Chesapeake BAY CROSSING STUDY
TIER 2 NEPA

ESSENTIAL FISH HABITAT ASSESSMENT

Maryland Transportation Authority
MDTA

March 2026

Revised May 2026

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ABBREVIATIONS AND ACRONYMS

°C	degrees Celsius
°F	degrees Fahrenheit
ARDS	Alternatives Retained for Detailed Study
ASMFC	Atlantic States Marine Fisheries Commission
BMPs	Best Management Practices
CB3MH	Upper Chesapeake Bay Watershed
CB4MH	Middle Central Chesapeake Bay Watershed
CBBMP	Chesapeake Bay Benthic Monitoring Program
CBP	Chesapeake Bay Program
CFPP	Chesapeake Fish Passage Prioritization
ChesMMAP	Chesapeake Bay Multispecies Monitoring and Assessment Program
CO_2	Carbon Dioxide
COMAR	Code of Maryland Regulations
DO	Dissolved Oxygen
EFH	Essential Fish Habitat
ESC	Erosion and Sediment Control
ERP	Environmental Review Program
FHWA	Federal Highway Administration
FMP	Fishery Management Plan
GARFO	Greater Atlantic Regional Fisheries Office
HAPC	Habitat Areas of Particular Concern
IBI	Index of Biotic Integrity
LOD	Limits of Disturbance
MAFMC	Mid-Atlantic Fishery Management Council
MARMAP	Marine Resources Monitoring, Assessment and Prediction Program
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDTA	Maryland Transportation Authority
MLW	Mean Low Water
MPN	Most Probable Number
MSA	Magnuson-Stevens Fishery Conservation and Management Act
NEFSC	North East Fisheries Science Center
NEPA	National Environmental Policy Act
NOAA	National Oceanic and Atmospheric Administration
NOB	Natural Oyster Bar
NTU	Nephelometric Turbidity Unit
PCBs	Polychlorinated Biphenyls
ppm	Parts per million
ppt	Parts per thousand
PSFA	Public Shellfish Fishery Area
RMS	Root-mean-square sound pressure level
SAV	Submerged Aquatic Vegetation
SEL_{cum}	Cumulative Sound Exposure Level
SEL_{ss}	Single Strike Sound Exposure Level

SWM	Stormwater Management
TMDL	Total Maximum Daily Load
TSS	Total Suspended Solids
VIMS	Virginia Institute of Marine Science
ZSFP	Zone of Safe Fish Passage

1 EXECUTIVE SUMMARY

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) and Federal Highway Administration (FHWA) to address existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (Bay Bridge) and its approaches along U.S. 50/301. The MDTA and FHWA are preparing an Environmental Impact Statement (EIS) for Tier 2 of the Bay Crossing Study (Tier 2 Study) pursuant to the National Environmental Policy Act (NEPA).

During development of the Draft EIS, National Oceanic and Atmospheric Administration (NOAA) Fisheries indicated that Essential Fish Habitat (EFH) exists for the following species that occur within the Tier 2 Study action area: Atlantic butterfish (*Peprilus triacanthus*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), and windowpane flounder (*Scophthalmus aquosus*). The project action area (Action Area) described in this document includes suitable habitat for these federally-managed fish species and other aquatic life. Demolition of the existing bridge and construction of a new bridge and approaches would have long-term and short-term adverse effects on federally-managed fish species. Activities such as pier construction, dredging, blasting, and filling would adversely affect federally-managed fish species. However, FHWA and the MDTA will work with NOAA Fisheries to develop measures to avoid and minimize adverse impacts to federally-managed fish, their prey, and habitats to the maximum extent practicable and work to offset unavoidable adverse impacts.

Construction of the Preferred Alternative would adversely affect several priority habitats including emergent tidal wetlands, and natural oyster bars. The action may result in temporary adverse effects to submerged aquatic vegetation (SAV).

2 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study) is a two-tiered engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) and Federal Highway Administration (FHWA). The Bay Crossing Study is addressing existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (Bay Bridge) and its approaches along U.S. 50/301. Each tier of the Bay Crossing Study involves development of an Environmental Impact Statement (EIS), in compliance with National Environmental Policy Act (NEPA), to describe potential significant environmental effects and inform the evaluation of alternatives. Tier 1 of the Bay Crossing Study (Tier 1 Study) was completed in April 2022. At that time, FHWA issued a Final EIS/Record of Decision (FEIS/ROD) identifying Corridor 7, the corridor that includes the Bay Bridge and its approaches, as the Selected Corridor Alternative for further evaluation. Tier 2 of the Bay Crossing Study (Tier 2 Study) was launched in June 2022 to focus on a project-level (site-specific) analysis within the Tier 1 Selected Corridor Alternative (Corridor 7). The Tier 2 NEPA process was initiated formally with the publication of a Notice of Intent (NOI) to prepare an EIS in the Federal Register on November 15, 2024. The MDTA identified the Alternatives Retained for Detailed Study (ARDS), which are the NEPA range of reasonable alternatives for evaluation in the Tier 2 Study EIS. Subsequently, the MDTA identified the MDTA Recommended Preferred Alternative, which Cooperating Agencies concurred with in May 2026 and is now referred to as the Preferred Alternative. A *Natural Environment Technical Report (NETR)* and *Draft EIS* were published on January 23, 2026.

Alternative C has been identified from among seven alternatives retained for detailed study (ARDS) as the Preferred Alternative. Alternative C meets the Tier 2 Study Purpose and Need and has the least environmental impact of the retained build alternatives. The Magnuson-Stevens Fishery Conservation and Management Act does not define an action area. The MDTA determined the project action area for federally-managed fish species described in this document (Action Area) to include direct and indirect fisheries impacts within the vicinity of the Bay Bridge. **Figure 2-1** shows the Action Area, which includes: the potential footprint for construction of the new bridge under Alternative C and demolition of the old bridge; dredging areas; and estimated underwater effects, including areas of increased underwater noise due to pile driving and blasting, and areas of decreased water quality due to turbidity and sedimentation.

The purpose of this EFH Assessment is to evaluate potential effects of the Preferred Alternative on EFH based on the Action Area, in accordance with the 1996 Amendments to the Magnuson-Stevens Fishery Conservation and Management Act (MSA). EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding or growth to maturity” (16 USC 1802(10)). National Oceanic and Atmospheric Administration (NOAA) Fisheries has indicated that the following federally-managed fish species occur within the Tier 2 Study Action Area: Atlantic butterfish (*Peprilus triacanthus*), black sea bass (*Centropristis striata*), bluefish (*Pomatomus saltatrix*), scup (*Stenotomus chrysops*), summer flounder (*Paralichthys dentatus*), and windowpane flounder (*Scophthalmus aquosus*).

2.1 Project Description and Background

The Bay Bridge is a two-span structure that crosses the Chesapeake Bay from Anne Arundel County on the Western Shore to Queen Anne’s County on the Eastern Shore. The original span

opened in 1952, and the second span opened in 1973. See the *Draft EIS* for additional details regarding the background of the Bay Crossing Study.

A wide range of engineering and environmental considerations were evaluated for the ARDS, which included one no-build alternative and six build alternatives as detailed in the *Draft EIS*. Alternative A (the no-build alternative) is not the Preferred Alternative because it would not increase roadway capacity or mobility, correct roadway deficiencies, or provide the navigational clearance established by the U.S. Coast Guard. Alternative A would also require substantial maintenance and related lane closures that would worsen congestion over time and compound existing traffic congestion, mobility, and roadway deficiency issues. Each of the six build alternatives meets the Tier 2 Study's purpose and need and would therefore be reasonable to implement. However, the build alternatives differ in the degree of transportation benefit they would provide as well as the likely environmental impacts and cost. The Preferred Alternative, Alternative C (6-8-6 South) (**Figure 2-2**), would have the least impact to natural, cultural, and socioeconomic resources compared to the other build alternatives. Among the build alternatives considered, Alternative C would result in the least impact to wetlands and non-tidal surface waters; benthic habitat, historic oyster bottom, and submerged aquatic vegetation (SAV).

The Preferred Alternative would replace the existing Bay Bridge spans with two new bridge spans and would consist of six lanes along U.S. 50/301 on the Western Shore (three per direction), eight lanes on a new bridge (four per direction), and six lanes along U.S. 50/301 on the Eastern Shore (three per direction). Construction activities would include, but are not limited to, pile driving; dredging; placement of fill/structure for piers, pier protection systems, and pier islands; increased vessel traffic; and demolition and removal of existing structures, including blasting. The two new bridge spans would include one span to the south and one span in between the location of the existing bridge spans. The approach roadways would remain on the existing roadway alignment, except where necessary to connect to the new bridge spans. Thus, the five existing bridge lanes would be increased to eight bridge lanes; however, the number of lanes on the Western Shore and Eastern Shore would not change and would remain at six total travel lanes beyond the immediate tie-ins to the new bridge spans. The Preferred Alternative could include a bicycle/pedestrian shared use path (SUP) along a new bridge. The MDTA has identified SUP connections to existing and proposed trails and recreational facilities on the Eastern Shore and Western Shore.

Figure 2-1: Essential Fish Habitat within the Action Area

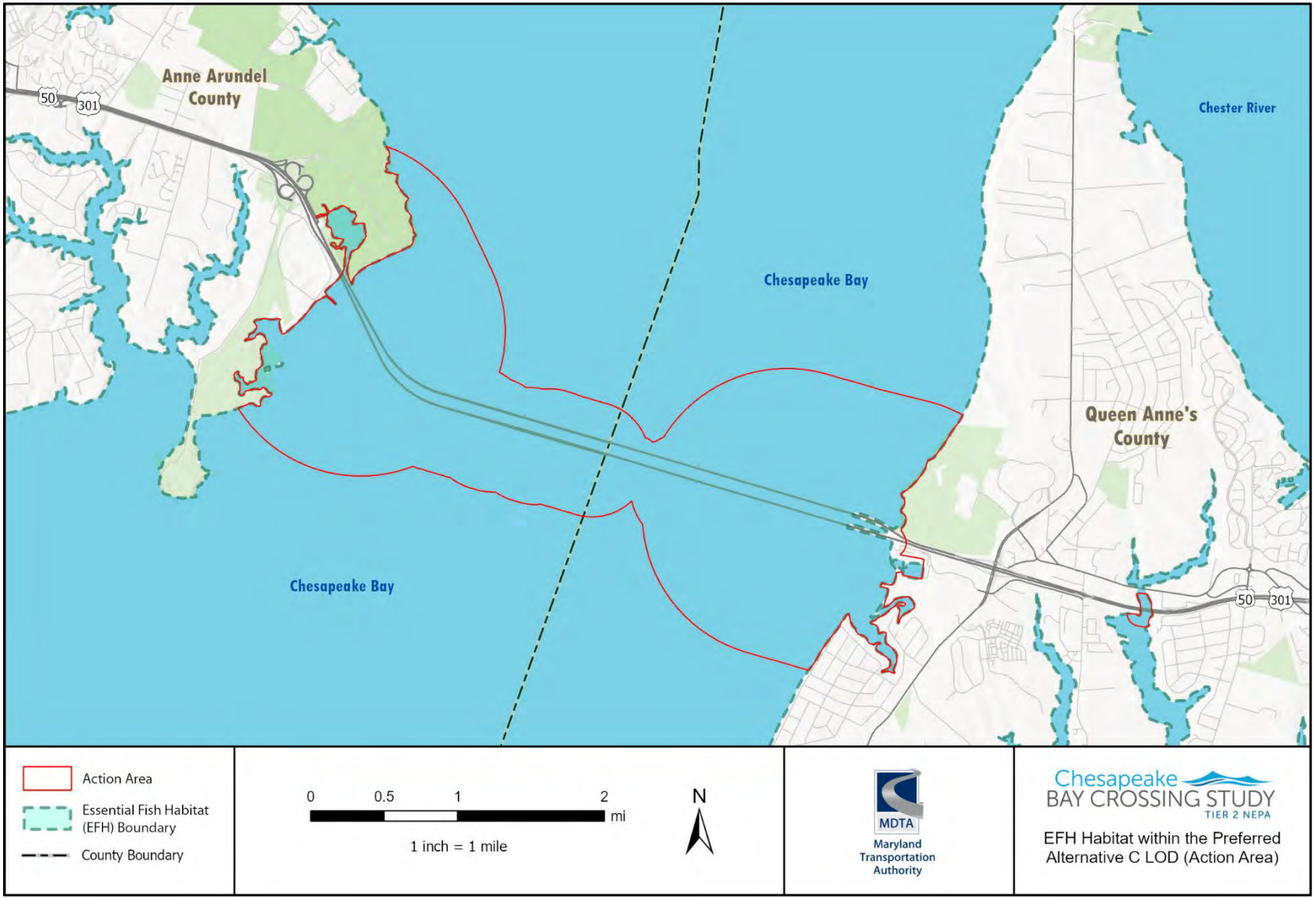


Figure 2-2: The Preferred Alternative



The Tier 2 Study is currently in preliminary engineering for the Preferred Alternative and as such, design, construction, and demolition means and methods are based on preliminary assumptions. Construction of the new bridge spans would likely occur in multiple phases. Phasing of the Preferred Alternative may involve building one span at a time: the first new bridge span may be built, then one existing bridge span could be demolished (mechanically and with blasting), and the new bridge span would be in use while the second new bridge span is built. Once both new bridge spans are complete, the second span of the existing bridge could be demolished. The exact order and timing of construction have yet to be determined, however, a preliminary construction sequence is included in **Table 2-1**:

Table 2-1: Preliminary Construction Sequence

Construction Activity	Construction Years
Construction of Bridge 1 (eastbound) – Occurring during years 1 through 5	
Start Construction, Bridge 1	1
Construct landings (work completed on land)	1-4
Constructing approaches and main span	1-5
Trestles and water access construction	1
Dredging for eastbound bridge	1-2
Transport and disposal of dredge	1-2
Substructure/pier protection construction	1-3
Superstructure construction	2-5
Complete construction, Bridge 1	5
Demolition of existing eastbound bridge – Occurring during years 6 through 7	
Start demolition, existing eastbound bridge	6
Blasting (total of 9 blast events)	6-7
Cantilever Deck Truss Spans (3 spans and 4 piers)	
Cantilever Deck Truss Spans (9 spans and 8 piers)	
Through Truss Spans (3 spans and 4 piers)	
250' Simple Deck Truss Spans (4 simple spans/4 piers)	
300' Simple Deck Truss Spans (6 simple spans/5 piers)	
Suspension Spans (3 suspension spans/4 piers)	
Dismantling	6-7
Complete demolition, existing eastbound bridge	7
Construction of Bridge 2 (westbound) – Occurring during years 7 through 13	
Start construction, Bridge 2	7
Construct landings (work completed on land)	7-13
Constructing approaches and main span	7-13
Trestles and water access construction	7
Dredging for westbound bridge	7-8
Transport and disposal of dredge	7-8
Substructure/pier protection construction	7-12
Superstructure construction	8-13
Complete construction, Bridge 2	13
Demolition of existing westbound bridge – Occurring during years 14 through 15	
Start demolition, existing westbound bridge	14
Blasting (7 total blast events)	14-15
Cantilever Deck Truss Spans (3 spans and 3 piers)	
Cantilever Deck Truss Spans (9 spans and 8 piers)	
Through Truss Spans (3 spans and 4 piers)	
Suspension Spans (3 suspension spans/4 piers)	
Dismantling	14-15
Complete demolition, existing westbound bridge	15

The following sections include initial assumptions based on the current design and best available information from similar bridge projects including the Francis Scott Key Bridge, Tappan Zee Bridge, and Nice-Middleton Bridge. Information regarding anticipated construction methods and current assumptions of each phase follows.

Construction phase:

Dredging:

Based on existing conditions within the Chesapeake Bay, dredging would likely be necessary to create access channels to support demolition and construction activities. Considering input from previous similar dredging efforts, a target depth of nine feet below the mean low water (MLW) level was assumed. The dredging areas were established using the "Maryland bathymetry Chesapeake Bay contours" data at both shores of the Bay (Western and Eastern Shores). The northern limit of dredging was assumed to have an approximate offset of 50-feet north of the existing piers of the existing westbound span (to be demolished), and the southern limit was assumed to have an approximate offset of 60-feet from the southern edge of the proposed eastbound span.

The total dredge area at both shores of the Bay would be approximately 50.2 acres (2.2 million square feet), totaling 16.4 acres on the Western Shore and 33.8 acres on the Eastern Shore. These areas exclude the footprints of the proposed and existing bridge pier footings. The total dredged volume within the dredging area is approximately 308,800 cubic yards. Applying a bulking factor of 1.3 to the dredged volume, the volume of spoil to be hauled is approximately 401,500 cubic yards and it is proposed to be hauled via barge. For the eastbound bridge, bucket dredging would likely take about 14 days within construction years 1 and 2 and for the westbound bridge bucket dredging would likely take about 7 days within construction years 7 and 8.

For access in shallow areas, dredging would need to be wide enough to facilitate equipment mobility, loading and unloading material barges, and erecting structures. The dredge area totals 50.2 acres and includes side slopes of up to 3:1 horizontal to vertical, which will prevent the material from sloughing back into the excavation areas. Additionally, based on the greater expanse of shallow water from the eastern shoreline, it is anticipated that more dredging would be required along the eastern shoreline than the western shoreline.

Dredging would occur prior to the construction of temporary trestles that facilitate the loading and unloading of barges and support vessels. Multiple access points (dredged channels or trestles) may be needed depending on the work configuration and the specific construction equipment needed. Access and dredging details would be evaluated and further refined in future design phases.

The MDTA expects the dredge sediment to be clean, based on sediment analysis from the USACE 50 Foot Project, which includes the main channel that runs through the Action Area. Sediment will be tested during geotechnical investigations and prior to disposal to determine the appropriate beneficial reuse or disposal site(s). Potential dredge disposal sites include Masonville Cove and Cox Creek dredged material containment facilities (DMCF). Utilizing Masonville Cove DMCF and Cox Creek DMCF would facilitate safe and efficient loading, transport, and placement of dredge material. Both sites are owned and operated by the Maryland Port Administration (MPA), are adjacent to the Patapsco River, and are accessible by barge for placement operations.

Masonville Cove DMCF has a permitted capacity of 10.4 million cubic yards (mcy) on 101 acres. Cox Creek DMCF has a permitted capacity of 14.7 mcy on 241 acres. Both facilities have plans in place to incorporate the creation of wildlife habitat and community access for recreation including birdwatching. The Bay Crossing Study has coordinated with MPA and determined that either DMCF would have the capacity to accommodate the dredging volumes generated by the build alternative. MPA would require that the material suitability and operational plans be approved prior to placement in accordance with their *Right of Entry Application*.

Bridge/Access Construction:

Preliminary engineering assumptions include using a trestle for temporary construction access in waters less than 10 feet deep below MLW. Based on the Francis Scott Key Bridge Rebuild Project design, the MDTA assumes trestle piers would be constructed every 38 feet supported on 36-inch steel pipe piles. Preliminary engineering assumes that bridge piers would be constructed with 36-inch square pre-stressed concrete piles as well as 36-inch, 48-inch, and 96-inch driven steel pipe piles. Pier protection fenders would likely be supported on 48-inch driven steel pipe piles. Pier protection dolphins are assumed to include 19.6-inch-wide sheet pile, backed by 14-inch steel H-piles. Pier protection would be built with the corresponding bridge. **Table 2-2** and **Table 2-3** provide the estimated number and type of proposed piles and piers for the eastbound and westbound bridges, respectively.

