ADDITIONAL FORESEEABLE EFFECTS REPORT

JANUARY 2026

REVISED MAY 2026

Maryland Transportation Authority

MDTA

ADDITIONAL FORESEEABLE EFFECTS

of the

CHESAPEAKE BAY CROSSING STUDY
ALTERNATIVES RETAINED for DETAILED STUDY

Maryland Transportation Authority

JANUARY 2026, REVISED MAY 2026

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ABBREVIATIONS AND ACRONYMS

AC	Assimilative Capacity
ADT	Average Daily Traffic
AFE	Additional Foreseeable Effects
ARDS	Alternatives Retained for Detailed Study
ATI	Area of Traffic Influence
BIBI	Benthic Macroinvertebrate Index of Biotic Integrity
BMC	Baltimore Metropolitan Council
BMPs	Best Management Practices
BRTB	Baltimore Regional Transportation Board
CBA	Chesapeake Bay Watershed Agreement
CBCA	Chesapeake Bay Critical Area
CBP	Chesapeake Bay Program
CFR	Code of Federal Regulations
CMP	Comprehensive Plan
COMAR	Code of Maryland Regulations
CP	Community Plan
CSA	Combined Statistical Area
CT	Census Tract
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Program
D.C.	District of Columbia
DO	Dissolved Oxygen
DOT	Department of Transportation
EDDMapS	Early Detection and Distribution Mapping System
EFH	Essential Fish Habitat
EIS	Environmental Impact Statement
EO	Executive Order
ERP	Environmental Review Program
ESA	Endangered Species Act
FCA	Maryland Forest Conservation Act
FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FIA	Forest Inventory and Analysis
FIBI	Fish Index of Biotic Integrity
FIDS	Forest Interior Dwelling Species
FORI	Forests of Recognized Importance
FRA	Federal Railroad Administration
GI	Green Infrastructure
GIS	Geographic Information System
HAPC	Habitat Areas of Particular Concern
HB	House Bill
HCN	Habitat Connectivity Network
IBI	Index of Biotic Integrity
ICE	Indirect and Cumulative Effects
IDA	Intensely Developed Area
IGSA	Induced Growth Study Area

ILF	In-lieu Fee
IPaC	Information for Planning and Consultation
LDA	Limited Development Area
LOD	Limit of Disturbance
LOS	Level of Service
LRTP	Long-Range Transportation Plan
LULC	Land Use / Land Cover
MALPF	Maryland Agricultural Land Preservation Foundation
MBSS	Maryland Biological Stream Survey
MD	Maryland
MDE	Maryland Department of the Environment
MDNR	Maryland Department of Natural Resources
MDOT	Maryland Department of Transportation
MDP	Maryland Department of Planning
MDTA	Maryland Transportation Authority
MET	Maryland Environmental Trust
mg/L	Milligrams per Liter
MHT	Maryland Historical Trust
MIHP	Maryland Inventory of Historic Properties
MSTM	Maryland Statewide Transportation Model
n.d.	No Date
NAIP	National Agriculture Imagery Program
NCHRP	National Cooperative Highway Research Program
NCSG	National Center of Smart Growth
NEPA	National Environmental Policy Act
NFIP	National Flood Insurance Program
NHA	Natural Heritage Area
NHPA	National Historic Preservation Act
NLEB	Northern Long-eared Bat
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NOI	Notice of Intent
NRHP	National Register of Historic Places
NSWD	Non-summer Weekday
NWF	National Wildlife Federation
NWI	National Wetlands Inventory
NWPA	Nontidal Wetland Protection Act
PA	Pennsylvania
PFA	Priority Funding Area
PlanQAC	Queen Anne’s County Comprehensive Plan
PSFA	Public Shellfish Fishery Areas
PTSU	Part Time Shoulder Use
RCA	Resource Conservation Area
RLA	Rural Legacy Area
RTE	Rare, Threatened, and Endangered
SAP	Small Area Plan
SAV	Submerged Aquatic Vegetation
SHA	State Highway Administration

