byrne, J.D. Boon, L.C. Schaffner, and M.O. Green. 1987. Spatial Variability of Bottom Types in the Lower Chesapeake Bay and Adjoining Estuaries and Inner Shelf. Estuarine, Coastal and Shelf Science (1987) 24, 765-784.