Table 2-2: Eastbound Bridge – Assumed Pile Summary

Pile Type and Size	Total Piles	Total Piers
Bridge Piers	**1,741**	**77**
36” Pre-stressed Square Piles	132	18
36” Steel Pipe Piles	240	10
48” Steel Pipe Piles	1,231	43
96” Steel Pipe Piles	138	6
Trestle Piers		
36” Steel Pipe Piles	628	157*
Pier Protection	**5,144**	**24**
48” Steel Pipe Piles for fenders	40	2
19.6” Sheet Piles (For Dolphins)	2,552**	22
14” Steel H-Piles (For Dolphins)	2,552**	
Grand Total	**7,513**	**258**

**A trestle pier is anticipated every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier.*

*** Pier protection dolphins have a diameter of 60’ and a circumference of 188.5’. Sheet piles and Steel H-piles would be constructed around the circumference of each dolphin and therefore, 116 sheet piles and 116 Steel H-piles are required per dolphin.*

Table 2-3: Westbound Bridge – Assumed Pile Summary

Pile Type and Size	Total Piles	Total Piers
Bridge Piers	**2,014**	**80**
36” Pre-stressed Square Piles	176	21
36” Steel Pipe Piles	270	10
48” Steel Pipe Piles	1,412	43
96" Steel Pipe Piles	156	6
Trestle Piers		
36” Steel Pipe Piles	628	157*
Pier Protection	**5,144**	**24**
48” Steel Pipe Piles for fenders	40	2
19.6” Sheet Piles (For Dolphins)	2,552**	22
14” Steel H-Piles (For Dolphins)	2,552**	
Grand Total	**7,786**	**261**

** A trestle pier is anticipated every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier.*

*** Pier protection dolphins have a diameter of 60’ and a circumference of 188.5’. Sheet piles and Steel H-piles would be constructed around the circumference of each dolphin and therefore 116 sheet piles and 116 Steel H-piles are required per dolphin.*

The following are construction assumptions based on preliminary engineering:

- Multiple foundation types could be used by the contactor; however to provide the most impactful estimate of noise, currently, the MDTA assumes the main span is supported by multiple driven steel pipe piles, which require impact and vibratory hammering, and the approach span piles are assumed to be pre-stressed square concrete piles installed by impact hammer.
    - Noise attenuation in the form of bubble curtains would be used.
- Currently, a cable-stayed or suspension bridge is being considered, for the purpose of NEPA.
- Piers would have some form of pier protection. Preliminary design assumes 2 fenders and 22 dolphins would be installed on both the eastbound and westbound bridges, respectively, to provide collision protection.
- Trestles would likely be used for temporary construction access to facilitate pier placement for the new bridge within the dredged area. The preliminary design assumes a trestle pier would be constructed every 38 feet, beginning on land and extending one bridge pier beyond the limits of dredging (extending to 10-feet below MLW). Four 36-inch steel pipe piles are assumed to be required for each trestle pier. Trestles would remain in place until construction is complete.
- Other temporary construction methods including cofferdams and other dewatering devices for pile driving may be used.
- Dredging in the shallows up to approximately 9-foot depth is assumed necessary to access areas for pier construction.
- It is assumed, based on the Francis Scott Key Bridge Test Pile Exposure Analysis assumptions, that impact driving would take a maximum of 2 hours per pile.
    - Due to equipment availability, it is assumed that up to eight 96” steel pipe piles may be driven in one day and up to 16 piles of other pile sizes could be driven in one day.

    - For the eastbound bridge, a total of about 120 days of pile driving is anticipated throughout years 1-5 of construction.
    - For the westbound bridge, a total of about 138 days of pile driving is anticipated throughout years 7-13 of construction.
- Throughout the duration of construction, an effective 12-hour quiet period of no pile driving will be implemented each day.
- For staging areas, the MDTA anticipates using the existing MDTA piers that are currently used for bridge maintenance. Additional staging areas may be needed, which will be determined during final design. Additional staging areas are anticipated to include public or private locations in the Baltimore Harbor area, which would not result in additional environmental impacts. Staging areas may also include mooring locations within the Chesapeake Bay. Mooring locations in the Chesapeake Bay may have additional environmental impacts, though the MDTA will commit to avoiding areas of oyster beds or SAV.

Temporary lights may be used during construction for extended day or night work, which may impact federally-managed fish species utilization of habitat; however, the use of aesthetic and continuous roadway lighting would be determined in final design. Navigation, aviation, and traffic control lighting are included on the existing bridges and will be included on the new bridges, as required by regulation.

Demolition phase:

Demolition of the existing bridge spans would occur following construction of each new span. During the demolition phase, noise and vibration impacts from blasting would likely have the most pronounced impacts to federally-managed fish species. The following are the demolition assumptions based on preliminary design:

- Mechanical removal would be employed wherever possible; however, blasting may be necessary when water depths or pier element size makes mechanical removal infeasible.
- Temporary trestles would be used where water depths are less than 10 feet to perform demolition activities, as needed.
- Marine cranes affixed to barges would be used where water depths are deeper than 10 feet below MLW to perform demolition activities, as needed.
- Steel bracing elements are anticipated to be torch cut and heavy lift marine cranes would be used to maneuver cut pieces.
- Shielding barges are anticipated for the removal and transportation of bridge elements from the water.
- Terrestrial demolition of bridge decks, girders, substructures, and abutments is anticipated to use saw cutting, excavators, and slab grab buckets. All demolition debris would be disposed of in accordance with regulatory permits and applicable laws and regulations.

3 EXISTING CONDITIONS

Descriptions of existing conditions including bathymetry, submerged substrates, and aquatic resources are included in this section to provide an overview of the physical characteristics, plant and animal species, and habitat types within the Action Area. Additional information on existing conditions is included in the *Natural Environment Technical Report*.

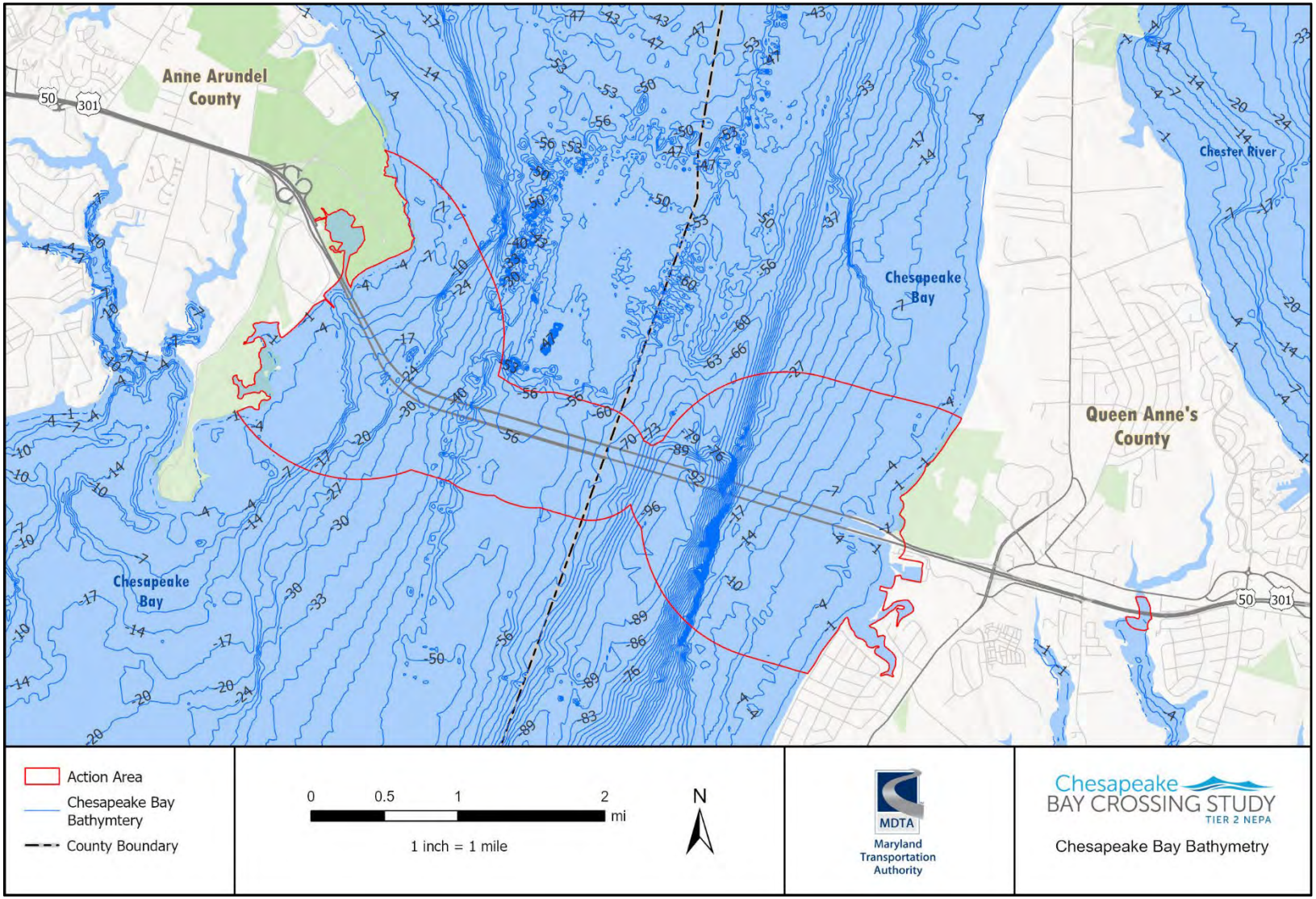
3.1 Bay Morphology and Bathymetry

The Bay Bridge is located at one of the narrowest points of the Bay, which influences the physical, chemical, and biological properties of the Action Area. This narrow point of the Bay has distinct hydrodynamics; is a crucial migratory pathway for fish; and provides distinct habitat for marine life, including the bridge foundations themselves, broad shallows, and a deep channel.

Within the Action Area, as depicted in **Figure 3-1**, the Chesapeake Bay is deepest in the center and east of the county boundary, within the Chesapeake Bay Auxiliary navigation channel. As expected, the Bay becomes shallower towards the shorelines, with broad shallow water habitat areas on either shore. The shallows of the Chesapeake Bay (1 to 3 feet) within the Action Area extend channelward approximately 800 to 950 feet from the western shoreline in Anne Arundel County, and approximately 1,200 to 1,300 feet from the eastern shoreline in Queen Anne's County. Areas with depths from approximately 3 feet to 12 feet generally extend from about 2,100 to 2,200 feet from the western shoreline and 3,900 to 4,700 feet from the eastern shoreline.

The Chesapeake Bay has an average depth of approximately 40 feet within the Action Area, with the main channel depth approximately 56 feet, and the Chesapeake Bay Bridge Auxiliary channel depth approximately 92 feet. **Figure 3-1** illustrates the bathymetry of the Chesapeake Bay.

Figure 3-1: Chesapeake Bay Bathymetry within the Action Area*



*Negative numbers represent contours for the elevation below sea level, and the close contours are indicative of varying steep slopes within the deeper areas.

3.2 Submerged Substrates

The Chesapeake Bay bottom is primarily formed by layers of Magothy, Matawan, and Monmouth formations, which are overlaid by sandy material in the shallow areas and loose silty clay material in the deeper channels. The waves and tide move fine silt, clay, and organic material out of the sand and deposit them in lower energy areas along the bottom. Surficial sand is generally found in the areas that are most affected by wave action and tidal fluctuations. There have been no indications of contaminated materials in the substrates tested for the USACE Baltimore Harbor and Channels 50-Foot Project in the vicinity of the Bay Bridge. Submerged substrate characteristics are described in the *Natural Environment Technical Report*.

The surficial sediments in the shallow areas of the shorelines within the Action Area contain benthic organisms that form an important part of the food web. Cultch areas that provide points of attachment for oyster spat are found in shallower areas (less than 26 feet deep) and generally found as inclusions in the sandy bottom but may also be incorporated into organic/silt mud areas. Potential benthic macroinvertebrate habitat, which largely aligns with state mapped historic oyster bottom, are located throughout the Action Area and addressed in **Section 3.4**.

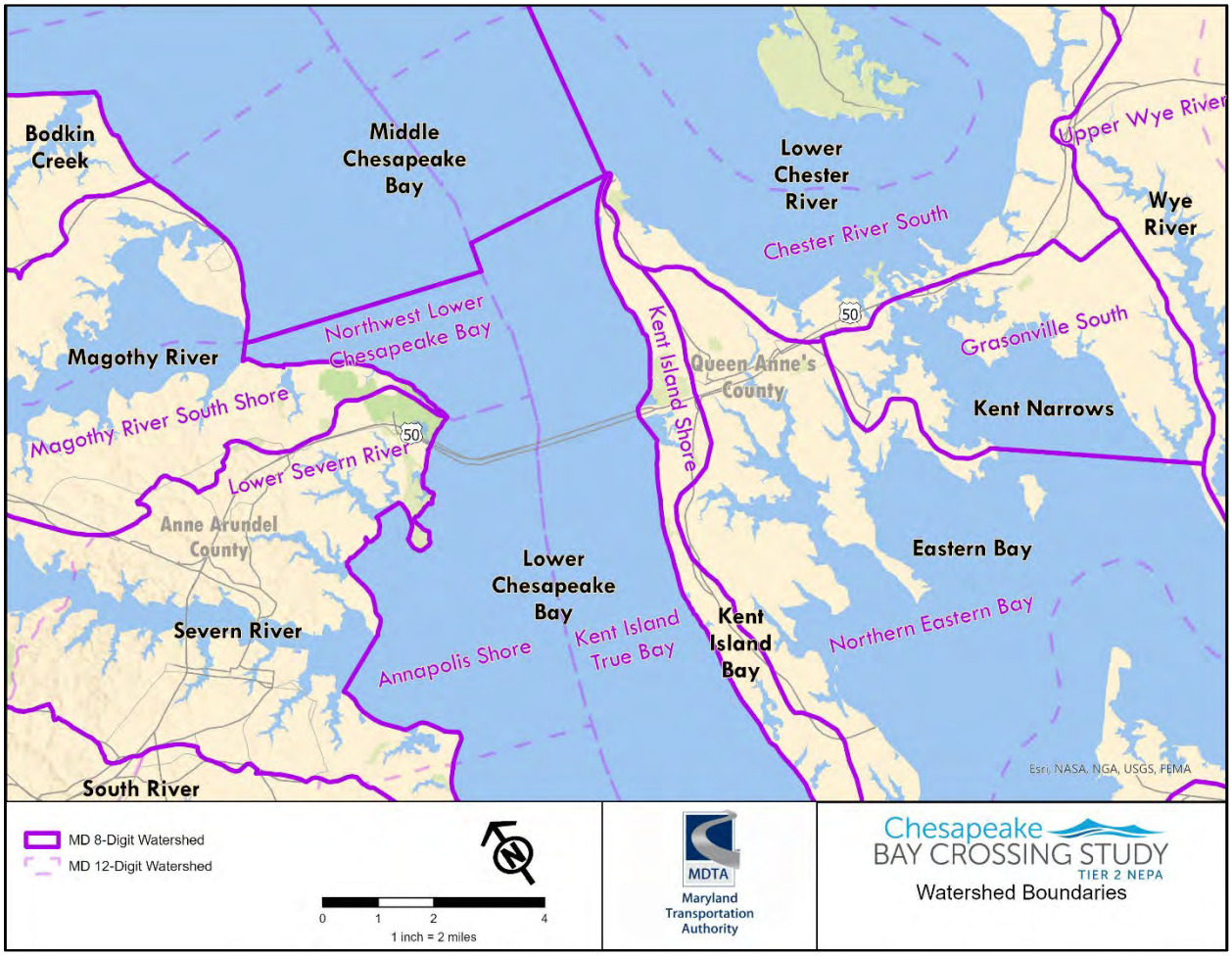
3.3 Water Quality

Watersheds

The Action Area spans three major state-designated 6-digit watersheds: West Chesapeake Bay, Chesapeake Bay Proper, and Chester River. Within each of these major watersheds, the Action Area crosses the Severn River, Magothy River, Lower Chesapeake Bay, Eastern Bay, and Kent Island Bay Maryland Department of the Environment (MDE) 8-digit watersheds and the Lower Severn River, Magothy River South Shore, Northwest Lower Chesapeake Bay, Annapolis Shore, Kent Island True Bay, Northern Eastern Bay, and Kent Island Shore MD 12-digit sub-watersheds, which are shown in **Figure 3-2**.

All MDE 8-digit watersheds crossed by the Action Area have been listed on the 303(d) impaired waters list due to poor water quality. Total maximum daily loads (TMDLs) have been completed for many of the pollutants, though some are still awaiting an approved TMDL. Pollutants such as fecal coliform, polychlorinated biphenyls (PCBs) in fish tissue, elevated levels of phosphorus and nitrogen, total suspended solids (TSS), and unknown pollutants (based on benthic Indices of Biotic Integrity or IBIs) have been documented within the Action Area. More details on watershed characteristics are included in the *Draft EIS* and *Natural Environment Technical Report.*

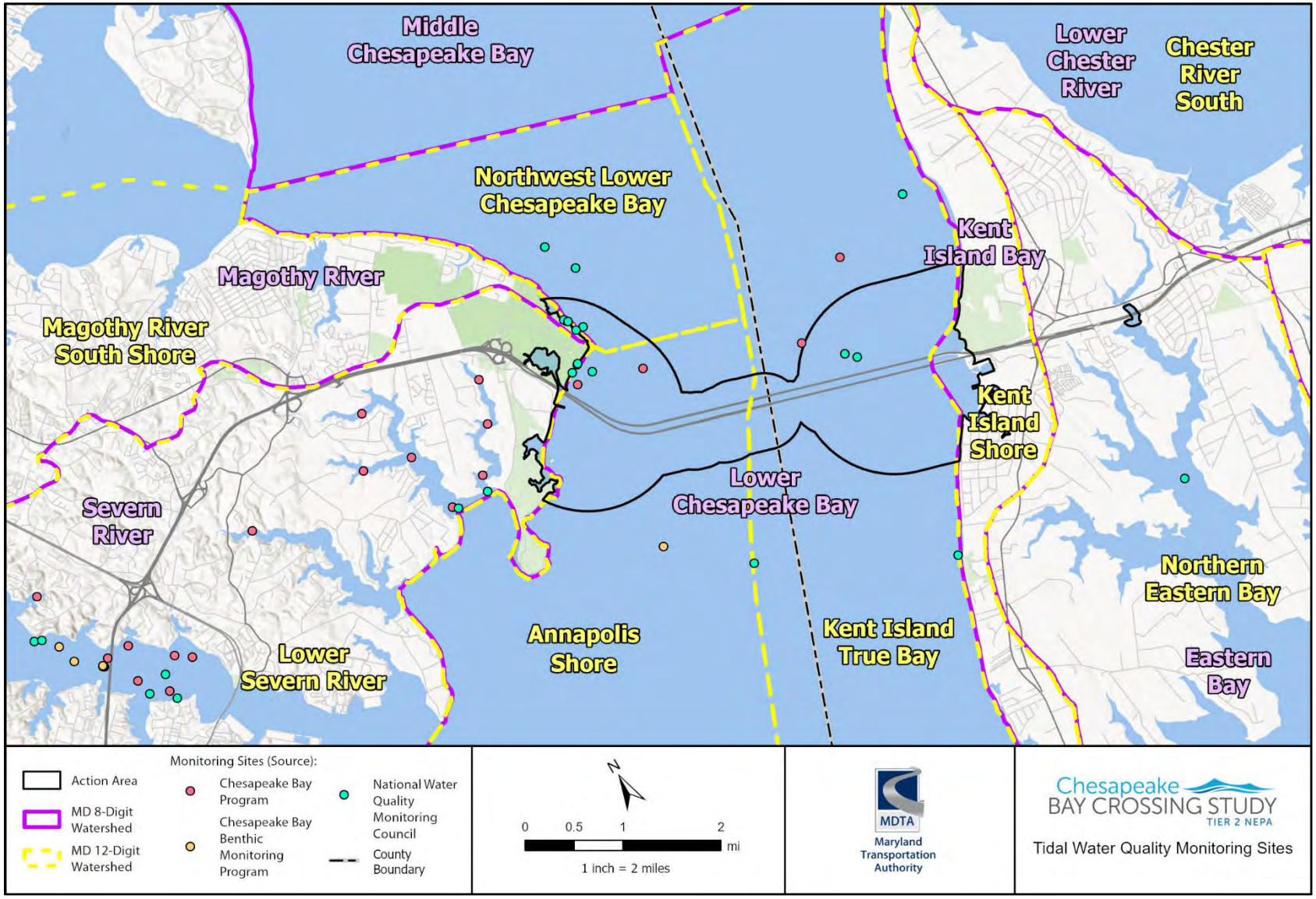
Figure 3-2: Sub-watersheds



Surface Water Quality

Nontidal and tidal waterways have different state and federally regulated water quality criteria. They also have guidelines that are not regulated criteria, intended to identify stress levels for aquatic biota. Monitoring locations utilized for water quality analyses within the Action Area are illustrated in **Figure 3-3**. Surface water quality of water bodies within the Action Area is described in more detail in the *Draft EIS* and *Natural Environment Technical Report.*

Figure 3-3: Water Quality Monitoring Sites



Major tidal waterways within and adjacent to the Action Area include the Chesapeake Bay, Mezick Pond, and Cox Creek. The Chesapeake Bay is designated by MDE as a Use II tidal waterway, or tidal waters designated for supporting estuarine and marine aquatic life and shellfish harvesting. East of U.S. 50/301, most surface flow is directed toward Mezick Pond and flanking wetlands, which are located within Sandy Point State Park, with hydrology directly connecting to the Chesapeake Bay. This area is largely influenced by the tides and floodplain, and therefore a mostly tidal estuarine system exists. Within the Eastern Bay Watershed, Cox Creek is a large Use II perennial tidal waterway which extends north and south of U.S. 50/301. Large areas of estuarine common reed (*Phragmites australis*) wetlands are located along the western bank of Cox Creek, on the south side of U.S. 50/301.