SHPO	State Historic Preservation Office
SSPRA	Sensitive Species Project Review Area
STAC	Staff Technical Advisory Committee (Queen Anne's County)
SUP	Shared Use Path
SWED	Summer Weekend Day
TA	Technical Advisory
TAZ	Transportation Analysis Zone
TDM	Transportation Demand Management
TEA	Targeted Ecological Area
TRB	Transportation Research Board
TSM	Transportation Systems Management
U.S.	United States
U.S.C.	United States Code
USACE	United States Army Corps of Engineers
USCB	United States Census Bureau
USD	United States Dollar
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency
USFS	United States Forest Service
USFWS	United States Fish and Wildlife Service
VA	Virginia
WHS	Wildlife and Heritage Service
WSSC	Wetlands of Special State Concern
WV	West Virginia

1 INTRODUCTION

The Chesapeake Bay Crossing Study (Bay Crossing Study, or Study) is an engineering and environmental study being advanced by the Maryland Transportation Authority (MDTA) to address existing and future transportation issues at the William Preston Lane, Jr. Memorial Bridge (Bay Bridge) and its approaches along United States (U.S.) 50/301. The Bay Crossing Study includes engineering and analysis to describe potential significant environmental effects and inform the evaluation of the Alternatives Retained for Detailed Study (ARDS).

The purpose of this report is to present an assessment of the Additional Foreseeable Effects (AFE) of the Bay Crossing Study alternatives on socioeconomic resources, natural resources, and historic properties within the defined AFE Analysis Area (Analysis Area). The report begins with a description of the study background, including the Analysis Area, the study limits, and the Study objectives in **Section 2**. **Section 3** details the alternatives evaluated. **Section 4** presents the relevant federal, state, and local regulations for the analyses completed in this report. **Section 5** details the methodologies used to identify and analyze the potential downstream, induced growth, and aggregate effects of the Study alternatives and the creation of the Analysis Area used in the analysis. **Section 6** presents the existing socioeconomics, natural resources, and historic property conditions within the Analysis Area. **Section 7** identifies direct impacts of the alternatives that may result in downstream effects and associated impacts to existing resources. **Section 8** provides an analysis of the potential downstream and induced growth effects of the alternatives. The aggregate and foreseeable effects from past, present, and future actions within the Analysis Area are described in **Section 9**. Finally, **Section 10** provides a detailed list of the references cited in this report.

2 BACKGROUND

2.1 Study Limits

The Chesapeake Bay is one of Maryland's most important natural, economic, and cultural resources and is the largest estuary in the United States. The Bay Bridge is a two-span structure that crosses Chesapeake Bay from Anne Arundel County on the Western Shore to Queen Anne's County on the Eastern Shore. The original span was built in 1952, and a parallel span directly north of the original Bay Bridge was opened in 1973. Today, the two-lane original span typically carries eastbound traffic, and the three-lane second span typically carries westbound traffic. However, lanes on the bridge can be reversed to accommodate periods of heavy traffic. The approaches along U.S. 50/301 on each shore include six lanes (three lanes for each travel direction).

The MDTA analyzed traffic volumes to determine the appropriate study limits for the completed analysis. The western study limit was identified as the Maryland (MD) 2/MD 450 interchange just east of the Severn River Bridge, and the eastern study limit was identified as the U.S. 50/301 split.

2.2 Study Objectives

The Bay Crossing Study is moving forward to address transportation needs across the Chesapeake Bay region, while considering both environmental and financial responsibility, recognizing the importance of these issues given the sensitivity of Chesapeake Bay as an environmental resource and the need to make responsible budgetary decisions regarding a costly proposed action. The needs include:

- Adequate capacity and reliable travel times;
- Mobility;
- Roadway deficiencies;
- Existing and future maintenance needs; and
- Navigation.

3 ALTERNATIVES

The MDTA has identified the ARDS, which are the NEPA range of reasonable alternatives for evaluation in the Bay Crossing Study EIS. The ARDS include one No-Build (No-Build Alternative) and six build alternatives (**Figure 3-1**). Each build alternative includes removing the existing eastbound and westbound Bay Bridge spans and replacing them with two new bridge spans constructed near the location of the existing Bay Bridge. The build alternatives are differentiated by the number of lanes provided across the new bridge and on the approaches, as well as the bridge location. Additionally, the build alternatives are differentiated in their tie-in location, the points where the approach roads transition from existing lanes to the proposed lane expansion, as described below, and their area of resource impacts as shown in **Table 7-1**.