Tidal grab sample and in situ water quality data collected in the Annapolis Shore, Northern Eastern Bay, and Kent Island True Bay MD 12-digit watersheds were reviewed for this assessment, since these watersheds directly cross the Action Area and drain into the Chesapeake Bay in the vicinity of the Action Area. Water quality data was gathered from MDE, Maryland Department of Natural Resources (MDNR) Eyes on the Bay Program and other monitoring programs accessed through the Chesapeake Bay Program (CBP). In situ data were obtained from MDNR's Chesapeake Bay Benthic Monitoring Program (CBBMP). It should be noted that in-situ data collected at one point in time are not representative of the full range of water quality conditions throughout the year in which data was collected, or across years.

Salinity within the Action Area generally ranges from 0.5 to 22.32 parts per thousand (ppt), and conductivity generally ranges from 3,100 to 35,500 UMHO/cm. Temperatures range from 1.0 to 30.9°C, pH ranges from 6.8 to 9.6, dissolved oxygen (DO) levels range from 0.09 to 17.8 mg/L, total suspended solids (TSS) range from 0 to 134 mg/L, Enterococcus bacteria levels range from 10 to 2,010 MPN/100mL, and Fecal Coliform bacteria levels range from 1 to 1,100 MPN. Tidal water quality within and surrounding the Action Area indicates many sampling locations are in compliance with current state and federal criteria and acceptable ranges of predicted stressors to aquatic biota. However, observations indicate that pH, DO, Enterococcus Bacteria, and Fecal Coliform Bacteria levels in the vicinity of the Action Area are not in compliance with Code of Maryland Regulations (COMAR) criteria for Use II waterways. In general, water quality is better within the main stem of the Chesapeake Bay than in adjacent tidal creeks due to tidal flushing.

High pH, low DO, and high bacteria levels may be caused by industrial, agricultural, and urban discharges of nutrient runoff. High pH levels can result in decreased reproduction, growth, biodiversity, and damage to fish organs and long-term exposures can result in death (EPA CADDIS, 2025). High pH levels could also affect the distribution of SAV within the Action Area. Waters with low DO are unlikely to support SAV, and low DO can affect aquatic community structure by altering the food web in favor of species and life stages that are more tolerant to low oxygen conditions. Low DO can also have acute effects on aquatic life resulting in biological impairments and even death. High bacteria levels in water can adversely impact fish by depleting oxygen levels as they decompose.

3.4 Aquatic Resources

Subtidal Benthic Habitat

Bottom substrates within the Action Area, based on MDNR's Chesapeake Bay Bottom Survey data (Smith et al., 2001), are mapped in the Annapolis Shore, Kent Island True Bay, and Kent Island Shore 12-digit watersheds. The Chesapeake Bay Bottom Survey geodatabase characterizes bottom type designations determined by MDNR's acoustic bay bottom survey conducted from 1974 to 1983 and includes natural oyster rubble and sand within the Action Area. Because this dataset is up to 30 years old and areas identified as cultch bottom when the survey was conducted may have degraded since the time of the survey, quantitative impacts were not calculated using this data source. More information on bottom substrates is discussed in the *Draft EIS*.

Benthic Macroinvertebrates

Benthic macroinvertebrate data was available from MDNR for the Action Area. Benthic macroinvertebrate data is used to calculate the Chesapeake Bay IBI (Bay-IBI), which varies based on salinity regime and bottom substrate (Weisberg et al., 1997; Llansó and Dauer, 2002). Benthic IBI scores within the vicinity of the Action Area range from "meets restoration goals" to "severely degraded." Benthic habitat, characteristics, and available data are discussed in more detail in the *Draft EIS*.

Submerged Aquatic Vegetation

SAV is designated as a Habitat Area of Particular Concern (HAPC) for summer flounder by the Mid-Atlantic Fisheries Management Council and is considered a priority habitat by NOAA Fisheries and MDNR resource managers. Within the Action Area, SAV has been identified on the eastern shoreline of the Chesapeake Bay mainstem along Terrapin Nature Park, north of the existing Chesapeake Bay Bridge. Within the period 2019 through 2023, SAV was only mapped within this area in 2019, and coverage was sparse.

Review of historical mapping revealed that SAV beds were much more abundant from 1971 through the early 2000s than they are currently. Numerous studies suggest that increases in nutrient loading are the primary cause of these declines.

As shown in **Figure 3-4**, SAV has been documented along the northern side of the eastern terminus of the Bay Bridge within the Action Area. The extent of SAV present in the vicinity of the Action Area was determined through an analysis of the existing and historical SAV beds documented by the Virginia Institute of Marine Science (VIMS) SAV monitoring program.

The 5-year average extents of SAV were determined using a GIS overlay of the Action Area with the VIMS data from 2019 through 2023. The MDTA analyzed SAV density from year to year, utilizing the 2000 to 2023 annual datasets from VIMS. MDNR considers any area mapped in those 5 years to be habitat that supports SAV, even if SAV is not found there on a given date during the growing season. This analysis revealed historic patterns and trends that enhanced understanding of SAV in the Action Area. The extent of SAV coverage would be re-evaluated at the time of permitting based on the 5-year composite coverage from VIMS.

From 2019 through 2023, 6 species of SAV were documented in the VIMS survey segments that are crossed by the Action Area (e.g., CBP segments). These 6 SAV species were all documented

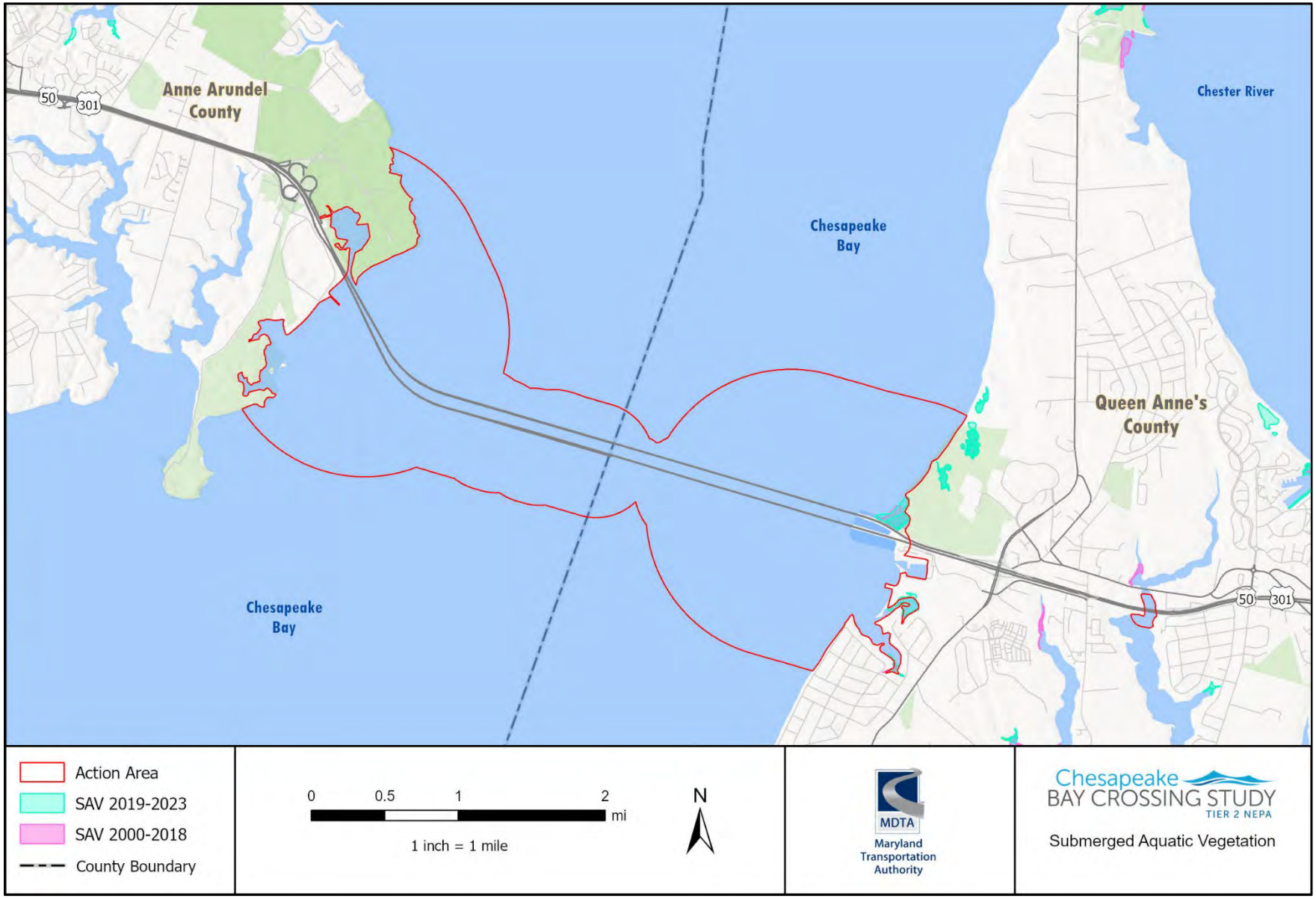
in 2019 in segment CB4MH. From 2020-2023, there were no recorded SAV ground survey observations within segment CB4MH. SAV likely to inhabit the Action Area range from freshwater to mesohaline species that can tolerate moderate salinity levels. These species are typically found in the middle and upper reaches of the Chesapeake Bay (see **Table 3-1**). Surveys conducted by VIMS occur later in the growing season; therefore, the presence and density of horned pondweed (*Zannichellia palustris*) beds is often underrepresented as the species senesces during warmer months. SAV habitat and the VIMS data development are discussed in detail in the *Natural Environmental Technical Report.*

Table 3-1: SAV Species Documented within the Action Area from 2019-2023*

Common Name	Scientific Name
Eurasian watermilfoil	*Myriophyllum spicatum*
Sago pondweed	*Stuckenia pectinata*
Redhead grass	*Potamogeton perfoliatus*
Common elodea	*Elodea canadensis*
Horned pondweed	*Zannichellia palustris*
Widgeon grass	*Ruppia maritima*

***Species identified only in 2019. All other years had no recorded VIMS SAV ground survey observations.

Figure 3-4: Submerged Aquatic Vegetation within the Action Area



Oyster Beds

The eastern oyster (*Crassostrea virginica*) is a critical component of the Chesapeake Bay ecosystem. Oyster habitat is typically brackish or salt water from 8 to 35 feet deep (CBP, 2023).

Information on the locations and characteristics of oyster beds within the Action Area was obtained from MDNR's Maryland Shellfish GIS layers, which provide locations of significant oyster features, including legally described Natural Oyster Bars (NOBs), designated Oyster Sanctuaries and oyster seeding areas, Public Shellfish Fishery Areas, and historic oyster bars, sites where watermen have engaged in oyster harvesting for centuries (MD iMap, 2023).

Oyster beds are located throughout the Chesapeake Bay. Within the Action Area north of the Bay Bridge, historic oyster habitat exists from approximately 1,400 feet to 4,500 feet off the Anne Arundel County shoreline towards the main channel. South of the Bay Bridge, historic oyster habitat exists from approximately 1,800 feet to 5,200 feet off the Anne Arundel County shoreline towards the main channel. See **Figure 3-5** for the location of oyster beds and habitat. This contiguous area of historic oyster habitat from the Magothy River, north of the Bay Bridge to the Severn River, south of the Bay Bridge, encompasses more than 2,000 acres. Oyster plantings and NOBs are located within the Action Area north and south of the Bay Bridge and oyster sanctuaries are located within Cox Creek in Queen Anne's County within the Action Area.

Fish

Information on tidal fish communities within the vicinity of the Action Area was compiled from the VIMS Chesapeake Bay Multispecies Monitoring and Assessment Program (ChesMMAP) online database (VIMS, n.d.). The ChesMMAP survey is used to describe fish assemblages in the Chesapeake Bay. For additional discussion of ChesMMAP, see the *Natural Environment Technical Report*. Tidal data from ChesMMAP was received from VIMS on January 18, 2024. Twenty-six species were detected at stations sampled from 2013 through 2023 and within 5 miles of the Bay Bridge. This 5-mile extent of the Chesapeake Bay mainstem on either side of the bridge captures the mouth of the Magothy and Severn Rivers on the western shoreline and north to Love Point on the Eastern Shore. Species documented are included in **Table 3-2**.

Figure 3-5: Oyster Beds and Habitat within the Action Area

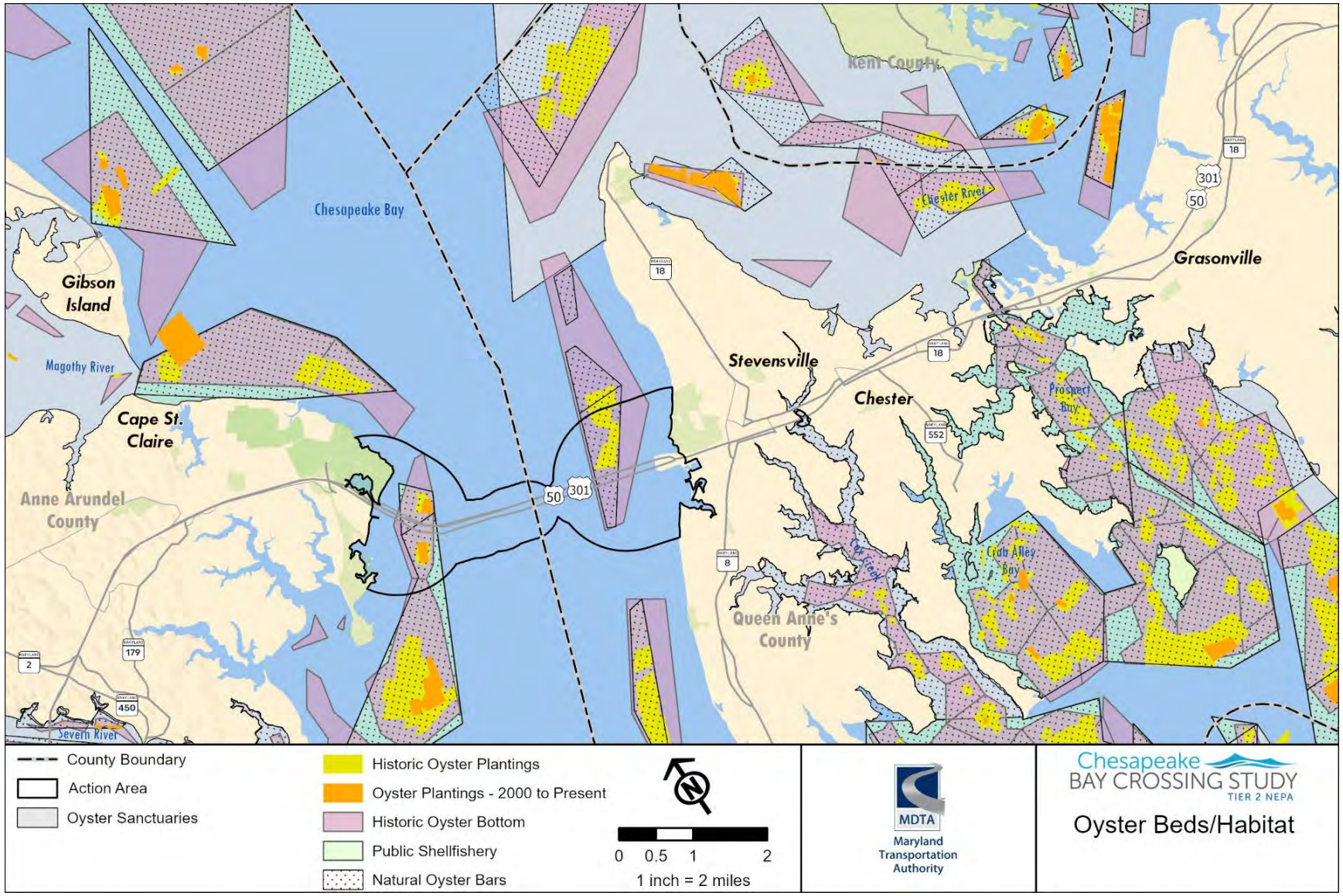


Table 3-2: Fish Species Documented Within 5 Miles of the Bay Bridge (2013-2023)

Common Name	Scientific Name	Common Name	Scientific Name
Alewife	*Alosa pseudoharengus*	Harvestfish	*Peprilus paru*
American eel	*Anguilla rostrata*	Hogchoker	*Trinectes maculatus*
American shad	*Alosa sapidissima*	Oyster toadfish	*Opsanus tau*
Atlantic croaker	*Micropogonias undulatus*	Rough scad	*Trachurus lathami*
Atlantic menhaden	*Brevoortia tyrannus*	Silver perch	*Bairdiella chrysoura*
Atlantic sturgeon	*Acipenser oxyrinchus*	Spanish mackerel	*Scomberomorus maculatus*
Bay anchovy	*Anchoa mitchilli*	Spot	*Leiostomus xanthurus*
Blue catfish	*Ictalurus furcatus*	Striped anchovy	*Anchoa hepsetus*
Blueback herring	*Alosa aestivalis*	Striped bass	*Morone saxatilis*
Bluefish	*Pomatomus saltatrix*	Summer flounder	*Paralichthys dentatus*
Channel catfish	*Ictalurus punctatus*	Weakfish	*Cynoscion regalis*
Cownose ray	*Rhinoptera bonasus*	White catfish	*Ameiurus catus*
Gizzard shad	*Dorosoma cepedianum*	White perch	*Morone americana*

Source: VIMS ChesMMAP

MDNR Environmental Review Program (ERP) indicated a diverse range of resident and migratory finfish species inhabit the tidal portion of the Chesapeake Bay and potentially occur in the vicinity of the Bay Bridge. The Chesapeake Fish Passage Prioritization (CFPP) project tool and MDNR's diadromous fish GIS data indicate that there are various diadromous species within the Action Area. The mainstem Chesapeake Bay is a significant migratory pathway for all diadromous species migrating/emigrating to/from the upper Bay and its tributaries. See the *Natural Environment Technical Report* for additional information regarding fish species.

Based on a review of the CFPP project tool and MDNR's diadromous fish GIS data, the species in **Table 3-3** are either documented to occur (D), likely to occur (L), or potentially occur (P) within these watersheds. Per MDNR ERP, areas including Whitehall Creek and Weems Creek are habitat for white perch and yellow perch.

Table 3-3: Diadromous Fish Species in the Action Area[1]

Common Name	Lower Severn River	Kent Island Shore	Northern Eastern Bay
Alewife	D	D	D
Blueback herring	L	--	L
American shad	D	D	D
Hickory shad	D	D	D
Striped bass	D	L	L
White perch	D	L	L
Yellow perch	D	--	--

[1] Note that the absence of these species in certain watersheds does not mean that they do not occur, rather that they are not specifically noted in the CFPP project tool and MDNR GIS data. The CFPP project tool uses waterbody feature center lines to display this information; therefore, certain species are likely unaccounted for in watersheds including open tidal portions of the Chesapeake Bay.

American eels are also found throughout all tidal and nontidal watersheds crossed by the Action Area. Special attention has been given to American eel management in recent years, due to their ecological and economic importance, and their declining numbers. American eels are catadromous, meaning they primarily live in rivers and estuaries but return to the ocean to spawn.

Fish Blockages

Information regarding fish blockages within the Action Area was obtained from the CFPP database, which was reviewed for all watersheds crossed by the Action Area. MDNR's Fish Blockage Locations GIS shapefile (MD iMap, 2017) and the North Atlantic Aquatic Connectivity database were used to supplement fish blockage information in the CFPP database. Four migration barriers exist in the Lower Severn River 12-digit watershed. These barriers can affect the historical range for the diadromous species that utilize the watershed. The culverts that carry tidal waterways under U.S. 50/301 within the Action Area are not listed as fish blockages in the CFPP database.

4 ESSENTIAL FISH HABITAT DESIGNATIONS

4.1 Essential Fish Habitat Within the Action Area

The Mid-Atlantic Fishery Management Council (MAFMC) (created by the MSA) is the regional fishery management council responsible for development of Fishery Management Plans (FMPs) for marine fisheries in U.S. federal waters (3-to-200 miles off the coasts) within the Mid-Atlantic region, including the portion of the Chesapeake Bay spanned by the Tier 2 Study Action Area. Based on text descriptions from the FMPs, the MDTA identified six species, included in **Table 4-1**, that are likely to occur within the Action Area. The following habitat parameter assumptions were used to assess fish habitat within the Action Area: a depth ranging from 0 to 92 feet below Mean Low Water (MLW), a salinity range of 5 to 18 ppt, and a water temperature range of 40° to 83 °F (4° to 28 °C). EFH for the species and life stages shown in **Table 4-1** is present within the Action Area. See **Appendix C** for an explanation of why Clearnose skate (*Raja eglanteria*) do not have EFH within the Action Area.

Table 4-1: EFH Designations Within the Action Area

Species Present	Life Stage(s)	Habitat
Atlantic butterfish *(Peprilus triacanthus)*	Eggs, larvae, juvenile, adults	Pelagic estuaries including the Chesapeake Bay, bottom depths between 33-1,150 feet, upper 650 feet of water column, water temps 40-81.5 °F, salinity above 5ppt.
Black sea bass *(Centropristis striata)*	Juvenile, adults	Inshore estuaries, water temps >43 °F, structured habitats (natural and man-made), “mixing” salinity zone.
Bluefish *(Pomatomus saltatrix)*	Juvenile, adults	Major estuaries, “mixing” salinity zone.
Scup *(Stenotomus chrysops)*	Juvenile, adults	Estuaries, “mixing” salinity zone, water temps >45 °F, salinity above 5ppt.
Summer flounder *(Paralichthys dentatus)*	Larvae, juvenile, adults	Pelagic estuaries, “mixing” salinity zone, nearshore, water temps >37 °F, depths between 30-230 feet.
Windowpane flounder *(Scophthalmus aquosus)*	Juvenile, adults	Estuaries, sandy substrate, “mixing” salinity zone, maximum depth of 200 feet.

4.2 Managed Fish Species

This section includes a brief summary of ecological information compiled from NOAA Fisheries' EFH source documents and other relevant sources.

4.2.1 Atlantic Butterfish

The Atlantic butterfish is a migratory species that ranges from Newfoundland and the Gulf of St. Lawrence to the Atlantic and Gulf coasts of Florida. Butterfish are a fast-growing, short-lived pelagic species that form loose schools, often near the surface. Based on the available habitat in the Action Area, eggs, larvae, juvenile, and adult Atlantic butterfish are likely to occur within the Action Area based on ecological and salinity tolerances of the species. Butterfish migrate seasonally, wintering near the edge of the continental shelf in the Middle Atlantic Bight and moving inshore in the spring into southern New England and Gulf of Maine waters. Butterfish occur throughout the entire mid-Atlantic shelf during the summer, from sheltered bays and estuaries, such as the Chesapeake Bay, out to depths of approximately 650 feet (about 200 meters) (Cross et al., 1999).

Butterfish spawning occurs from May to October in the Middle Atlantic Bight, on the continental shelf, inshore areas, and bays and estuaries, including the Chesapeake Bay, where spawning begins as early as late May and peaks in June and July. Butterfish eggs and larvae are pelagic and occur from the outer continental shelf to higher salinity parts of estuaries in the Middle Atlantic Bight. Butterfish eggs are approximately 0.68 to 0.82 mm in size, butterfish larvae are approximately 2.6 to 16 mm in size, and both eggs and larvae weigh less than 2 grams (Robins and Ray, 1986). Based on the Northeast Fisheries Science Center's (NEFSC) Marine Resources Monitoring, Assessment and Prediction program ichthyoplankton survey, eggs can be found in water temperatures ranging from 43º to 79ºF (6º to 26ºC) but can be found most often in water temperatures ranging from 52º to 63ºF (11º to 17ºC). Eggs are found in surface waters at depths ranging from 33 to 5,740 feet (10 to 1,750 meters) but are mostly found at depths less than 650 feet (200 meters). Butterfish larvae can be found in water temperatures ranging from 45º to 79ºF (7º to 26ºC) and depths ranging from 33 to 4,100 feet (10 to 1,250 meters) but occur most often in water temperatures ranging from 48º to 66ºF (9º to 19ºC) and depths less than 820 feet (250 meters). Butterfish eggs tolerate estuarine to full seawater (about 25 to 33 ppt), and butterfish larvae tolerate salinity levels ranging from 6.4 to 37.4 ppt. Butterfish eggs and larvae are common in high salinity zones of estuaries in the Middle Atlantic Bight, and in the mixing zone of the Chesapeake Bay (Cross et al., 1999).

Juvenile and adult butterfish are pelagic and form loose schools near the surface. Juvenile butterfish are approximately 16 to 120 mm in size and typically weigh approximately 0.06 to 36 g, and adult butterfish are approximately 121 mm to 31 cm in size and typically weigh approximately 36 to 712 g (Robins and Ray, 1986). Both juveniles and adults are tolerant of wide water temperatures (14º to 71ºF (4.4º to 21.6º C)) and salinity (5 to 32 ppt) ranges. Juvenile and adult butterfish are often found over sand, mud, and mixed substrates. During the summer months, butterfish occur inshore where they remain at shallow depths and are frequently observed on shallow flats, in sheltered bays and estuaries, and in the surf zone. Smaller juvenile butterfish often form groups beneath floating objects, such as jellyfish, while larger juveniles are pelagic schooling fishes which are found near the bottom during the day and disperse upwards at night. Butterfish are primarily planktivorous and feed on a variety of planktonic prey, including mollusks, crustaceans, worms, coelenterates, small fish, and ctenophores (Cross et al., 1999).

Butterfish are managed under the Mackerel, Squid, Butterfish FMP. The FMP is administered by the MAFMC and includes commercial quotas, recreational limits, as well as other thresholds as defined on the MAFMC website (www.mafmc.org).

4.2.2 Black Sea Bass

The black sea bass is a warm temperate migratory species that ranges from Southern Nova Scotia and the Bay of Fundy to southern Florida and into the Gulf of Mexico. The black sea bass exists as two populations, or stocks: the Middle Atlantic stock and the South Atlantic stock. Black sea bass are seasonal migrants. Based on the available habitat in the Action Area, juvenile and adult black sea bass are likely to occur within the Action Area based on ecological and salinity tolerances of the species. When water temperatures dip below 57ºF (14ºC) in the autumn, the Middle Atlantic stock migrates south and offshore to wintering areas in deeper waters between New Jersey and North Carolina. As bottom waters warm above 45ºF (7ºC) in the spring, the stock migrates inshore to coastal areas and bays, including the Chesapeake Bay.

Black sea bass spawning occurs from May to July in the Middle Atlantic population, primarily along the inner continental shelf during inshore migrations. Black sea bass eggs are pelagic and typically found in water ranging from 54º to 75ºF (12º to 24ºC) at depths less than 120 feet (50 meters), according to the NEFSC Marine Resources Monitoring, Assessment and Prediction Program (MARMAP) ichthyoplankton survey. Black sea bass eggs are not often found in estuaries. Black sea bass larvae are also pelagic and are most commonly found in waters ranging from 52º to 79ºF (11º to 26ºC) at depths less than 392 feet (200 meters). Similarly to their eggs, black sea bass larvae are seldom found in estuaries. Black sea bass eggs and larvae are sensitive to extremely low or high salinity levels, and larvae prefer salinity levels ranging from 30 to 35 ppt (Steimle et al., 1999).

Juvenile black sea bass are most abundant in oceanic waters and polyhaline estuaries. They are most commonly encountered in the spring and summer where they are generally associated with structurally complex habitats and steep depth gradients. Juvenile black sea bass display extremely high site fidelity and use a variety of man-made habitats including artificial reefs, shipwrecks, bridge abutments, piers, and pilings. In the Mid-Atlantic Bight, most black sea bass nurseries occur at depths less than 65 feet (20 meters). Within estuaries, older juveniles use habitats less than 33 feet (10 meters) deep. Growth rates of juvenile black sea bass vary with temperature, salinity, DO levels and prey quality. They prefer intermediate salinities between 28 and 36 ppt, however they may occur at salinities as low as 8 ppt. Juveniles prefer temperatures between 40 º to 65º F (4 to18 ºC), and a wide range of depths (between 3 feet to 460 feet (1 to 140 meters) (Drohan et.al., 2007).

Adult black sea bass prefer deeper waters (6 to 125 feet (2 to 38 meters)) and salinity levels greater than 20 ppt in the summer, when they can be found occupying mussel beds, rocky bottom areas, artificial reefs, wrecks, and other structures. Adult black sea bass are approximately 11 to 60 cm in size and typically weigh approximately 24 to 3,390 g (Robins and Ray, 1986). Adult black sea bass are found at much greater depths (typically 197 to 492 feet (60 to 150 meters)) and prefer water temperatures ranging from 48º to 54ºF (9º to 12ºC). Adult black sea bass prefer salinity levels ranging from 15 to 35 ppt and are intolerant of DO levels less than 2 parts per million (ppm). Adult black sea bass prey on epibenthic invertebrates as well as small fish and squid (*Lolliguncula brevis*) (Steimle et al., 1999).

Black sea bass are managed under the Summer Flounder, Scup, and Black Sea Bass FMP. This FMP is administered jointly by the Atlantic States Marine Fisheries Commission (ASMFC) and MAFMC, and includes commercial quotas, recreational limits, as well as other thresholds as defined on the MAFMC website (www.mafmc.org).

4.2.3 Bluefish

The bluefish is a migratory species that is found in the Atlantic Ocean from Maine to Florida, and around the world in temperate coastal regions (Fahay et al., 1999). Bluefish are a pelagic species, inhabiting the water column anywhere from the surface to the ocean floor, but are usually found between 25 to 33 feet deep. Based on the available habitat in the Action Area, juvenile and adult bluefish are likely to occur within the Action Area based on ecological and salinity tolerances of the species. Juvenile bluefish are approximately 4 to 24 cm in size and weigh approximately <2 to 145 g (Dooley, 1990). Juvenile bluefish generally occur in estuaries from May through October in Mid-Atlantic waters (Shepherd, 2006). Bluefish migrate seasonally, moving north in spring and

summer as water temperatures rise and then south in autumn and winter to waters in the South Atlantic Bight (NOAA Fisheries, 2025).

Based on VIMS bottom trawl surveys within the Chesapeake Bay tributaries between 1988 and 1999, juvenile bluefish prefer salinity ranges greater than 16 ppt, with the majority of fish in the 31 ppt to 32 ppt range (Shepherd, 2006) but are known to enter estuaries where salinity is less than 10 ppt (SMS, 2005). Most juveniles occur between 75.2°F and 78.8°F (24° to 26°C) and at DO levels of 6 to 8 ppm (Shepherd and Packer, 2006). Bluefish cannot tolerate temperatures below 50°F (10°C) or above 86.7°F (30.4°C) (SMS, 2005), and as a pelagic open water species, bluefish are not well adapted to hypoxic conditions. Juveniles prefer sandy ocean bottoms but will also inhabit mud, silt, or clay ocean bottoms or vegetated areas (NOAA Fisheries, 2025). Disturbances that increase water turbidity may affect distribution and feeding of bluefish due to a reliance on vision to locate prey.

Adult bluefish live in both inshore and offshore areas and favor warmer water (NOAA Fisheries, 2025). Adult bluefish are approximately 25 to 115 cm in size and weigh approximately 163 g to 6.8 kg (Dooley, 1990). Spawning occurs in open ocean waters and takes place twice a year. It is also possible that the species has a long spawning period, and the eggs do not survive during the middle of the season, which gives the appearance of two separate spawning periods. Once bluefish hatch and are able to swim, they appear in nursery areas in estuaries and along the continental shelf in late May to mid-June with a second stock of juveniles appearing in estuaries in late August (Shepherd and Packer, 2006). Juveniles from both seasons migrate toward North Carolina in October. The current bluefish FMP was implemented in 1990 and prepared cooperatively by the MAFMC and the ASMFC. The FMP limits recreational and commercial fishing for the bluefish (these fishing limits are described in detail on the MAFMC website (www.mafmc.org)).

4.2.4 Scup

Scup is a migratory species that is found in the Atlantic Ocean from Maine to Cape Hatteras, North Carolina (Steimle et al., 1999), although it has been found as far south as Florida coastal areas and bays in the spring. Based on the available habitat in the Action Area, juvenile and adult scup are likely to occur within the Action Area based on ecological and salinity tolerances of the species. The life history of scup is typical of most demersal fishes, with pelagic eggs and larvae, and a gradual transition to the demersal adult stage. There are two stocks of scup: Mid-Atlantic and South Atlantic, however the South Atlantic population has not been assessed and so the population status is unknown (NOAA, 2025). The Middle Atlantic Bight scup population appears to make extensive seasonal migrations and is commonly found during the summer in larger estuaries such as the Chesapeake Bay and in coastal waters.

Scup spawn once a year beginning in spring when water temperatures are greater than 50°F (10°C), along the inner continental shelf off southern New England from May through August, with a peak in June to July. Most spawning occurs in southern New England in shoal waters less than 33 feet deep until late June, when scup move into deeper waters. As inshore temperatures drop below 46°F (8°C) in the winter, scup migrate to warmer waters along the outer continental shelf to about 200 meters deep. Juveniles follow adults to the mid to outer continental shelf south of Long Island, although some remain in larger and deeper estuaries during warmer winters. During the summer and early fall, juveniles and adults are common in most larger estuaries and coastal areas in open and structured habitats. Juvenile scup appear in estuaries such as the Chesapeake

Bay in June, migrate south for the winter, and return in the spring. Juvenile scup feed during the day, primarily on polychaetes, epibenthic amphipods, and other small crustaceans, mollusks and fish eggs and larvae. Copepods and mysids are also important to early juvenile diets. Juvenile scup are approximately 1.5 to 13 cm in size and weigh approximately 0.05 to 45 g. Juvenile scup have been collected at bottom temperatures of 45° to 65°F (7°to 18°C) in the spring and 59° to 72°F (15° to 22°C) in the fall at salinities of 18 to 33 ppt, and DO levels greater than 4 ppm.

Adult scup reside in the Middle Atlantic Bight from spring to fall and are generally found on a variety of structured habitats such as mussel beds, reefs, or rough bottom. Adult scup are approximately 15.5 to 46 cm in size and weigh approximately 79 g to 2.1 kg. Smaller adult scup are commonly found in larger bays and estuaries such as the Chesapeake Bay, but larger scup tend to be found in deeper waters. Adult scup are benthic feeders and forage on a variety of prey, including small crustaceans, polychaetes, mollusks, small squid, vegetable detritus, insect larvae, hydroids, sand dollars, and small fish. When scup move inshore, they gradually accumulate food reserves from the spring into the fall to support extra energy demands of migration, reproductive development, and reduced feeding in winter. Adult scup can be found at bottom water temperatures of 43° to 81°F (6° to 27°C), and their winter distribution is mostly limited by their preferred lower limit of 45°F (7°C). Adult scup are found primarily in waters with the salinity range of 20 to 31 ppt and DO levels greater than or equal to 4 ppm.

4.2.5 Summer Flounder

Summer flounder exhibit strong seasonal inshore-offshore movements, although they are not as migratory as other species (Packer et al., 1999). Their geographical range encompasses the shallow estuarine waters and outer continental shelf from Nova Scotia to Florida; however, they are most abundant within the Middle Atlantic Bight from Cape Cod, MA to Cape Hatteras, NC. Based on the available habitat in the Action Area, larvae, juvenile, and adult summer flounder are likely to occur within the Action Area based on ecological and salinity tolerances of the species. Adult flounder normally inhabit shallow coastal and estuarine waters such as those of the Chesapeake Bay during the warmer months at depths of 40 to 50 feet (12 to 15 meters) and move offshore during colder months to the outer continental shelf, as deep as 150 meters. Some older adults have been shown to remain offshore year-long; however, due to overfishing most summer flounder are three years of age or less.

Tagging studies have shown that fish which spend their summer in a particular bay tend to return to that same bay in the following year. Migration timing of inshore fish varies across regions but typically occur around late April and early May. Summer flounder migrate to the outer continental shelf beginning in September or October, and it is believed that spawning occurs within the territorial waters south of Cape Cod. Summer flounder adults average 30-50cm in length and they are found in salinities of 15ppt or more. Preferred habitat for summer flounder includes sandy/shell substrates or artificial reefs (Packer et al., 1999). Information regarding summer flounder HAPC, SAV, is included in **Section 4.3**.

Estuaries, such as the Chesapeake Bay, serve as an important nursery area for juvenile summer flounders, at intermediate or high salinities. Summer flounder spawn during the fall and winter as fish move offshore to the open ocean areas of the continental shelf. The older and larger fish migrate first each year, timed by the beginning of the spawning migration period which can vary by latitude (Packer et al., 1999).

Larval summer flounder are planktonic and most abundant at depths of 10 to 70 meters between September and February (Packer et al., 1999). Larval summer flounder are approximately 8.1 to 17 mm in size and weigh less than 2 g (Robins and Ray, 1986). Larvae are most abundant at temperatures ranging from 48° to 64°F (9° to 18°C), and salinities of 20 to 35ppt. Once larval to juvenile metamorphosis begins, they leave the water column and settle to the bottom where they bury in the sediment and develop into juveniles. Juvenile summer flounder are distributed inshore and in many estuaries throughout the species range during spring, summer, and fall. Juvenile summer flounder are approximately 18 to 390 mm in size and weigh approximately 0.04 to 666 g (Robins and Ray, 1986). Some juveniles will migrate offshore to deeper waters with adult fish during the colder months, however most will remain inshore. Juvenile summer flounder inhabit many estuarine habitats such as marsh creeks, seagrass beds, mud flats, and open bay areas, in similar temperature and salinity profiles as larval summer flounder.

Adult summer flounder are often found in temperatures from 48° to 79°F (9° to 26°C) in the fall, 39° to 55°F (4° to 13°C) in the winter, 36° to 68°F (2° to 20°C) from the spring, and 48° to 81°F (9° to 27°C) in summer, and high salinity portions of estuaries. Adult summer flounder are approximately 28 to 94 cm in size and weigh approximately 232 g to 12 kg (Robins and Ray, 1986). They are opportunistic feeders; however, fish and crustaceans make up the majority of their diet. They are most active during daylight hours and can be commonly found in seagrass and sand habitats. (Packer et al., 1999). DO effects on summer flounder adults have not been investigated.

Despite various literature suggesting several separate stock populations of summer flounder within the Atlantic Ocean habitats, summer flounder are managed and assessed as a single stock by the MAFMC within the U.S. Exclusive Economic Zone. Spring surveys have shown that the Chesapeake Bight is a significant habitat for this species, particularly for juvenile summer flounder.

4.2.6 Windowpane Flounder

The windowpane flounder is a fast-growing left-eyed flounder species found from the Gulf of St Lawrence to Florida. Windowpane flounder make seasonal movements as bottom temperatures decrease, though their movements are less significant than other more migratory species. Based on the available habitat in the Action Area, juvenile and adult windowpane flounder are likely to occur within the Action Area based on ecological and salinity tolerances of the species. Both adult and juvenile flounder make seasonal movements from estuarine areas such as the Chesapeake Bay and shallow coastal waters into deeper areas during the autumn but are wide ranging throughout the year along the continental shelf, according to NEFSC bottom trawl survey data (Chang et al., 1999).

Windowpane flounder spawning occurs throughout most of the year in the Middle Atlantic Bight, with separate peaks in the spring and autumn. Spawning occurs at or near the bottom in high-salinity areas of estuaries within the Middle Atlantic Bight, though spawning is not common in the Chesapeake Bay. Windowpane flounder eggs are pelagic and are found along the nearshore continental shelf in the Middle Atlantic Bight in water temperatures ranging from 41° to 68°F (5° to 20°C) at depths less than 230 feet (70 meters), according to the NEFSC MARMAP ichthyoplankton survey. Larvae are planktonic and are found across a similar geographic range to eggs, in water temperatures ranging from 37° to 66°F (3° to 19°C) at depths less than 230 feet

(70 meters). Windowpane flounder eggs and larvae are not common in the Chesapeake Bay (Chang et al., 1999).

Adult and juvenile windowpane flounder occur in nearshore bays and estuaries throughout the Middle Atlantic Bight throughout most of the year, moving into deeper waters in the winter. Juvenile windowpane flounder are approximately 11 mm to 21 cm in size and weigh approximately 0.02 to 106 g. Adult windowpane flounder are approximately 22 to 46 cm in size and weigh approximately 121 g to 1.05 kg (Robins and Ray, 1986). Both adult and juvenile flounder are typically found in waters less than 246 feet (75 meters) deep and at temperatures ranging from 39° to 75°F (4° to 24°C), on fine sandy sediment bottoms. Both adult and juvenile flounder tolerate salinity ranging from 15 to 33 ppt and DO levels ranging from 2 to 13 mg/l. Juvenile windowpane flounder prey upon small worms, fish, and crustaceans, especially mysid shrimp (Chang et al., 1999).

Windowpane flounder are managed by the New England Fishery Management Council (NEFMC) and NOAA Fisheries under the Northeast Multispecies FMP. This FMP includes commercial quotas, recreational limits, as well as other thresholds as defined on the NEFMC website (www.nefmc.org).

4.2.7 Prey Species of Managed Fish

Federally-managed fish species prey upon other fish species within the project area. Prey species are important to an assessment of federally-managed fish species occurrence because fish species often travel based on the migratory patterns of their prey. Any impacts to these prey species are likely to result in behavioral modifications to the federally-managed fish species as they adapt to the changing prey conditions. Prey species of each of the federally-managed fish species are discussed below.

Prey species within the project area that are consumed by butterfish include a wide variety of planktonic prey, including crustaceans, mollusks, small fish, and a variety of other invertebrate species (Cross et al., 1999). Plankton can be found in the Chesapeake Bay throughout the year.