3.1 Alternative A: No-Build

Alternative A (6-5-6), the No-Build Alternative, would retain the existing Bay Bridge, the U.S. 50/301 alignment, and the existing number of lanes. This alternative would retain six lanes on the approaches on the Eastern and Western Shores and five lanes on the two-span Bay Bridge. The No-Build Alternative will include regular maintenance of the Bay Bridge and U.S. 50/301, but no capital improvements other than currently planned and programmed projects.

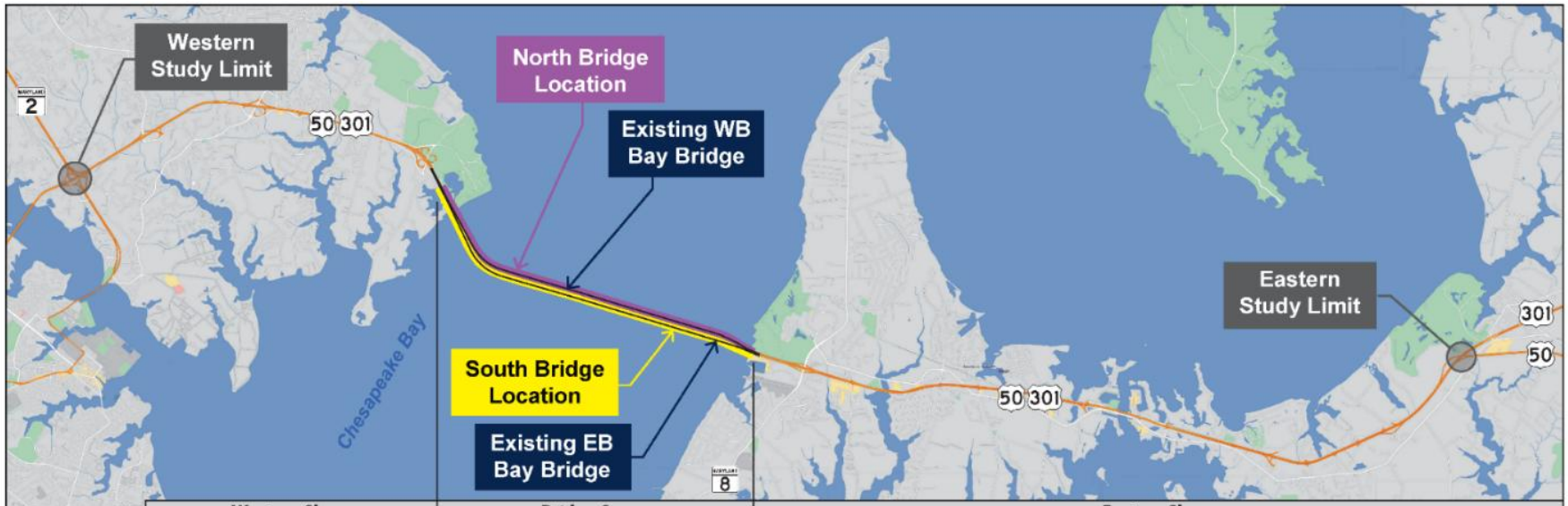
3.2 Alternative B: 6-8-6 North

Alternative B (6-8-6 North) would replace the existing Bay Bridge 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). The two new bridge spans would include one span to the north 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, with Alternative B, 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. On the Western Shore, the transition from the existing six lanes to eight lanes approaching the bridge would occur west of Oceanic Drive in both directions. On the Eastern Shore, the transition from eight lanes to the existing six lanes would occur east of Cox Creek in both directions.

3.3 Alternative C: 6-8-6 South

Alternative C (6-8-6 South) 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). 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, with Alternative C, 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. On the Western Shore, the transition from the existing six lanes to eight lanes approaching the bridge would occur west of Oceanic Drive in both directions. On the Eastern Shore, the transition from eight lanes to the six existing lanes would occur east of Cox Creek in both directions.