Prey species within the project area that are consumed by black sea bass and scup include small crustaceans such as juvenile blue crab (*Callinectes sapidus*), mollusks such as mussels, multiple species of small pelagic baitfish, squid, and a variety of other aquatic invertebrates. Blue crab are found along the Atlantic coast from Massachusetts Bay to northern South America. Blue crabs are abundant throughout the Chesapeake Bay during the summer and male crabs winter in shallow grass beds, muddy-bottom areas, and deep water throughout the bay, while female crabs winter in saltier waters near the mouth of the bay (MDNR, 2007c). Blue crabs are managed by MDNR within the Action Area under the Chesapeake Bay Blue Crab FMP. This FMP includes commercial quotas, recreational limits, as well as other thresholds.

Prey species within the project area that are consumed by bluefish include bay anchovies, squid, butterfish, round herring (*Etrumeus sadina*), alewife, American shad, white perch, Atlantic menhaden, and blueback herring (Buckel et al., 1998).

Alewife and blueback herring are often managed together and collectively known as "river herring." Alewife spawn in coastal rivers in the spring when water temperatures reach 60.8°F (16°C) to 66.2°F (19°C), and blueback spawn in coastal rivers in temperatures of 69.8°F (21 °C)

to 75.2°F (24°C) (Haas-Castro, 2006). River herring have been managed since 1985 by ASMFC under the FMP for American shad and river herring to stop exploitation of the species. American shad are found from Labrador to northern Florida (Haas-Castro, 2006). Shad migrate to the Chesapeake Bay in the spring for spawning and leave the Bay by summer. The American shad is managed by ASMFC under the FMP for American shad and river herring. White perch inhabit the Chesapeake Bay and its tidal tributaries. Mid-Atlantic Acoustic Telemetry Observation System data for 2021 through 2024 from the Chesapeake Bay North Array, located just south of the Bay Bridge, indicates that tagged white perch were detected in the area around the Bay Bridge in March and April. They are found in open waters close to the shore and upstream tributaries (Lippson, 2006) and reside throughout the year within the Chesapeake Bay and its tributaries. White perch spawn in fresh or brackish water during the summer (Jordan and Evermann, 1896 to 1900).

Atlantic menhaden are an important food source for many predatory fish species in the Chesapeake Bay, including bluefish and summer flounder. They are common throughout the Chesapeake Bay from spring to fall. Menhaden are a migratory species and typically migrate from the Chesapeake Bay to deeper waters off the coast in late fall (VIMS, 2025a). Menhaden are managed by the ASMFC Atlantic Menhaden Management Board (ASMFC, 2025).

Other small forage fish species common in the Chesapeake Bay that are preyed upon by bluefish and summer flounder include Atlantic silversides (*Menidia menidia*), bay anchovies (*Anchoa mitchilli)*, killifishes (*Cyprinodontiformes* family), gizzard shad, and spot. Atlantic silversides are one of the most common forage fish species found in the Bay and are common in shallow waters of the Bay during the summer (CBP, 2025a). Bay anchovies are another abundant forage fish species found throughout the Bay. The striped killifish and mummichog are the most common killifish species found in the Chesapeake Bay. Mummichog can tolerate a wider salinity range and can be found in fresher water than the striped killifish, which prefers more saline waters (CBP, 2025b and CBP, 2025c). Gizzard shad are found year-round in fresh to slightly brackish waters in the Chesapeake Bay region. Mid-Atlantic Acoustic Telemetry Observation System data for 2021 through 2024 from the Chesapeake Bay North Array indicates that gizzard shad are common in the area around the Bay Bridge in November and December. Adult gizzard shad are tolerant of brackish to saline waters, while juveniles are less tolerant of salinity than adults and are more commonly found upstream in freshwater habitats (MDNR, 2007a). Spot are found in the Chesapeake Bay from spring to fall, before moving offshore to spawn. Spot are known to aggregate around a sand shoal near Sandy Point State Park during the summer (J. Watson – NOAA Fisheries, personal communication, January 7, 2026). Juveniles are more widespread than adults and can be found in the bay as well as freshwater habitats (MDNR, 2007b).

Prey species within the project area that are consumed by windowpane flounder include small worms, fish, and crustaceans, especially mysid shrimp (Chang et al., 1999). Mysid shrimp are abundant in the Chesapeake Bay and are an important food source for many juvenile and adult fish species (Sea Grant, 2021).

4.3 Habitat Areas of Particular Concern Within the Action Area

SAV, or rooted macrophytes, are important HAPCs for the growth and protection of juvenile summer flounder. SAV is present within and surrounding the Action Area. The Fisheries Management Councils and NOAA Fisheries provide conservation, management, and research

priority to HAPCs because they are critical elements of healthy ecosystems and sustainable fisheries.

4.3.1 SAV Habitat and Requirements

Summer flounder HAPC is defined by MAFMC as, "all native species of macroalgae, seagrasses, and freshwater and tidal macrophytes in any size bed, as well as loose aggregations, within adult and juvenile summer flounder EFH…". SAV beds serve as vital habitat for summer flounder in several life stages. Juvenile summer flounder favor eelgrass for shelter and feeding, as preferred prey species are attracted to eelgrass beds. Macroalgae beds are also used by juvenile flounder, as they offer similar ecological benefits to eelgrass beds. Adult flounder use seagrass and macroalgae beds as foraging habitat by sheltering in sandy areas within or adjacent to beds and using seagrass or macroalgae as visual cover to capture prey moving within the beds (Packer et al, 1999). SAV beds also serve as essential habitat for many other species.

SAV is present within the Action Area along the shoreline and shallows near Terrapin Nature Park, according to VIMS SAV GIS data from 2019-2023. The Chesapeake Bay Program Tier 1 SAV habitat areas include clear, shallow water (i.e., less than 1 meter deep) where sunlight can reach the bottom sediment. Turbidity in the water column limits the depth at which SAV can grow and can cause SAV dieback at high levels (VIMS, 2025b). Sediment can be trapped in epiphytic growth common on SAV plants, limiting their ability to photosynthesize by weighing them down and moving them out of the zone where photosynthetically-active radiation may reach. Excess nutrients in the water column contribute to algal blooms, which can shade underlying SAV and limit growth or cause die-back. Physical impact to SAV beds from dredging, debris, and boat propellers can uproot and damage SAV plants, eliminating sections of or even entire SAV beds.

5 ASSESSMENT OF IMPACTS AND MITIGATION MEASURES

The Tier 2 Study is in preliminary engineering for the Preferred Alternative and as such, design, construction, and demolition means and methods are based on preliminary assumptions. Impact analysis is estimated from preliminary design assumptions based on best professional judgement and information gathered from similar bridge construction projects. Dredging, pile driving for construction of the temporary trestles and new bridge, fill for pier protection, demolition of the existing bridges, and construction of roadway approaches would all cause adverse effects to EFH. Permanent impacts and extended temporary impacts (i.e., fills in place longer than 12 months) are both anticipated to result in short and long-term adverse effects to EFH. Details regarding construction activities, including the sequence of construction, are included in **Section 2.1**.

Table 5-1 summarizes the estimated impact of the Preferred Alternative to EFH and other aquatic habitats found within the Action Area. Impacts to EFH in acres were determined by overlaying the EFH boundaries from the NOAA Fisheries EFH Mapper with the Action Area in GIS. All EFH boundaries for federally-managed fish species were reviewed to ensure they accurately reflect the EFH text descriptions and were amended as needed.

Table 5-1: Action Area EFH and Aquatic Habitat Impacts

EFH Resource/Habitat	Impact (acres)
Atlantic butterfish* EFH – Adult, Juvenile, Larvae, and Egg	1,289
Black sea bass EFH – Adult and Juvenile Bluefish EFH – Adult and Juvenile Scup EFH – Adult and Juvenile Summer flounder EFH – Adult, Juvenile, and Larvae Windowpane flounder EFH – Adult and Juvenile	4,013
Tidal Wetlands (Acres)	9
Tidal Waterways** (Acres)	4,013
SAV† (Acres)	22
NOB (Acres)	729
Historic Oyster Bottom (Acres)	1,065
Oyster Plantings (Acres)	38
Oyster Sanctuaries (Acres)	15
Public Shellfisheries (Acres)	372

EFH boundaries derived from the NOAA Fisheries EFH Mapper – New England/Mid-Atlantic Region at: https://www.habitat.noaa.gov/protection/efh/newInv/index.html
** Atlantic butterfish EFH boundaries were amended from the NOAA-mapped EFH boundaries to more accurately reflect butterfish habitat as described in the EFH text description and only includes depths of 33 feet and greater.*
*** Tidal waterways are considered diadromous fish migrating, rearing, and ranging habitats.*
† The Action Area's 500-foot buffer of the Preferred Alternative LOD accounts for potential turbidity effects to SAV. The areas covered by the existing Bay Bridge structural elements were not excluded from the EFH impact numbers reported above.

The MDTA is committed to implementing appropriate mitigation measures to avoid and minimize adverse impacts to federally-managed fish species, their designated EFH, and HAPC identified within the Action Area. During final design, the MDTA, in consultation with NOAA Fisheries, would use the latest and evolving technologies, and techniques from similar projects in the area, to determine project-specific protection measures for aquatic resources. During construction, methods to minimize impacts within the Action Area would be implemented to the greatest extent practicable.

Potential construction BMPs to minimize impacts to federally-managed fish species were adapted from the *NOAA Fisheries/FHWA BMP Manual* (NMFS Greater Atlantic Regional Fisheries Office [GARFO], 2017) and the *FHWA Programmatic Essential Fish Habitat Consultation and General Concurrence for Select Transportation Actions in the NMFS Greater Atlantic Region* (NMFS GARFO, 2024). The MDTA will commit to and implement the avoidance and minimization measures listed as commitments and will consider all other measures/methods listed as considerations. Considerations will be coordinated and evaluated further during final design. A complete list of commitments and considerations is included in **Appendix B**.

5.1 Dredging

5.1.1 Impact Types, Magnitude, and Duration

Construction of the Preferred Alternative would include approximately 50.2 acres of dredging in shallow areas of the Chesapeake Bay. The exact timing of anticipated dredging is unknown; however, an estimated two thirds of the dredging would take place in the first and second years of construction to accommodate the eastbound bridge. The remaining dredging would occur when construction of the westbound bridge starts. Dredging for the eastbound bridge is estimated to take up to 14 days to complete and dredging for the westbound bridge is estimated to take up to 7 days to complete.

Turbidity and Sedimentation

Dredging would result in the destruction and degradation of benthic habitat and potential smothering of benthic populations through deposition of dredge-induced suspended sediment downstream of the dredging zone. Turbid water resulting from dredging adversely effects vision in fish, which can inhibit their predation success and limit their movements. Turbidity and sedimentation impacts from dredging would be temporary.

Reduced Water Quality

Dredging would potentially result in respiratory issues in fish, including gill injury, from the generation of suspended solids/turbidity, re-suspension of contaminants, and release of nutrients from the bottom sediments. The resulting eutrophication of the waters and increased biological oxygen demand would potentially result in reduced dissolved oxygen in the shallow water areas. Bluefish are not well-adapted to low DO levels; summer flounder are highly sensitive to DO levels less than 3 ppm; adult black sea bass are intolerant of DO levels less than 2 ppm; and adult scup are found primarily in waters with DO levels greater than or equal to 4 ppm.

Dredging could result in a decreased photic zone for SAV within the Action Area due to increased turbidity, which could limit growth. The Preferred Alternative preliminary LOD has been developed to avoid direct adverse effects to SAV. SAV is mapped outside the LOD, north of the existing bridge; therefore, shading impacts are not anticipated, and the direct impact of SAV from dredging or fill placement is not anticipated. However, SAV is located within the Action Area and construction could result in indirect adverse effects to SAV. Ground disturbances (i.e., dredging, grading) could indirectly affect SAV by increasing turbidity and sedimentation, which could adversely affect photosynthesis.

Water quality impacts from dredging would be temporary.

Habitat Alteration

Dredging would result in changes to bottom sediments and bathymetry in the shallow areas of the Action Area and would convert and/or completely fill bottom habitat of federally-managed fish species and their prey. Dredging is likely to result in fish and benthic organism mortality due to direct impact to benthic organisms and the removal of benthic habitat by dredge equipment. Existing habitat within the proposed dredging footprint would be permanently impacted. However, after initial dredging, the dredged areas would be left to restore naturally over a number of years, and benthic habitat would recover.

Fish Passage and Migration Habitat

Dredging could disrupt normal foraging and migration behaviors of federally-managed fish species within the Action Area, but this would be a temporary impact. Dredging for the eastbound and westbound bridges will be separate events in the construction schedule allowing for normal foraging and migration behaviors before, after, and between dredging events.

Vessel Interaction

Impacts to federally-managed fish species from vessel interaction are unlikely because dredging would utilize slow-moving vessels that fish can readily avoid. Impacts to SAV are possible from vessel movement and shading and would be temporary impacts.

Impingement/Entrainment and Entanglement

Fish entanglement and entrainment are unlikely to occur during dredging, given the current design assumptions.

5.1.2 Avoidance, Minimization, and Mitigation

5.1.2.1 Commitments Related to Dredging

Turbidity and Sedimentation

- Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls, such as turbidity curtains.
- Only use mechanical dredging.

Reduced Water Quality

- Only use clean fill.
- Evaluate dredge material to determine the appropriate disposal method and location.
- Remove cofferdams, turbidity curtains, or other diversion structures only after water quality is consistent with ambient levels outside the structure.

Habitat Alteration

- Employ an Independent Environmental Monitor (IEM).
- Coordinate with the NOAA Fisheries GARFO and MDNR on specific recommended time-of-year restriction dates, based on the proposed activities and location.
- Incorporate necessary measures to avoid, minimize, or otherwise offset impacts to SAV, as appropriate. Impacts to SAV shall be mitigated at a ratio of at least 3:1, depending on the nature and scale of impacts.

- Coordinate with NOAA Fisheries and MDNR during Final Design to determine if SAV surveys would be informative of permit conditions. If so, conduct SAV surveys during the growing season, prior to construction, within nearshore areas of the Action Area to determine the presence and extent of SAV beds.

Vessel Interaction

- Do not operate or moor vessels in or immediately adjacent to SAV in such a way that could shade or otherwise impact SAV.

5.1.2.2 Considerations Related to Dredging:

Turbidity and Sedimentation

- Use operational modifications such as conducting the work at low tide to limit sedimentation and turbidity.
    - This may include using an environmental bucket on mechanical dredges, reducing lift speeds, using small diameter cutterhead dredges, and/or limiting the use of large hopper dredges.
- Prohibit side-casting or temporary storage of dredged material in the waterway.
- Prohibit unfiltered or unprocessed overflows from barges into the water and ensure that any barge transfer is accomplished without generating sediment plumes.

Reduced Water Quality

- Monitor water quality to determine whether temperature and DO levels remain within a close threshold to background levels, as determined in coordination with NOAA Fisheries and MDNR in final design, and if levels fluctuate beyond this threshold, contact NOAA Fisheries and MDNR within 24 hours to determine appropriate actions.

Habitat Alteration

- Minimize maintenance dredging to the greatest extent practicable.
- Within the dredged area, leave benthic contours to restore naturally. If not restored within a certain time period (to be determined during final design in coordination with NOAA Fisheries and MDNR) then consider active restoration of bottom contours with clean sand fill.
- Design the dredge footprint to avoid sensitive habitats to the greatest extent practicable and provide appropriate buffers to protect these areas from accretion of sediment resuspended during dredging.
- Develop a project schedule and plan prior to construction, which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.
- Complete pre- and post-construction monitoring to determine fishery resources present, habitat impacts, and mitigation needs. Determine the project was completed as intended by documenting the extent of permanent fills, demolition material removal, and recovery of dredged areas.

- Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
- Prioritize beneficial uses of suitable sediments that contribute to habitat restoration and enhancement. The MDTA will coordinate with NOAA Fisheries Habitat and Ecosystem Services Division (HESD) in final design, prior to determining any commitment(s) for sediment beneficial use.
- Ensure that any proposed dredging is necessary to maintain target depths. Evaluate recent bathymetric surveys to determine the existing depths of the proposed dredge area.
- Avoid and minimize all activities (including work footprint, structures, shading, temporary and permanent fill, excavation, etc.) in shallow water habitats and sensitive habitats such as SAV, mudflats, salt marsh, areas containing shellfish, and intertidal areas.
- Provide compensatory mitigation for all unavoidable impacts to EFH and sensitive habitats.

Fish Passage and Migration Habitat

- Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.
- Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from habitat.
- Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.

Vessel Interaction

- Reduce vessel speeds in inshore areas, or otherwise minimize wake damage to shorelines, and consider no-wake zones in highly sensitive areas, such as spawning habitat and SAV beds. Identify appropriate vessel routes in the design process to minimize impacts to shorelines and shallow water habitats.
- Work to minimize the effects of increased vessel traffic when conducting in-water actions.
- Ensure that vessels are operated in adequate water depths to avoid propeller scour and grounding at all tides. Use shallow draft vessels that maximize the navigational clearance between the vessel and the bottom in shallow areas.

Impingement/Entrainment and Entanglement

- Ensure any in-water lines, ropes, or chains are made of materials and installed in a manner (properly spaced) to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. Lines can be enclosed in a rigid sleeve.
- Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.
- Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.
- Employ screening (1 mm wedgewire or better technology with maximum intake velocity of 0.5 fps) on any water intakes (e.g., pumps) drawing from surface tidal waters to minimize impingement/entrainment of fish and nekton.

5.2 Pile Driving and Pier Protection

5.2.1 Impact Types, Magnitude, and Duration

Underwater Noise/Hydroacoustic Energy

According to Popper and Hawkins, underwater noise resulting from pile driving can cause a variety of adverse effects on fish, ranging from minor behavioral changes to fatal injuries. Noise can cause a wide range of behavioral changes in fish, which vary by fish species and can vary by age and time of day within the same species. Behavioral changes can include changes in swimming speed and avoidance of, or attraction to, sound sources. This could include avoidance of migration routes if a continuous sound source is present along a migration route. Noise can also affect foraging behavior, as noise can either mask relevant sounds fish use to locate prey, or resemble prey sounds. Sound exposure may also result in hearing loss in fish. Fish are known to experience temporary hearing loss from anthropogenic noise, which could be worsened by continuous sound exposure. Sound exposure may cause physiological stress responses in fish, though this subject is understudied and poorly understood. Fish can also be injured or killed by sound, especially from intense impulsive noise sources (such as pile driving). Severe injuries to fish caused by noise typically result from rapid oscillation of the swim bladder walls, which can result in damage to surrounding organs (Popper and Hawkins, 2019). Fish kills can attract predators to the area, including other fish, birds, and mammals (C. Kucera - FHWA, personal communication, January 22, 2026). These predators may then be affected by construction and demolition operations, compounding their effects.