Figure 3-1: Alternatives Summary



	Western Shore	Bridge Spans	Eastern Shore
Alternative A: No-Build	6 Lanes	5 Lanes	6 Lanes
Alternative B	6 Lanes	8 Lanes NORTH	6 Lanes
Alternative C	6 Lanes	8 Lanes SOUTH	6 Lanes
Alternative D	8 Lanes	8 Lanes NORTH	8 Lanes
Alternative E	8 Lanes	8 Lanes SOUTH	8 Lanes
Alternative F	8 Lanes	10 Lanes NORTH	8 Lanes
Alternative G	8 Lanes	10 Lanes SOUTH	8 Lanes

3.4 Alternative D: 8-8-8 North

Alternative D (8-8-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in-between the location of the existing bridge spans. Alternative D would increase the number of lanes along the U.S. 50/301 approaches to eight lanes from the MD 2/450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative D, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes. On the Western Shore, the transition from the existing six lanes to eight lanes would occur at the MD 2/MD 450 interchange in both directions. On the Eastern Shore, the transition from eight lanes to the existing six lanes would occur through the U.S. 50/301 interchange in both directions.

3.5 Alternative E: 8-8-8 South

Alternative E (8-8-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), eight lanes on a new bridge (four per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in-between the location of the existing bridge spans. Alternative E would increase the number of lanes along the U.S. 50/301 roadway approaches to eight lanes from the MD 2/450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative E, the five existing bridge lanes would be increased to eight bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes. On the Western Shore, the transition from the existing six lanes to eight lanes would occur at the MD 2/MD 450 interchange in both directions. On the Eastern Shore, the transition from eight lanes to the existing six lanes would occur through the U.S. 50/301 interchange in both directions.

3.6 Alternative F: 8-10-8 North

Alternative F (8-10-8 North) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), 10 lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the north and one span in-between the location of the existing bridge spans. Alternative F would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative F, the five existing bridge lanes would be increased to 10 bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes. On the Western Shore, the transition from the existing six lanes to eight lanes would occur at the MD 2/MD 450 interchange in both directions, and the transition from eight lanes to 10 lanes would occur west of Oceanic Drive in both directions. On the Eastern Shore, the transition from 10 lanes to eight lanes would occur east of Cox Creek

in both directions, and the transition from eight lanes to the existing six lanes would occur through the U.S. 50/301 interchange in both directions.

3.7 Alternative G: 8-10-8 South

Alternative G (8-10-8 South) would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore (four per direction), 10 lanes on a new bridge (five per direction), and eight lanes along U.S. 50/301 on the Eastern Shore (four per direction). The two new bridge spans would include one span to the south and one span in-between the location of the existing bridge spans. Alternative G would increase the number of lanes along the U.S. 50/301 approach roadway to eight lanes from the MD 2/450 interchange on the Western Shore to the U.S. 50/301 split on the Eastern Shore and would generally remain on the existing roadway alignment except where necessary to connect to the new bridge spans. Thus, with Alternative G, the five existing bridge lanes would be increased to 10 bridge lanes and the number of lanes on the Western Shore and Eastern Shore would increase from six total travel lanes to eight total travel lanes. On the Western Shore, the transition from the existing six lanes to eight lanes would occur at the MD 2/MD 450 interchange in both directions, and the transition from eight lanes to 10 lanes would occur west of Oceanic Drive in both directions. On the Eastern Shore, the transition from 10 lanes to eight lanes would occur east of Cox Creek in both directions, and the transition from eight lanes to the existing six lanes would occur through the U.S. 50/301 interchange in both directions.

3.8 Other Components of the Build Alternatives

3.8.1 Pedestrian / Bicycle Shared Use Path

All proposed build alternatives include the option for the safe inclusion of a pedestrian/bicycle shared use path (SUP) along a new bridge. The MDTA has identified connections to existing and proposed trails and recreational facilities on the Eastern Shore and Western Shore.

3.8.2 Tolling

The MDTA owns and operates the Bay Bridge and uses toll revenues to operate and maintain its transportation facilities. The Bay Bridge will continue to be a tolled facility and the MDTA will continue to manage it and the toll to address the current and future traffic and the associated congestion.

3.8.3 Stormwater Management (SWM)

A planning-level, conceptual SWM analysis was completed that identified the stormwater needs and potential treatment locations throughout the Analysis Area for each build alternative.

3.8.4 Utilities

The study area along U.S. 50/301 contains public utilities including: potable water, sanitary sewer, natural gas, electric power/distribution, communications, and cable television. The build alternatives would impact some of these utilities that are in close proximity to U.S. 50/301, and the impacts to these utilities and associated replacements have been included in the build alternatives.

3.8.5 Truck Weigh and Inspection Station (TWIS)

There are two existing Truck Weigh and Inspection Stations (TWIS) along U.S. 50/301 between Oceanic Drive and the Bay Bridge, one in each direction. As part of the build alternatives, these facilities would be upgraded and relocated where necessary.

3.8.6 Limits of Disturbance (LOD)

The LOD is the proposed boundary that would include all construction, erosion and sediment control, SWM, and right-of-way offsets. The LODs for the alternatives were developed from the proposed horizontal and vertical geometry, typical sections, roadside design, and proposed interchange modifications. For Alternatives B and C, 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. This would mean the limits of roadway improvements associated with Alternatives B and C would end at the immediate tie-ins to the new bridge spans, compared with the limits of roadway improvements for Alternatives D through G, which would end at the Study limits (MD 2/MD 450 and the U.S. 50/301 Split). Due to the shorter distance of proposed roadway modifications associated with Alternatives B and C, the LODs associated with these two Build ARDS are smaller than the LODs associated with the other Build ARDS.

3.8.7 Transit-related Improvements

Transit-related improvements would be made through a financial commitment from the MDTA that would focus on providing a one-time investment for local transit agencies near the Bay Bridge. The same commitment would be made for all build alternatives and would not be used to differentiate between alternatives.

All transit-related opportunities would be determined in the future, closer to the time of construction. The MDTA would coordinate with the Maryland Transit Administration (MTA), local governments, and local transit agencies to help determine the opportunities. However, these agencies would determine the transit-related improvements that would be most beneficial for them at that time, and they would be separate and distinct projects from the Bay Crossing.

3.8.8 TSM / TDM Considerations

Two Transportation Systems Management/Transportation Demand Management (TSM/TDM) improvements were considered with the retained build alternatives for potential implementation: congestion pricing and part-time shoulder use (PTSU) lanes.

The Bay Bridge will continue to be a tolled facility. If a build alternative is selected, congestion pricing could be used in the future to provide flexibility for toll management strategies that the MDTA could use to further reduce congestion and achieve transportation goals.

The shoulders on the bridge would be full width (12 feet wide) to accommodate future maintenance needs and incident management; therefore, they would also be wide enough to accommodate a PTSU lane. Although the build alternatives have been developed to accommodate PTSU, the operation of PTSU lanes is not being included as part of the build alternatives. Future implementation of PTSU is not precluded.

4 REGULATORY CONTEXT

4.1 Federal Statutes

A select list of federal laws and directives considered during this AFE analysis is provided below as impacts to those resources protected by these laws and directives would require federal review regardless of FHWA's federal NEPA decision for the Bay Crossing Study. For more details about these federal statutes and how they may relate to the resources evaluated in this report, see the *Bay Crossing Study Tier 2 Cultural Resources Technical Report*, *Bay Crossing Study Tier 2 Socioeconomic and Land Use Technical Report* and *Bay Crossing Study Tier 2 Natural Environmental Technical Report*.

- Clean Water Act (CWA) of 1972 (33 United States Code [U.S.C.] § 1251 et seq.)
- Coastal Barriers Resources Act (CBRA) of 1982, as amended (16 U.S.C. § 3501 et seq.)
- Coastal Zone Management Act (CZMA) (16 U.S.C. § 1451 et seq.)
- Endangered Species Act (ESA) (16 U.S.C. § 1531 et seq.)
- Farmland Protection Policy Act of 1981 (7 U.S.C. § 4201 et seq.)
- Fish and Wildlife Coordination Act (1964) (16 U.S.C. § 661 et seq.)
- Magnuson-Stevens Fishery Conservation and Management Act, Section 305(b)(4)(B) (16 U.S.C. § 1855(b)(4)(B))
- Migratory Bird Treaty Act (16 U.S.C. § 703 et seq.)
- Rivers and Harbors Act Sections 9 and 10 (33 U.S.C. §§ 401 & 403)
- National Historic Preservation Act (NHPA) (54 U.S.C. § 300101 et seq.)
- Chesapeake Bay Protection and Restoration (Executive Order 13508)
- Protection of Wetlands (Executive Order 11990)