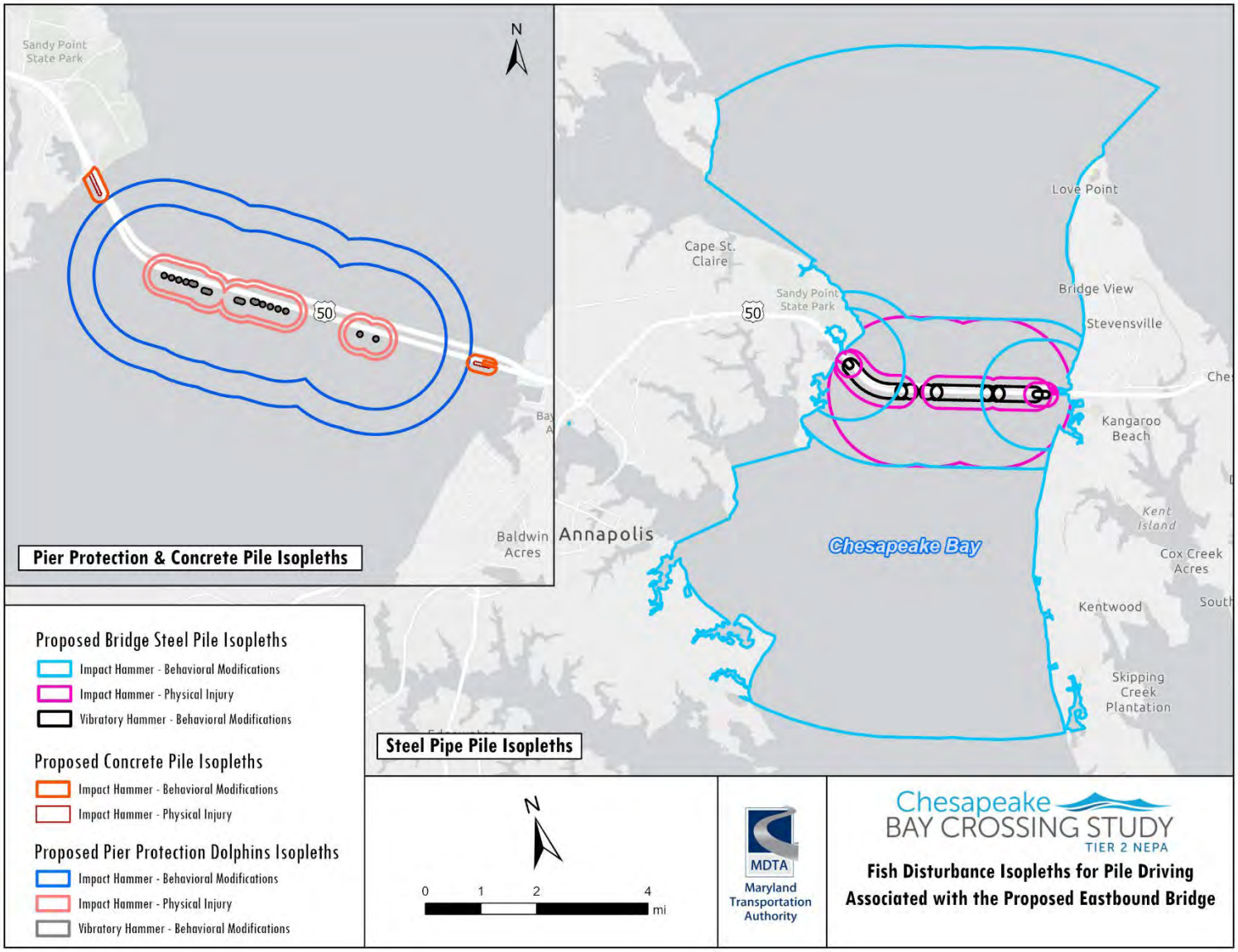
Compared to other adverse effects, underwater noise and vibrations would likely have the most pronounced short-term adverse effects on federally-managed fish species. All life stages of federally-managed fish species with designated EFH in the Action Area would likely be affected by underwater noise, since the current design assumptions indicate that pile driving could occur throughout years 1 through 3 of construction of the eastbound bridge and its pier protection, and years 7 through 12 for the westbound bridge and its pier protection, for a total of 9 years of intermittent pile driving. It is estimated that pile driving would be required on about 120 days for eastbound bridge construction within a 3-year window, and on about 138 days for westbound bridge construction within a 6-year window. It is important to understand that although the pile driving time would be protracted, it may not necessarily occur on consecutive days and when it occurs, it may not always occur for a full 12-hour period. Exact timing for pile driving has not been determined, but it could possibly take place throughout multiple seasons of the year, with breaks for time-of-year restrictions to protect aquatic species, for adverse weather conditions, to set-up or break-down equipment, and to conduct other construction activities.

A 12-hour quiet period will be implemented on days when pile driving is conducted to minimize underwater noise effects; however, extended periods of noise throughout the middle Chesapeake Bay are likely to affect migration patterns. Disrupted or delayed migration patterns may affect spawning success. Proposed mitigation measures aim to avoid population-level effects; however, population numbers may be affected, as multiple year classes of federally-managed fish and their prey may be affected by far-reaching and high-intensity underwater noise and vibrations caused by pile driving. The fact that pile driving for the eastbound and westbound bridges would likely be intermittent, both seasonally and daily, may allow for localized recovery of species.

Noise disturbance is quantified as a circular area emanating from a point source (in this case, pile driving), indicated by an underwater isopleth. As shown in **Figure 5-1**, the distance of the sound effects of pile driving is dependent upon the pile size, material, and methods used. Note that individual pile driving isopleth extents were merged for each pile type and are shown in **Figure 5-1**. Up to 16 piles could be driven at any given time, resulting in concurrent isopleths or zones of fish injury/behavioral modification.

Though specific construction means and methods have not been developed, estimates of pile types and installation methods were assumed based on construction means and methods of similar projects, including Nice-Middleton Bridge and Francis Scott Key Bridge, and to provide the most conservative reasonable estimate of impacts. Actual noise levels resulting from pile driving operations for the pile types and sizes assumed during preliminary design are not available at this time. Therefore, the extent of pile installation noise impacts were calculated using proxy noise levels for pile driving provided by the National Marine Fisheries Service Multi-Species Pile Driving Calculator (NMFS Calculator) (NMFS, 2025). Proxy sound levels were used for the Peak, Single Strike Sound Exposure Level (SELss), and Root Mean Square (RMS) Unattenuated Single Strike Level. Calculations were completed for multiple bridge pier types based on current design assumptions, including: impact hammer installation of 36” square concrete piles; impact hammer and vibratory hammer installation of 36” steel pipe piles, 48” steel pipe piles (for bridge pier and fender installation), 96” steel pipe piles, and 14” steel H-piles and 19.6” sheet piles for dolphin pier protection. Conservative estimates were used for all instances. When a proxy was not available for a specific pile type, a larger pipe proxy was included in the calculations to provide the highest underwater noise estimate.

Figure 5-1: Fish Disturbance Isopleths for Pile Driving Associated with the Proposed Eastbound Bridge



To estimate the behavioral modifications and physical injury to federally-managed fish species from impact and vibratory hammer operations, the MDTA included the following assumptions in the NMFS Calculator: installation of up to 16 piles per day, 30 minutes per pile (vibratory) and then 2,500 strikes per pile (impact), based on the Underwater Noise Monitoring Plan for the Francis Scott Key Bridge Project. It is assumed that steel piles will initially be driven with a vibratory hammer through softer, sandy soils prior to using an impact hammer through stiffer material, as practicable. In the NMFS Calculator, the Distance Associated with Single Strike Level/Measurement Distance (meters) and Transmission Loss Constant values were maintained at their default values, 10 and 15, respectively. Bubble curtains would be installed around all piles to minimize impacts; therefore, noise attenuation is expected. Calculations were completed with attenuation levels set at 10 dB for bridge pile installation, a conservative estimate based on the MDTA's documentation of higher levels of attenuation in other recent bridge projects. Dolphin pier protection installation calculations were completed with attenuation levels set at 5 dB based on the assumption that only a less protective bubble curtain system would be feasible in this scenario. Highly effective multi-ring bubble curtain systems are feasible for single pile installation, however dolphin construction involves driving connected sheet piles in a large circle, and only a single ring, perimeter bubble curtain is feasible.

Table 5-2 provides a summary of the pile driving isopleths resulting from impact and vibratory hammers for each of the proposed pile types that would likely cause onset of physical injury and behavioral modification to fish. Isopleths (in feet) provided by the NMFS Calculator include peak threshold, cumulative Sound Exposure Level (SEL_{cum}) for physical injury, and RMS threshold for behavioral modification.

Table 5-2: NMFS Calculator Summary: Response of Fish to Impact and Vibratory Hammer Operation

Pile Type	Impact Hammer			Vibratory Hammer
	Onset of Physical Injury		Behavior Modification	Behavior Modification
	Peak threshold (FT)	SEL_{cum} (FT)	RMS Threshold (FT)	RMS Threshold (FT)
36" Square Concrete	2.8	82.4	382.5	N/A
36" Steel Pipe	13.1	1,120.3	5,199.8	328.1
48" Steel Pipe	20.7	606.3	4,459.8	706.8**
48" Steel Pipe (60" Steel Pipe Proxy)*	13.1	1,522.8	7,068.4	706.8**
96" Steel Pipe	60.6	7,068.4	32,808.4	706.8**
14" Steel H-Pile	20.7	960.8	4,459.8	15.23
AZ Sheet Pile	13.1	1,522.8	7,068.4	152.3

Note: SEL_{cum} for fish >2g and fish <2g are the same value and therefore only presented once.
**In order to create an increasing trend in noise effect between all steel pipe pile sizes, two 48" steel pipe proxies were used to create a range of likely impacts. The noise proxy levels for a 48" steel pipe did not produce the expected impacts for the SEl_{cum} and RMS Threshold and therefore the noise proxy for a 60" steel pipe was used instead.*
***The NMFS Calculator only includes vibratory proxies for 36" steel pipes and 72" steel pipes. Therefore, for every steel pipe greater than 36" in diameter, 72" steel pipe sound proxy levels were used.*
*Sound proxy levels used were not attenuated and a 10dB attenuation was then added in the NMFS Calculator. See **Appendix A** for the NMFS Calculator output.*

Pile driving (via impact hammer) the 96" steel pipe piles would likely result in the largest ensonified area of all pile types, as indicated in **Table 5-2**. Up to 12 hours of noise due to piling driving is anticipated on days when pile driving is proposed. See **Figure 5-1** for a visual representation of the isopleths associated with all pile driving activities. The resulting isopleths for installation of piles for the main bridge spans, pier protection, and trestle(s) would potentially result in physical injury and likely result in behavior modification to fish. Accurate fish stock counts for the middle Chesapeake Bay are not known at this time; therefore, exact mortality and behavior modification numbers for federally-managed fish species cannot be determined.

Underwater noise and vibrations would be temporary impacts, but would have the potential to cause fish kills and to affect fish populations in the Bay given the protracted duration of this activity.

Turbidity and Sedimentation

Turbidity and sedimentation resulting from pile driving operations could potentially cause respiratory issues for federally-managed fish species and limit the areas where they can swim safely. Turbidity and sedimentation from pile driving would be temporary impacts.

Reduced Water Quality

Fill and other construction materials used during pile driving operations have the potential to introduce contaminants into the Action Area and increase turbidity conditions, both of which can have adverse health effects on federally-managed fish species including reduced respiration and

vision. Pile driving operations have the potential to decrease DO levels in the water column, as nutrients from the underlying sediments are released, creating high oxygen demand, and resulting in reduced oxygen levels for fish species. Reduced water quality from pile driving would be a temporary impact to federally-managed fish species.

Habitat Alteration

Trestle construction would result in long-term temporary fills and construction of bridge piles and pier protection would result in permanent fills. Permanent fills from pier construction and pier protection would result in irretrievable loss of bottom habitat and/or habitat conversion. Temporary fills associated with pile driving would degrade habitat for federally-managed fish species. Fill impacts will be quantified during design.

Potential temporary impacts to habitat from pile driving would include sediment disturbance, shading from structures, noise, and physical obstruction, which can adversely affect the foraging and migratory behavior of federally-managed fish species. Pile driving also has the potential to increase turbidity and sedimentation, which can negatively impact SAV by limiting photosynthesis and negatively impact fish by reducing respiration and vision.

Vessel Interaction

Operating vessels in or near SAV beds during pile driving and pier protection operations can result in mortality or degradation of SAV through physical impact or shading, which could be a temporary or permanent impact, depending on the duration of impact.

Fish Passage and Migration Habitat

Noise impacts and turbidity from pile driving affect the ability of migratory fish to navigate to their spawning grounds. Temporary structures and turbidity control measures used for pile driving have the potential to block the movements of federally-managed fish species through migratory pathways. Pile driving operations can affect water flow and water quality, which affect fish movement and respiration. The effects on fish passage and migration would be temporary.

Impingement/Entrainment and Entanglement

Dewatering and turbidity control measures used during pile driving and pier protection operations have the potential to trap fish. Water intakes such as pumps used for dewatering during pile driving operations can impinge/entrain fish and cables, ropes, and utility lines can entangle fish. These impingement/entrainment impacts would be temporary.

5.2.2 Avoidance, Minimization, and Mitigation

5.2.2.1 Commitments Related to Pile Driving

Underwater Noise/Hydroacoustic Energy

- Develop an Underwater Noise Monitoring Plan to describe the underwater noise generated by project activities and adaptive management measures planned to address the underwater noise.
- Implement an effective quiet time of no pile driving for 12 hours per day.
- Use noise attenuation and minimization measures during pile driving, including:
    - Use a bubble curtain system that achieves 10 dB or greater attenuation for bridge piles and 5 dB or greater attenuation for dolphin pier protection piles. The

effectiveness of the bubble curtain attenuation shall be demonstrated with a test pile and underwater noise program prior to initiating production pile driving activities.
    - Using a "soft start" or "ramping up" pile driving (e.g., driving does not begin at 100% energy). This soft start technique will involve a low-energy start-up (e.g., hammer operated at 50% capacity) over a period of up to 20 minutes to allow fish to leave the area.
    - Initially drive steel piles with a vibratory hammer through softer, sandy soils prior to using an impact hammer through stiffer material, as practicable and as appropriate.
    - Using cushion blocks to drive concrete piles with an impact hammer, as practicable and as appropriate.
- Include methods to document fish stuns/kills in the Underwater Noise Monitoring Plan and coordinate these methods with NOAA Fisheries HESD.

Turbidity and Sedimentation

- Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as turbidity curtains.

Reduced Water Quality

- Only use clean fill.
- Avoid, to the greatest extent practicable, the use of creosote piles or other in-water structures, and coordinate with NOAA Fisheries if there is an essential use identified by the contractor.
- Remove cofferdams, turbidity curtains, or other diversion structures only after water quality is consistent with ambient levels outside the structure.
- Minimize raw concrete or grout contact with the water to the maximum extent practicable.

Habitat Alteration

- Employ an Independent Environmental Monitor (IEM).
- Coordinate with the NOAA Fisheries GARFO and MDNR on specific recommended time-of-year restriction dates, based on the proposed activities and location.
- Coordinate with NOAA Fisheries and MDNR during Final Design to determine if SAV surveys would be informative of permit conditions. If so, conduct SAV surveys during the growing season, prior to construction, within nearshore areas of the Action Area to determine the presence and extent of SAV beds.

Fish Passage and Migration Habitat

- From January 15 through May 15 (the anadromous fish migratory period), ensure a minimum contiguous Zone of Safe Fish Passage (ZSFP) equivalent to approximately one-third the waterway width - approximately 7,000 linear feet. The ZSFP will allow federally-managed fish species, including migratory fish, to safely navigate to their spawning grounds around undesirable noise (i.e., above the 150 dB RMS behavioral threshold) and turbidity levels. The ZSFP will encompass the channel edges. To maintain the ZSFP, 96"

steel pipe piles will not be driven from January 15 through May 15, unless underwater noise monitoring results demonstrate 96" piles can be driven while ensuring a minimum contiguous 7,000-foot-wide ZSFP. The contractor shall use pile driving underwater noise monitoring results to determine an acceptable pile driving sequence of construction that ensures the ZSFP is achieved from January 15 through May 15. The project team will work with NOAA Fisheries and MDNR to refine and approve ZSFP locations and the migratory focal period during Final Design and permitting.

Vessel Interaction

- Do not operate or moor vessels in, or immediately adjacent to, SAV in such a way that could shade or otherwise impact SAV.

5.2.2.2 Considerations Related to Pile Driving

Underwater Noise/Hydroacoustic Energy

- Conduct noise-generating work in a way that minimizes acoustic effects and avoids injury to federally-managed fish species. Explore potential attenuation measures based on the NMFS Calculator.
- Use noise attenuation and minimization measures during pile driving, such as:
    - Surrounding all piles with a bubble curtain, isolation casing, or dewatered cofferdam. Contained bubble curtains will be utilized to the extent practicable. Where use of a contained bubble curtain is not feasible, use of an uncontained bubble curtain would be evaluated.
    - Using vibratory hammers and construction phasing to minimize acoustic impacts to fish. Balance with potential impacts to other species, including marine mammals.
    - Minimizing the number and size of temporary and permanent piles.
    - Using concrete piles and pre-cast piles versus steel piles to reduce underwater noise, as practicable and as appropriate.
    - Using drilled shafts instead of hammered piles, as practicable and as appropriate.

Turbidity and Sedimentation

- Use operational modifications such as conducting the work at low tide to limit sedimentation and turbidity.
- Position new structures to avoid altering natural sediment accretion rates and patterns.

Reduced Water Quality

- Monitor water quality to determine whether temperature and DO levels remain within a close threshold to background levels, as determined in coordination with NOAA Fisheries and MDNR in final design, and if levels fluctuate beyond this threshold, contact NOAA Fisheries and MDNR within 24 hours to determine appropriate actions.
- Consider alternatives to the use of pressure treated (Chromated Copper Arsenate or Alkaline Copper Quaternary, etc.) piles or other in-water structures, as practicable and as appropriate.

Habitat Alteration

- Place a geotextile barrier under any temporary access fills to ensure that any fill would be removed completely at the end of construction.
- Develop a project schedule and plan prior to construction, which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.
- Complete pre- and post-construction monitoring to determine fishery resources present, habitat impacts, and mitigation needs. Determine the project was completed as intended by documenting the extent of permanent fills, demolition material removal, and recovery of dredged areas.
- Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
- Use waterline pile cap/pier footings to avoid dredging to construct footings below the mudline.
- Avoid and minimize all activities (including work footprint, structures, shading, temporary and permanent fill, excavation, etc.) in shallow water habitats and sensitive habitats such as SAV, mudflats, salt marsh, areas containing shellfish, and intertidal areas.
- Provide compensatory mitigation for all unavoidable impacts to EFH and sensitive habitats.
- Work with engineers to consider the potential for designs that enhance underwater habitat.

Fish Passage and Migration Habitat

- Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.
- Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.
- Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from habitat.

Impingement/Entrainment and Entanglement

- Allow all fish to exit an enclosed area prior to any dewatering. Trapped fish greater than 5 inches long observed during dewatering shall be captured and released from the dewatering area except for invasive species (snakehead, blue catfish, flathead catfish) that will be disposed of.
- Employ screening (1 mm wedge wire or better technology with maximum intake velocity of 0.5 fps) on any water intakes (e.g., pumps) drawing from surface tidal waters to minimize impingement/entrainment of fish and nekton.
- Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.
- Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.

5.3 Demolition

5.3.1 Impact Types, Magnitude, and Duration

The preliminary design assumes most of the demolition would be accomplished through mechanical means; however, it is assumed that based on the depth and size of some existing piers, blasting would likely be required to remove select bridge elements. Mechanical demolition is unlikely to result in adverse effects to federally-managed fish species with implementation of appropriate avoidance and minimization measures, however blasting would adversely affect federally-managed fish species.

According to current design assumptions, blasting would likely occur in years 6 and 7 for the eastbound bridge, totaling 9 blast events, and would likely occur again in years 14 and 15 for the westbound bridge, totaling 7 blasting events. Blasting instances are considered intense, discrete impact events.

Underwater Noise/Hydroacoustic Energy

Blasting would have an acute adverse effect on fish in close proximity to the charge; however, the duration of impact would likely be short. Blasting produces pressure waves that can cause swim bladders to rupture, causing severe injury or mortality. The acoustic effects of blasting affect fish hearing and tissues. Blasting can also increase water turbidity and sedimentation in the area surrounding the blasting event, resulting in decreased water quality and impacts on fish respiration and vision. Juveniles and adults of all federally-managed fish species and larval summer flounder would be affected by blasting within the Action Area.

Turbidity and Sedimentation

Blasting could result in increased turbidity and sedimentation, which have the potential to cause temporary adverse effects to federally-managed fish species and their habitat through smothering of SAV and other benthic habitat and reduced vision and respiration in fish.

Reduced Water Quality

Saw operations during mechanical demolition produce effluent that can be toxic to fish if it enters the water column. The turbidity and sedimentation resulting from demolition can reduce water quality and negatively affect vision and respiration. These potential water quality effects of demolition would be temporary.

Habitat Alteration

Temporary structures and fill used in demolition can degrade or remove benthic habitat.

Vessel Interaction

Operating vessels in or near SAV beds during demolition operations can result in mortality or degradation of SAV through physical impact or shading. Vessel impacts during demolition would be temporary.

Fish Passage and Migration Habitat

Noise impacts and turbidity from blasting affect the ability of migratory fish to navigate to their spawning grounds. Temporary structures and turbidity control measures used for demolition have the potential to block the movements of federally-managed fish species through migratory pathways. Demolition can affect water quality, which affects fish vision, movement, and respiration. Impacts to fish passage and migration from demolition would be temporary.

Impingement/Entrainment and Entanglement

Dewatering and turbidity control measures used during demolition operations have the potential to trap fish. Cables, ropes, and utility lines used during demolition can entangle fish. Impingement/entrainment impacts from demolition would be temporary.

5.3.2 Avoidance, Minimization, and Mitigation

5.3.2.1 Commitments Related to Demolition

Underwater Noise/Hydroacoustic Energy

- Continue to coordinate to minimize the use of blasting.
- Develop an Underwater Noise Monitoring Plan to describe the underwater noise generated by project activities and adaptive management measures planned to address the underwater noise.
- Include methods to document fish stuns/kills in the Underwater Noise Monitoring Plan and coordinate these methods with NOAA Fisheries HESD.
- Employ scare charges and fish deterrent boats ahead of blasting activities. Use low weight/energy repellent charges that startle fish from the area prior to blasting, and minimize the time between repellent activities and blasting, such that fish are not allowed a recovery period to re-enter the blasting danger zone.
- Develop a detailed Demolition Plan in coordination with NOAA Fisheries and submit to NOAA Fisheries for review and approval, in advance of any detonation activity. The Demolition Plan will evaluate the following measures:
    - Detonation bore hole stemming, capping, or filling;
    - Firing all charges in a single firing circuit with a delayed detonation between each charge;
    - Focusing blast energy towards a solid substrate rather than towards the water column;
    - Employing noise attenuating devices such as bubble curtains;
    - Conducting the blasting during periods of low water or low tide;
    - Using rubber blasting mats to reduce debris and acoustic signature;
    - Employing scare charges;
    - Installing appropriate monitoring devices to confirm the impact distance to adaptively manage the Demolition Plan;
    - Using explosive weights that result in injury/mortality thresholds remaining within 100 feet of the blasting source; and
    - Using adaptive management actions between blast events to minimize fish mortality.