4.2 Chesapeake Bay Executive Order and Multi-State Bay Program

The Chesapeake Bay Program (CBP) was established in 1983 and is a multi-state, regional partnership to protect and restore the Bay. The CBP partners include the states of Delaware, Maryland, New York, Pennsylvania, Virginia, and West Virginia; the District of Columbia; the Chesapeake Bay Commission, a tri-state advisory body; and the U.S. Environmental Protection Agency (USEPA) (representing the federal government). In 2014, the Chesapeake Executive Council signed the Chesapeake Bay Watershed Agreement (CBA), a plan that established goals and outcomes for the CBP partners, including headwater states (USEPA, 2025a). Many of the 2014 goals and outcomes had a target deadline of December 2025. A revised Chesapeake Bay Watershed Agreement was approved at the Chesapeake Executive Council meeting on December 2, 2025. Recommendations for the updated structure and process are to be incorporated into the Chesapeake Bay Program's governance framework.

4.3 State Statutes

Although they are not considered for Federal NEPA decisions, Maryland has implemented a framework for habitat and resource protection at the state level that includes identification, project review and compliance, and recommended protection through local master plans and zoning. Further, there are numerous measures in place at the state and local levels to direct where and how new development occurs and to protect existing resources. The Chesapeake Bay Critical Area (CBCA) Act of 1984 (codified in Subtitle 18 of Title 8 of the Natural Resources Article) sought to control future land use and development in the Chesapeake Bay watershed to safeguard Chesapeake Bay from negative impacts due to intense development.

Maryland's 1997 Priority Funding Areas (PFA) Act (codified in Subtitle 7B of Title 5 of the State Finance and Procurement Article) allows localities to identify areas to prioritize state spending to support future growth. The 1997 planning law recognizes the important role of local governments in managing growth and determining the locations most suitable for state-funded projects (Maryland Department of Planning [MDP], 2019). State spending is therefore directed towards infrastructure needs of existing urbanized areas and districts designated for growth. Future growth can be guided to these areas, rather than to rural areas where sprawling development might occur with greater impact to sensitive resources (MDP, 2007). Section 5-7B-01 of the PFA Act exempts from the definition of "growth-related project" any existing transportation facilities project, as that term is defined in § 4-101(h) of the Transportation Article, which includes the Bay Bridge.

The Maryland Smart and Sustainable Growth Act of 2009 clarifies the link between local and comprehensive plans (CMP) and local land use ordinances; it defines "*consistency*" to be when an action is required to be consistent with or have consistency with a local plan, and that local jurisdictions must implement and follow the CMPs they adopt. To bolster land preservation in the Bay watersheds, the MDP worked with the USEPA CBP to include land use goals in the 2014 CBA. The CBP Maintain Healthy Watersheds Goal Team methodology includes land use methods and metrics and options and land conservation.

The Maryland Sustainable Growth and Agricultural Preservation Act of 2012 (the Septics Law) prohibits major residential subdivisions in areas planned for preservation and conservation. This limits the disproportionate environmental impacts of large subdivisions on septic systems on Maryland's farm and forest land. The Septics Law provides counties and municipalities the option to map four tiers: Tier I areas are currently served by sewerage systems; Tier II areas are planned to be served by sewerage systems; Tier III areas are not planned to be served by sewerage systems (these are areas where large lot development on septic systems can occur); and Tier IV areas are planned for preservation and conservation and prohibit major residential subdivisions. The number of lots permitted in a major or minor subdivision is defined by the local jurisdiction; however, the Septics Law prohibits major subdivisions from exceeding seven lots. Jurisdictions that do not map Tiers are prohibited from approving major subdivisions outside of areas currently served by public sewerage systems. Note that the Septics Law does not prohibit residential development on existing lots and does not directly regulate non-residential development. See MDP's SB236 Implementation Guidance for more information and the specific details concerning the statutory mapping criteria. The Septics Law was used in this analysis to inform land development patterns and identify the extent of induced growth that this project could cause.