Turbidity and Sedimentation

- Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as turbidity curtains and bridge netting to catch falling debris.
- Minimize the suspension of sediments and disturbance of the substrate when removing piles by implementing the applicable techniques:
    - Remove piles with a vibratory hammer, rather than by direct pull, jetting, or clamshell;
    - Remove piles slowly to reduce sediment sloughing off in the water column;
    - Strike or vibrate the pile to break the bond between the sediment and pile to minimize the pile breakage, and reduce the amount of sediment sloughing off the pile during removal;
    - Place piles on a barge equipped with a basin to contain all attached sediment and runoff water after removal.
- Prevent sediment and debris from entering the water using nets, tarps, and pans when demolishing bridge superstructures; remove demolition debris that falls into the water.

Reduced Water Quality

- Manage concrete wash water and cooling water effluent from concrete saw operations to ensure they do not enter surface waters untreated.
- Remove cofferdams, turbidity curtains, or other diversion structures only after water quality is consistent with ambient levels outside the structure.

Habitat Alteration

- Employ an Independent Environmental Monitor (IEM).
- Coordinate with the NOAA Fisheries GARFO and MDNR on specific recommended time-of-year restriction dates, based on the proposed activities and location.
- Remove temporary structures and fills including monitoring devices in their entirety. Return aquatic habitats impacted by temporary activities, fills, or structures to pre-construction or better condition, including contours, elevations, substrate, and vegetation.

Fish Passage and Migration Habitat

- From January 15 through May 15 (the anadromous fish migratory period), ensure a minimum contiguous Zone of Safe Fish Passage (ZSFP) equivalent to approximately one-third the waterway width - approximately 7,000 linear feet. The ZSFP will allow federally-managed fish species, including migratory fish, to safely navigate to their spawning grounds around undesirable noise (i.e., above the 150 dB RMS behavioral threshold) and turbidity levels. The ZSFP will encompass the channel edges.

Vessel Interaction

- Do not operate or moor vessels in, or immediately adjacent to, SAV in such a way that could shade or otherwise impact SAV.

5.3.2.2 Considerations Related to Demolition

Underwater Noise/Hydroacoustic Energy

- Use mechanical demolition methods, instead of blasting, when possible.
- Schedule timing of blasting events to minimize impacts to federally-managed species. This will be coordinated with NOAA Fisheries during final design and construction. To minimize duration and magnitude of impact, any required blasting would likely take place during times of lower biological activity, which is still to be determined.
- Conduct noise-generating work in a way that minimizes acoustic effects and avoids injury to federally-managed fish species. Explore potential attenuation measures based on the NMFS Calculator.

Reduced Water Quality

- Monitor water quality to determine whether temperature and DO levels remain within a close threshold to background levels, as determined in coordination with NOAA Fisheries and MDNR in final design, and if levels fluctuate beyond this threshold, contact NOAA Fisheries and MDNR within 24 hours to determine appropriate actions.

Habitat Alteration

- Develop a project schedule and plan prior to construction, which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.
- Fill all depressions left by the piles with clean substrate appropriate for the site if the depression does not naturally aggrade.
- Complete pre- and post-construction monitoring to determine fishery resources present, habitat impacts, and mitigation needs. Determine the project was completed as intended by documenting the extent of permanent fills, demolition material removal, and recovery of dredged areas.
- Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
- Provide compensatory mitigation for all unavoidable impacts to EFH and sensitive habitats.
- Leave existing anchor blocks to provide underwater habitat.
- Work with engineers to consider the potential for designs that enhance underwater habitat.
- Determine the exact number and location(s) of shielding barges during permitting. These barges would be positioned underneath the existing bridge decks to capture any debris that may be released during demolition. All proposed barges would be located in areas already assumed for impact.

Fish Passage and Migration Habitat

- Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.

- Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.
- Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from habitat.

Impingement/Entrainment and Entanglement

- Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.
- Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.

5.4 Upland Runoff and Land Cover Change

5.4.1 Impact Types, Magnitude, and Duration

Turbidity and Sedimentation

Land cover change can result in increased erosion, turbidity, and sedimentation, which have the potential to cause adverse effects to federally-managed fish species and their habitat through smothering of SAV and other benthic habitat and reduced vision and respiration in fish. The effects of increased turbidity and sedimentation could be temporary or permanent in nature, depending on the duration of construction and stabilization measures implemented.

Reduced Water Quality

Adverse effects within the Action Area may include pollution from stormwater runoff resulting from increased impervious area, potentially resulting in long-term loss of forage and prey species that are sensitive to changes in water quality (EPA CADDIS, 2025).

Roadway maintenance and stormwater runoff may convey particulates, metals, oil and grease, organics, nutrients, and other substances to EFH. These runoff constituents can be grouped as heavy metals, salt, organic molecules, and nutrients (Trombulak and Frissell, 1999). As noted in **Section 3**, pH and bacteria levels sampled within the Action Area are already above regulated water quality criteria. Additional impervious area resulting from the Preferred Alternative construction activities may increase the levels of pH and bacteria in EFH and may further affect federally-managed fish species and their prey. Water quality impacts would be temporary.

Habitat Alteration

Erosion, sedimentation, shading, and reduced water quality resulting from nearshore construction can reduce habitat quality for federally-managed fish species. Habitat alteration due to nearshore construction would be temporary.

Vessel Interaction

Operating vessels in or near SAV beds during nearshore operations can result in mortality or degradation of SAV through physical impact or shading. Vessel impacts to SAV would be temporary.

Fish Passage and Migration Habitat

Temporary barriers such as turbidity curtains have the potential to block federally-managed fish species' access to foraging areas and migratory pathways.

Impingement/Entrainment and Entanglement

Dewatering and turbidity control measures used during nearshore operations have the potential to trap fish. Cables, ropes, and utility lines can entangle fish. Impingement/entrainment impacts due to nearshore construction would be temporary.

5.4.2 Avoidance, Minimization, and Mitigation

The increase in impervious surfaces related to the project would be managed through implementation of erosion and sediment control BMPs along with water quality monitoring plans, which will document compliance with state water quality standards.

5.4.2.1 Commitments Related to Upland Runoff and Land Cover Change

Turbidity and Sedimentation

- Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as turbidity curtains, silt curtains, settling basins, and cofferdams. The MDTA will specify the measures to be used in the construction plans:
    - Install erosion control measures prior to ground disturbance;
    - Inspect daily and maintain continuously in an effective operating condition all ESC measures until such time as they are removed with prior permission from the MDE inspector;
    - Upon project completion, remove and stabilize all temporary construction materials with sediment and erosion control measures to prevent reentry into waterways.
- Prevent sediment and debris from entering the water using geo-textile fabric, hay bales, or other methods. Use nets, tarps, and pans when demolishing bridge superstructures; remove demolition debris that falls into the water.

Reduced Water Quality

- Remove contaminants and sediments from water discharge prior to entering aquatic habitats.

- Manage concrete wash water and cooling water effluent from concrete saw operations to ensure they do not enter surface waters untreated.
- Minimize raw concrete or grout contact with the water to the maximum extent practicable.
- Avoid, to the greatest extent practicable, the use of creosote piles or other in-water structures, and coordinate with NOAA Fisheries if there is an essential use identified by the contractor.
- Remove silt and turbidity curtains, or other diversion structures, only after water quality is consistent with ambient levels.
- Only use clean fill.

Habitat Alteration

- Employ an Independent Environmental Monitor (IEM).
- Coordinate with the NOAA Fisheries GARFO and MDNR on specific recommended time-of-year restriction dates, based on the proposed activities and location.

Vessel Interaction

- Do not operate or moor vessels in, or immediately adjacent to, SAV in such a way that could shade or otherwise impact SAV.

5.4.2.2 Considerations Related to Upland Runoff and Land Cover Change

Turbidity and Sedimentation

- Use operational modifications such as conducting the work at low tide to limit sedimentation and turbidity.
- Position new structures to avoid altering natural sediment accretion rates and patterns.

Reduced Water Quality

- Minimize the amount of new impervious surfaces and maintain a vegetated buffer between the water and upland activities.
- Incorporate stormwater controls to minimize pollutants in aquatic habitats, including determining whether the proposed bridge could include measures to collect runoff and route it to upland features for treatment prior to discharge.
- Monitor water quality to determine whether temperature and DO levels remain within a close threshold to background levels, as determined in coordination with NOAA Fisheries and MDNR in final design, and if levels fluctuate beyond this threshold, contact NOAA Fisheries and MDNR within 24 hours to determine appropriate actions.

Habitat Alteration

- Place a geotextile barrier under any temporary access fills to ensure that any fill would be removed completely at the end of construction.
- Develop a project schedule and plan prior to construction, which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.

- Complete pre- and post-construction monitoring to determine fishery resources present, habitat impacts, and mitigation needs. Determine the project was completed as intended by documenting the extent of permanent fills, demolition material removal, and recovery of dredged areas.
- Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
- Orient artificial lighting on crossings to avoid illumination of the surrounding waters at night.
- Design bridge abutments to minimize disturbances to banks and locate them outside of the floodplain.
- Avoid and minimize all activities (including work footprint, structures, shading, temporary and permanent fill, excavation, etc.) in shallow water habitats and sensitive habitats such as SAV, mudflats, salt marsh, areas containing shellfish, and intertidal areas.
- Incorporate measures that increase the ambient light transmission under the bridge including:
    - maximizing the height of the structure;
    - minimizing the width of the structure; and
    - the number of instream pilings/piers.

Fish Passage and Migration Habitat

- Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.
- Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.
- Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from habitat.

Impingement/Entrainment and Entanglement

- Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.
- Employ screening (1 mm wedgewire or better technology with maximum intake velocity of 0.5 fps) on any water intakes (e.g., pumps) drawing from surface tidal waters to minimize impingement/entrainment of fish and nekton.
- Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.

6 CONCLUSION

FHWA, in coordination with the MDTA, has determined that the Chesapeake Bay Crossing Study Preferred Alternative will result in substantial adverse effects to EFH. This assessment is based on preliminary design, construction, and demolition methods. The exact suite of construction measures will be defined in final design in coordination with NOAA Fisheries.

The project's Action Area contains suitable habitat for Atlantic butterfish, black sea bass, bluefish, scup, summer flounder, and windowpane flounder. Based on current design assumptions, noise and vibration impacts from pile driving would likely have the most pronounced short-term adverse effects on federally-managed fish species, potentially resulting in physical injury or behavior modification. The MDTA and FHWA, in coordination with NOAA Fisheries, have committed to implementing a ZSFP and other BMPs to minimize adverse effects to federally-managed and migratory fish species and will continue to coordinate to determine whether it is practicable to implement additional BMPs to further minimize these effects.

The action would likely result in permanent, substantial adverse effects to EFH that include physical, chemical, or biological alterations of the waters or substrate and potential loss of, or injury to, benthic organisms, prey species, and their habitat, and other ecosystem components. Adverse effects to EFH could include site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

The action may result in temporary adverse effects to summer flounder HAPC. The MDTA is dedicated to ensuring that adverse effects to EFH and HAPC within the project area are avoided, minimized, or otherwise offset to the greatest extent practicable.

FHWA is requesting an expanded EFH consultation due to the potential for substantial adverse effects to EFH. Additional consultation may be necessary during design once more detailed information is available.

7 REFERENCES

7.1 Federal Regulations and Executive Orders

Contents of fishery management plans (16 USC 1853(a)(7))

Essential Fish Habitat definition (16 USC § 1802(10))

Magnuson-Stevens Fishery Conservation and Management Act of 1976 (16 USC § 1801 et seq.)

7.2 State Regulations

Annotated Code of Maryland (Nat. Res. § 4-213)

Maryland Water Quality Standards. (COMAR 26.08.02)

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APPENDIX A

NOAA MARINE FISHERIES SERVICE (NMFS) MULTI-SPECIES PILE DRIVING CALCULATOR OUTPUT

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	190	156	166
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	202		

OTHER INFO 0

NOTES 36" Square Concrete Pile - Using Proxy of 30" Square Concrete Pile Tyle II

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	0.9	25.1	25.1	116.6
Isopleth (feet)	2.8	82.4	82.4	382.5

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.0	158.3	2.5
Isopleth (feet)	0.1	519.5	8.2

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.1	0.0	1.6	0.1	0.0
AUD INJ ONSET (Peak isopleth, feet)	0.2	0.1	5.2	0.2	0.1
AUD INJ ONSET (SEL_{cum} isopleth, meters)	184.4	23.5	285.4	163.9	61.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	605.1	77.2	936.4	537.6	200.4
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	25.1	NO LF CET.			
Behavior (RMS isopleth, feet)	82.4				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	173	183
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	219		

OTHER INFO 0

NOTES 36" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	4.0	341.5	341.5	1,584.9
Isopleth (feet)	13.1	1,120.3	1,120.3	5,199.8

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	2152.4	34.1
Isopleth (feet)	0.3	7,061.8	112.0

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	2,507.2	319.9	3,880.0	2,227.3	830.3
AUD INJ ONSET (SEL_{cum} isopleth, feet)	8,225.9	1,049.5	12,729.6	7,307.6	2,723.9
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	341.5	NO LF CET.			
Behavior (RMS isopleth, feet)	1,120.3				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	165
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	210

OTHER INFO 0

NOTES 36" Steel pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	100.0
ISOPLETHS (feet)	328.1

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	59.0	2.2
ISOPLETHS (feet)	193.7	7.1

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	68.2	26.2	55.7	87.7	29.5
AUD INJ ONSET (SELcum isopleth, feet)	223.6	85.9	182.7	287.9	96.9
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	10,000.0	NO LF CET.			
Behavior (RMS isopleth, feet)	32,808.4				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	203	169	182
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	215		

OTHER INFO 0

NOTES 48" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	6.3	184.8	184.8	1,359.4
Isopleth (feet)	20.7	606.2	606.2	4,459.8

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.2	1164.8	29.3
Isopleth (feet)	0.5	3,821.6	96.1

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.5	0.2	11.7	0.5	0.2
AUD INJ ONSET (Peak isopleth, feet)	1.8	0.5	38.3	1.5	0.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	1,356.8	173.1	2,099.7	1,205.4	449.3
AUD INJ ONSET (SEL_{cum} isopleth, feet)	4,451.6	568.0	6,888.8	3,954.6	1,474.1
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	292.9	NO LF CET.			
Behavior (RMS isopleth, feet)	960.8				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	175	185
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	221		

OTHER INFO 0

NOTES 48" Steel Pipe - Using proxy for 60" steel pipe to assume higher SELss and RMS values

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	4.0	464.2	464.2	2,154.4
Isopleth (feet)	13.1	1,522.8	1,522.8	7,068.4

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	2925.9	46.4
Isopleth (feet)	0.3	9,599.5	152.3

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	3,408.2	434.9	5,274.3	3,027.8	1,128.6
AUD INJ ONSET (SEL_{cum} isopleth, feet)	11,181.9	1,426.7	17,304.0	9,933.6	3,702.8
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	170
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	215

OTHER INFO 0

NOTES 48" Steel Pipe - Using 72" Steel Pipe Proxy

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	215.4
ISOPLETHS (feet)	706.8

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	127.2	4.6
ISOPLETHS (feet)	417.3	15.2

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	146.9	56.4	120.0	189.0	63.6
AUD INJ ONSET (SELcum isopleth, feet)	481.8	185.1	393.6	620.2	208.8
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	21,544.3	NO LF CET.			
Behavior (RMS isopleth, feet)	70,683.6				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	210	185	195
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	8		
Number of strikes per pile	2500		
Number of strikes per day	20000		
Cumulative SEL at measured distance	228		

OTHER INFO 0

NOTES 96" Steel Pipe

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth	
		Fish ≥ 2 g	Fish < 2 g		
ISOPLETHS (meters)	18.5	2,154.4	2,154.4	10,000.0	Fishes present
Isopleth (feet)	60.6	7,068.4	7,068.4	32,808.4	

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	0.5	8555.5	215.4	Sea Turtles present
Isopleth (feet)	1.5	28,069.2	706.8	

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	1.6	0.5	34.1	1.4	0.5
AUD INJ ONSET (Peak isopleth, feet)	5.2	1.5	112.0	4.5	1.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	9,965.8	1,271.5	15,422.0	8,853.2	3,300.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	32,696.1	4,171.6	50,597.2	29,045.9	10,827.1
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	2,154.4	NO LF CET.			
Behavior (RMS isopleth, feet)	7,068.4				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	170
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	8
Duration to drive pile (minutes)	30
Duration of sound production in day	14400
Cumulative SEL at measured distance	212

OTHER INFO 0

NOTES 96" Steel Pipe - Using 72" Steel Pipe proxy

Attenuation 10

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	215.4
ISOPLETHS (feet)	706.8

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	80.1	4.6
ISOPLETHS (feet)	262.9	15.2

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	92.5	35.5	75.6	119.1	40.1
AUD INJ ONSET (SELcum isopleth, feet)	303.5	116.6	247.9	390.7	131.5
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	21,544.3	NO LF CET.			
Behavior (RMS isopleth, feet)	70,683.6				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	203	172	182
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	218		

OTHER INFO 0

NOTES 14" Steel H-pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth	
		Fish ≥ 2 g	Fish < 2 g		
ISOPLETHS (meters)	6.3	292.9	292.9	1,359.4	Fishes present
Isopleth (feet)	20.7	960.8	960.8	4,459.8	

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR	
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth	
ISOPLETHS (meters)	0.2	1846.1	29.3	Sea Turtles present
Isopleth (feet)	0.5	6,056.9	96.1	

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.5	0.2	11.7	0.5	0.2
AUD INJ ONSET (Peak isopleth, feet)	1.8	0.5	38.3	1.5	0.5
AUD INJ ONSET (SEL_{cum} isopleth, meters)	2,150.5	274.4	3,327.8	1,910.4	712.1
AUD INJ ONSET (SEL_{cum} isopleth, feet)	7,055.3	900.2	10,918.1	6,267.7	2,336.3
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	292.9	NO LF CET.			
Behavior (RMS isopleth, feet)	960.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	145
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	190

OTHER INFO 0

NOTES 14" Steel H-pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	4.6
ISOPLETHS (feet)	15.2

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	2.7	0.1
ISOPLETHS (feet)	9.0	0.3

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	3.2	1.2	2.6	4.1	1.4
AUD INJ ONSET (SELcum isopleth, feet)	10.4	4.0	8.5	13.4	4.5
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

IMPACT PILE DRIVING REPORT

VERSION 2.1-Multi-Species: 2025

Chesapeake Bay Crossing Study - Tier 2 NEPA

PRINT IN LANDSCAPE TO CAPTURE ENTIRE SCREEN

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

PROJECT INFORMATION	PEAK	SELss	RMS
Single strike level (dB)	200	175	185
Distance associated with single strike level (meters)	10	10	10
Transmission loss constant	15		
Number of piles per day	16		
Number of strikes per pile	2500		
Number of strikes per day	40000		
Cumulative SEL at measured distance	221		

OTHER INFO 0

NOTES 24" AZ Sheet Pile

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	ONSET OF PHYSICAL INJURY			BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth		RMS Isopleth
		Fish ≥ 2 g	Fish < 2 g	
ISOPLETHS (meters)	4.0	464.2	464.2	2,154.4
Isopleth (feet)	13.1	1,522.8	1,522.8	7,068.4

Fishes present

SEA TURTLES

	AUD INJ ONSET		BEHAVIOR
	Peak Isopleth	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	0.1	2925.9	46.4
Isopleth (feet)	0.3	9,599.5	152.3

Sea Turtles present

MARINE MAMMALS

	LF Cetacean	HF Cetaceans	VHF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (Peak isopleth, meters)	0.3	0.1	7.4	0.3	0.1
AUD INJ ONSET (Peak isopleth, feet)	1.1	0.3	24.1	1.0	0.3
AUD INJ ONSET (SEL_{cum} isopleth, meters)	3,408.2	434.9	5,274.3	3,027.8	1,128.6
AUD INJ ONSET (SEL_{cum} isopleth, feet)	11,181.9	1,426.7	17,304.0	9,933.6	3,702.8
	ALL MM	HF Cet. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	464.2	NO LF CET.			
Behavior (RMS isopleth, feet)	1,522.8				

VIBRATORY PILE DRIVING REPORT

PRINT IN **LANDSCAPE** TO CAPTURE ENTIRE SCREEN

VERSION 2.1-Multi-Species: 2025

(if OTHER INFO or NOTES get cut-off, please include information elsewhere)

Chesapeake Bay Crossing Study - Tier 2 NEPA

PROJECT INFORMATION	RMS
Sound pressure level (dB)	160
Distance associated with sound pressure level (meters)	10
Transmission loss constant	15
Number of piles per day	16
Duration to drive pile (minutes)	30
Duration of sound production in day	28800
Cumulative SEL at measured distance	205

OTHER INFO 0

NOTES AZ Steel Sheet - loudest

Attenuation 5

RESULTANT ISOPLETHS

(Range to Effects)

FISHES

	BEHAVIOR
Fishes present	RMS Isopleth
ISOPLETHS (meters)	46.4
ISOPLETHS (feet)	152.3

SEA TURTLES

	AUD INJ ONSET	BEHAVIOR
Sea Turtles present	SEL_{cum} Isopleth	RMS Isopleth
ISOPLETHS (meters)	27.4	1.0
ISOPLETHS (feet)	89.9	3.3

MARINE MAMMALS

	LF Cetacean	MF Cetaceans	HF Cetaceans	PW Pinniped	OW Pinnipeds
AUD INJ ONSET (SELcum isopleth, meters)	31.6	12.2	25.8	40.7	13.7
AUD INJ ONSET (SELcum isopleth, feet)	103.8	39.9	84.8	133.6	45.0
	ALL MM	HF CET. present	NO VHF CET.	NO PHOCIDS	NO OTARIIDS
Behavior (RMS isopleth, meters)	4,641.6	NO LF CET.			
Behavior (RMS isopleth, feet)	15,228.3				

APPENDIX B

LIST OF COMMITMENTS AND CONSIDERATIONS

Avoidance and Minimization Commitments:

Underwater Noise/Hydroacoustic Energy

- Develop an Underwater Noise Monitoring Plan to describe the underwater noise generated by project activities and adaptive management measures planned to address the underwater noise.
- Include methods to document fish stuns/kills in the Underwater Noise Monitoring Plan and coordinate these methods with NOAA Fisheries Habitat and Ecosystem Services Division.
- Use noise attenuation and minimization measures during pile driving, including:
    - Use a bubble curtain system that achieves 10 dB or greater attenuation for bridge piles and 5 dB or greater attenuation for dolphin pier protection piles. The effectiveness of the bubble curtain attenuation shall be demonstrated with a test pile and underwater noise program prior to initiating production pile driving activities.
    - Using a “soft start” or “ramping up” pile driving (e.g., driving does not begin at 100% energy). This soft start technique will involve a low-energy start-up (e.g., hammer operated at 50% capacity) over a period of up to 20 minutes to allow fish to leave the area.
    - Initially drive steel piles with a vibratory hammer through softer, sandy soils prior to using an impact hammer through stiffer material, as practicable and as appropriate.
    - Using cushion blocks to drive concrete piles with an impact hammer, as practicable and as appropriate.
- Implement an effective quiet time of no pile driving for 12 hours per day.
- Develop a detailed Demolition Plan in coordination with NOAA Fisheries and submit to NOAA Fisheries for review and approval, in advance of any detonation activity. The Demolition Plan will evaluate the following measures:
    - Detonation bore hole stemming, capping, or filling;
    - Firing all charges in a single firing circuit with a delayed detonation between each charge;
    - Focusing blast energy towards a solid substrate rather than towards the water column;
    - Employing noise attenuating devices such as bubble curtains;
    - Conducting the blasting during periods of low water or low tide;
    - Using rubber blasting mats to reduce debris and acoustic signature;
    - Employing scare charges;
    - Installing appropriate monitoring devices to confirm the impact distance to adaptively manage the Demolition Plan;
    - Using explosive weights that result in injury/mortality thresholds remaining within 100 feet of the blasting source; and
    - Using adaptive management actions between blast events to minimize fish mortality.
- Continue to coordinate to minimize the use of blasting.
- Employ scare charges and fish deterrent boats ahead of blasting activities. Use low weight/energy repellent charges that startle fish from the area prior to blasting, and

minimize the time between repellent activities and blasting, such that fish are not allowed a recovery period to re-enter the blasting danger zone.

Turbidity and Sedimentation

- Only use mechanical dredging.
- Prevent sediment and debris from entering the water using geo-textile fabric, hay bales, or other methods. Use nets, tarps, and pans when demolishing bridge superstructures; remove demolition debris that falls into the water.
- Limit the amount and extent of turbidity and sedimentation by using appropriate sedimentation and turbidity controls such as turbidity curtains, silt curtains, settling basins, bridge netting and cofferdams. The MDTA will specify the measures to be used in the construction plans:
    - Install erosion control measures prior to ground disturbance;
    - Inspect daily and maintain continuously in an effective operating condition all ESC measures until such time as they are removed with prior permission from the MDE inspector;
    - Upon project completion, remove and stabilize all temporary construction materials with sediment and erosion control measures to prevent reentry into waterways.
- Minimize the suspension of sediments and disturbance of the substrate when removing piles by implementing the applicable techniques:
    - Remove piles with a vibratory hammer, rather than by direct pull, jetting, or clamshell;
    - Remove piles slowly to reduce sediment sloughing off in the water column;
    - Strike or vibrate the pile to break the bond between the sediment and pile to minimize the pile breakage, and reduce the amount of sediment sloughing off the pile during removal;
    - Place piles on a barge equipped with a basin to contain all attached sediment and runoff water after removal.

Reduced Water Quality

- Only use clean fill.
- Evaluate dredge material to determine the appropriate disposal method and location.
- Remove cofferdams, turbidity curtains, silt curtains, or other diversion structures only after water quality is consistent with ambient levels outside the structure.
- Avoid, to the greatest extent practicable, the use of creosote piles or other in-water structures, and coordinate with NOAA Fisheries if there is an essential use identified by the contractor.
- Minimize raw concrete or grout contact with the water to the maximum extent practicable.
- Remove contaminants and sediments from water discharge prior to entering aquatic habitats.
- Manage concrete wash water and cooling water effluent from concrete saw operations to ensure they do not enter surface waters untreated.

Habitat Alteration

- Employ an Independent Environmental Monitor (IEM).
- Coordinate with the NOAA Fisheries Greater Atlantic Regional Fisheries Office (GARFO) and MDNR on specific recommended time-of-year restriction dates, based on the proposed activities and location.
- Coordinate with NOAA Fisheries and MDNR during Final Design to determine if SAV surveys would be informative of permit conditions. If so, conduct SAV surveys during the growing season, prior to construction, within nearshore areas of the Action Area to determine the presence and extent of SAV beds.
- Incorporate necessary measures to avoid, minimize, or otherwise offset impacts to SAV, as appropriate. Impacts to SAV shall be mitigated at a ratio of at least 3:1, depending upon the nature/scale of the impacts.
- Remove temporary structures and fills including monitoring devices in their entirety. Return aquatic habitats impacted by temporary activities, fills, or structures to pre-construction or better condition, including contours, elevations, substrate, and vegetation.

Fish Passage and Migration Habitat

- From January 15 through May 15 (the anadromous fish migratory period), ensure a minimum contiguous Zone of Safe Fish Passage (ZSFP) equivalent to approximately one-third the waterway width - approximately 7,000 linear feet. The ZSFP will allow federally-managed fish species, including migratory fish, to safely navigate to their spawning grounds around undesirable noise (i.e., above the 150 dB RMS behavioral threshold) and turbidity levels. The ZSFP will encompass the channel edges. To maintain the ZSFP, 96" steel pipe piles will not be driven from January 15 through May 15, unless underwater noise monitoring results demonstrate 96" piles can be driven while ensuring a minimum contiguous 7,000-foot-wide ZSFP. The contractor shall use pile driving underwater noise monitoring results to determine an acceptable pile driving sequence of construction that ensures the ZSFP is achieved from January 15 through May 15. The project team will work with NOAA Fisheries and MDNR to refine and approve ZSFP locations and the migratory focal period during Final Design and permitting.

Vessel Interaction

- Do not operate or moor vessels in, or immediately adjacent to, SAV in such a way that could shade or otherwise impact SAV.

Avoidance and Minimization Considerations:

Underwater Noise/Hydroacoustic Energy

- Conduct noise-generating work in a way that minimizes acoustic effects and avoids injury to federally-managed fish species. Explore potential attenuation measures based on the NMFS Calculator.
- Use noise attenuation and minimization measures during pile driving, such as:
    - Surrounding all piles with a bubble curtain, isolation casing or dewatered cofferdam. Contained bubble curtains will be utilized to the extent practicable.

Where use of a contained bubble curtain is not feasible, use of an uncontained bubble curtain would be evaluated.
    - Using vibratory hammers and construction phasing to minimize acoustic impacts to fish. Balance with potential impacts to other species, including marine mammals.
    - Minimizing the number and size of temporary and permanent piles.
    - Using concrete piles and pre-cast piles versus steel piles to reduce underwater noise, as practicable and as appropriate.
    - Using drilled shafts instead of hammered piles, as practicable and as appropriate.
- Use mechanical demolition methods, instead of blasting, when possible.

Schedule timing of blasting events to minimize impacts to federally-managed species. This will be coordinated with NOAA Fisheries during Final Design and Construction. To minimize duration and magnitude of impact, any required blasting would take place during times of lower biological activity, which is still to be determined.

Turbidity and Sedimentation

- Use operational modifications such as conducting the work at low tide to limit sedimentation and turbidity.
    - This may include using an environmental bucket on mechanical dredges, reducing lift speeds, using small diameter cutterhead dredges, and/or limiting the use of large hopper dredges.
- Prohibit side-casting or temporary storage of dredged material in the waterway.
- Prohibit unfiltered or unprocessed overflows from barges into the water and ensure that any barge transfer is accomplished without generating sediment plumes.
- Position new structures to avoid altering natural sediment accretion rates and patterns.

Reduced Water Quality

- Monitor water quality to determine whether temperature and DO levels remain within a close threshold to background levels, as determined in coordination with NOAA Fisheries and MDNR in Final Design, and if levels fluctuate beyond this threshold, contact NOAA Fisheries and MDNR within 24 hours to determine appropriate actions.
- Minimize the amount of new impervious surfaces and maintain a vegetated buffer between the water and upland activities.
- Incorporate stormwater controls to minimize pollutants in aquatic habitats, including determining whether the proposed bridge could include measures to collect runoff and route it to upland features for treatment prior to discharge.
- Consider alternatives to the use of pressure treated (Chromated Copper Arsenate or Alkaline Copper Quaternary, etc.) piles or other in-water structures, as practicable and as appropriate.

Habitat Alteration

- Minimize maintenance dredging to the greatest extent practicable.
- Within the dredged area, leave benthic contours to restore naturally and if not restored within a time period, to be determined during Final Design in coordination with NOAA Fisheries and MDNR, then consider active restoration of bottom contours with clean sand fill.
- Design the dredge footprint to avoid sensitive habitats to the greatest extent practicable and provide appropriate buffers to protect these areas from accretion of sediment resuspended during dredging.
- Complete pre- and post-construction monitoring to determine fishery resources present, habitat impacts and mitigation needs. Determine the project was completed as intended by documenting the extent of permanent fills, demolition material removal, and recovery of dredged areas.
- Use multiple-season biological sampling data (pre- and post-construction) to assess the potential and resultant impacts on habitat and aquatic organisms.
- Prioritize beneficial uses of suitable sediments that contribute to habitat restoration and enhancement. The MDTA will coordinate with NOAA Fisheries Habitat and Ecosystem Services Division (HESD) in final design, prior to determining any commitment(s) for sediment beneficial use.
- Ensure that any proposed dredging is necessary to maintain target depths. Evaluate recent bathymetric surveys to determine the existing depths of the proposed dredge area.
- Avoid and minimize all activities (including work footprint, structures, shading, temporary and permanent fill, excavation, etc.) in shallow water habitats and sensitive habitats such as SAV, mudflats, salt marsh, areas containing shellfish, and intertidal areas.
- Provide compensatory mitigation for all unavoidable impacts to EFH and sensitive habitats.
- Fill all depressions left by the piles with clean substrate appropriate for the site, if the depression does not naturally aggrade.
- Place a geotextile barrier under any temporary platforms and/or access fills to ensure that any fill would be removed completely at the end of construction.
- Use waterline pile cap/pier footings to avoid dredging to construct footings below the mudline.
- Work with engineers to consider the potential for designs that enhance underwater habitat.
- Develop a project schedule and plan prior to construction which avoids or minimizes sediment disturbance, noise, and physical obstruction during sensitive life stages (migration and spawning) of federally-managed fish species. This may include isolating in-water work or implementing time-of-year restrictions.
- Leave existing anchor blocks to provide underwater habitat.
- Determine the exact number and location(s) of shielding barges during permitting. These barges would be positioned underneath the existing bridge decks to capture any debris that may be released during demolition. All proposed barges would be located in areas already assumed for impact.
- Orient artificial lighting on crossings to avoid illumination of the surrounding waters at night.

- Design bridge abutments to minimize disturbances to banks and locate them outside of the floodplain.
- Incorporate measures that increase the ambient light transmission under the bridge including:
    - maximizing the height of the structure;
    - minimizing the width of the structure; and
    - minimizing the number of instream pilings/piers.

Fish Passage and Migration Habitat

- Ensure temporary structures or barriers do not block federally-managed fish species' access to an area, preventing movement in or out of a river or channel.
- Properly secure turbidity control measures and design them in a manner that does not block entry to or exit from habitat.
- Design projects to maintain adequate flow conditions for fish passage, maintain water quality, and to maintain properly functioning channel, floodplain, riparian, and estuarine conditions.

Vessel Interaction

- Reduce vessel speeds in inshore areas, or otherwise minimize wake damage to shorelines, and consider no-wake zones in highly sensitive areas, such as spawning habitat and SAV beds. Identify appropriate vessel routes in the design process to minimize impacts to shorelines and shallow water habitats.
- Work to minimize the effects of increased vessel traffic when conducting in-water actions.
- Ensure that vessels are operated in adequate water depths to avoid propeller scour and grounding at all tides. Use shallow draft vessels that maximize the navigational clearance between the vessel and the bottom in shallow areas.

Impingement/Entrainment and Entanglement

- Ensure any in-water lines, ropes, or chains are made of materials and installed in a manner (properly spaced) to minimize the risk of entanglement by using thick, heavy, and taut lines that do not loop or entangle. Lines can be enclosed in a rigid sleeve.
- Monitor turbidity control measures to ensure aquatic species are not entangled or trapped within them.
- Attach any cables or utility lines to structures above the water, instead of locating them in water or within the substrate. Bury and prevent cables or utility lines from coming through the substrate if they are necessary to be in the water.
- Employ screening (1 mm wedgewire or better technology with maximum intake velocity of 0.5 fps) on any water intakes (e.g., pumps) drawing from surface tidal waters to minimize impingement/entrainment of fish and nekton.
- Allow all fish to exit an enclosed area prior to any dewatering. Trapped fish greater than 5 inches long observed during dewatering shall be captured and released from the dewatering area except for invasive species (snakehead, blue catfish, flathead catfish) that will be disposed of.

APPENDIX C

SUMMARY OF WHY CLEARNOSE SKATE EFH IS NOT DESIGNATED WITHIN THE ACTION AREA

Summary of Why Clearnose Skate EFH Is Not Designated Within the Action Area

Essential Fish Habitat (EFH) for clearnose skate (*Raja eglanteria*) is not designated within the Action Area based on the text descriptions included in the fisheries management plan that defines EFH for skate species: *Final Omnibus Essential Fish Habitat Amendment 2, Volume 2: EFH and HAPC Designation Alternatives and Environmental Impacts* prepared by the New England Fishery Management Council in cooperation with the National Marine Fisheries Service. Text descriptions on page 163 of the fisheries management plan indicate that Clearnose skate EFH is designated within high salinity zones of the Chesapeake Bay. While this conflicts with the information provided in Table 28 of the document, which indicates EFH for this species in the mixing zone, NOAA Fisheries reached out to VIMS for their ChesMMAP trawl data and that survey has not ever identified a Clearnose skate within the Action Area in its 20 plus years of monitoring. Although this does not prove absence of the species within the Action Area, it is an indicator that Clearnose skate do not frequent the Action Area. NOAA Fisheries indicated that this species can be removed from consideration for this project, based on monitoring data and the errors in Table 28 of the fisheries management plan. See the attached correspondence with NOAA Fisheries.

Maddy Sigrist

From: Jonathan Watson - NOAA Federal <jonathan.watson@noaa.gov>
Sent: Tuesday, February 10, 2026 3:24 PM
To: Maddy Sigrist
Cc: Sarah Williamson; Megan Bolcar; Alex Nussbaum; Eric Almquist
Subject: Re: BCST2 EFH Designation Question

EXTERNAL EMAIL: Do not click links or open attachments unless you trust the 'Sender' and know the content is safe.

Hi Maddy,

Here is the underlying fisheries management plan document that defines EFH for the skate species. The document is a bit confusing - thanks for encouraging me to take another look.

Table 28 (hyperlinked) indicates that the Chesapeake Bay mixing zone (0.5<salinity<25 ppt) is EFH for clearnose (juv, adult), little (adult), and winter (adult). The text then goes on to say the following:

Little Skate (pg 157) "Chesapeake Bay would no longer be designated as EFH for little skate (juveniles or adults) if the proposed designations are approved " pg 157
Winter Skate (pg 159): "The other significant change was the elimination of EFH in Chesapeake Bay"

So, this seems to eliminate these two species. Finally, the EFH text description for clearnose skate is:

Text descriptions:

For clearnose skate (*Raja eglanteria*), essential fish habitat is designated anywhere within the geographic areas that are shown on the following maps and listed in Table 28 and meets the conditions described below. Additional habitat-related information for this species can be found in Appendix B.

Juveniles: Sub-tidal benthic habitats in coastal and inner continental shelf waters from New Jersey to the St. Johns River in Florida as shown on Table 28, including the high salinity zones of Chesapeake Bay, Delaware Bay, and the other bays and estuaries listed in Table 28. Essential fish habitat for juvenile clearnose skates occurs from the shoreline to 30 meters, primarily on mud and sand, but also on gravelly and rocky bottom.

Adults: Sub-tidal benthic habitats in coastal and inner continental shelf waters from New Jersey to Cape Hatteras as shown on Map 96, including the high salinity zones of Chesapeake Bay, Delaware Bay, and the other bays and estuaries listed in Table 28. Essential fish habitat for adult clearnose skates occurs from the shoreline to 40 meters, primarily on mud and sand, but also on gravelly and rocky bottom.

This conflicts with Table 28, which stipulates EFH in the mixing zone. I reached out to VIMS for their ChesMMAP trawl data and that survey hasn't ever picked up a skate in 20+ years of effort. Absence from the survey does not indicate true absence, but is an indicator.

At this point, I think it's safe to remove clearnose skate EFH from consideration based on the text description and clear errors in Table 28. I will confirm with my team and let you know if I hear differently.

Apologies for the confusion on our end.

Jonathan

On Tue, Feb 10, 2026 at 10:22 AM Maddy Sigrist <msigrist@rkk.com> wrote:

Good morning, Jonathan,

We have not included adult Clearnose skate as having EFH designation in the BCST2 EFH Assessment. In a recent review of the document, it has come to our attention that adult Clearnose skate were included in the EFH designation for the Bay Bridge Protection Project, which has an overlapping action area.

After original review of the FMPs/EFH text descriptions, we did not include Clearnose skate as having EFH designation within the BCST2 Action Area. We then added juvenile Clearnose skate to the BCST2 EFH designation based on your DEIS comment below from the attached comments:

6. Pg 4-82, Section 4.5.7.2, paragraph 4: Based on our reading of the EFH designations and the associated abundance designations in the Estuarine Living Marine Resources: Mid-Atlantic Regional Distribution and Abundance Database, some additional species and/or life stages should be included in the EFH assessment. This includes all life stages of butterfish, which are all designated as common in the mixing zone (0.5 ppt < salinity < 25 ppt) of Chesapeake Bay during summer months. Also, juvenile black seabass are designated as common in the mixing zone of Chesapeake Bay. Juvenile clearnose skate also have designated EFH in the mixing zone (see footnote to Table 28 in the Omnibus Essential Fish Habitat Amendment 2, Vol 2). You're correct to disregard the mapper on Atlantic herring and red hake, but the document would benefit from an explanation of how this conclusion was determined such as describing the salinity or other habitat preferences for the species and contrasting this with on-site salinity or habitat characteristics. We acknowledge that it can be confusing to use the designations and the ELMR database to verify the delineations in the mapper and appreciate the effort.

Are adult Clearnose skate expected to be present within the BCST2 Action Area? Do they need to be added to the BCST2 EFH Assessment as an EFH designated species?

Thank you,

Maddy

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