Maryland legislation (Senate Bill 266 and House Bill 286) titled Local Comprehensive Planning and State Economic Growth, Resource Protection, and Planning Policy - Planning Principles was signed into law in April 2025. The Land Use Article of the Annotated Code of Maryland codifies the eight Planning Principles and requires all local jurisdictions to include the Planning Principles in their local comprehensive plans and implement them through zoning ordinances and regulations. The Planning Principles address land, transportation, housing, economy, equity, resilience, place, and ecology.

State laws considered during the AFE analysis included:

- Waterways and Floodplain Legislation (1933) (Envir. Art. §§ 5-501 to 5-504 Code of Maryland Regulations [COMAR] 26.17.04);
- Maryland Tidal Wetlands Act (1970) (Envir. Art. tit. 16; COMAR 26.24);
- Maryland Agricultural Land Preservation Foundation (MALPF) (1977) (Agric. Art. tit. 2 subtitle 5; COMAR 15.15);
- CBCA Act of 1984 (Nat. Res. Art. 8-1801 et seq.);
- Nontidal Wetlands Protection Act (NWPA) (1989) (Envir. Art. tit. 5 subtitle 9; COMAR 26.23);
- Local Comprehensive Planning and State Economic Growth, Resource Protection, and Planning Policy - Planning Principles (State Fin. & Proc. Art. tit. 5 subtitle 7A);
- Irreplaceable Natural Areas Program (Nat. Res. Art. tit. 3 subtitle 5; COMAR 08.03.17);
- Maryland Forest Conservation Act (FCA) (1991) (Nat. Res. Art. tit. 5 subtitle 16; COMAR 08.19);
- Maryland Smart and Sustainable Growth Act of 2009 (Senate Bill 280/HB 297);
- Maryland Sustainable Growth and Agricultural Preservation Act of 2012 (SB 236);
- The Planning and Zoning Enabling Act (Article 66B);
- Program Open Space Law 1969; and
- Maryland Nongame and Endangered Species Conservation Act (Nat. Res. Art. tit. 10 subtitle 2A; COMAR 08.03.08).

5 METHODOLOGY AND SCOPING

5.1 Methodology

This AFE analysis evaluates the Bay Crossing Study ARDS in alignment with state law and Maryland State Environmental Codes, and it relied on the analysis process described in the Maryland State Highway Administration's (SHA) *Indirect and Cumulative Effects (ICE Analysis) Guidelines for Environmental Impact Statements, and Environmental Assessments and Categorical Exclusions* (SHA, 2007) for evaluating potential AFE.

Resources that can be sensitive to changes caused by transportation improvements include those social, economic, cultural, and environmental resources detailed in **Section 6**. As the AFE may be influenced by actions taken by others outside of the immediate Analysis Area, the potential effects of these actions were considered in **Section 8**. This analysis therefore includes readily available assessments of the potential foreseeable effects of probable actions by others within the AFE Analysis Area.

The completed analysis used readily available Geographic Information System (GIS) data, such as information published by the Maryland Department of Natural Resources (MDNR), MDP, Maryland Historical Trust (MHT), Maryland Department of the Environment (MDE), the CBCA Program, USEPA CBP, the U.S. Fish and Wildlife Service (USFWS), and the Federal Emergency Management Agency (FEMA) as detailed in this report.

5.1.1 Downstream Effects

The direct encroachment upon or alteration of the human and natural environment may result in changes to the environment that occur later in time or some distance away from the initial direct physical impacts. These "downstream" effects can cause alteration of the behavior and functions of the affected environment due to project encroachment (physical, biological, socioeconomic, and cultural).

The ARDS may have downstream effects which are outcomes of direct effects. Construction of transportation improvements may have direct effects, such as:

- Alteration of travel times by providing improvements in the alternative's area of influence;
- Land clearing and grading to construct bridge and roadway alternatives (the LOD);
- Alteration of tidal waters and aquatic habitat to construct the new bridge and demolish the existing bridge;
- Alteration of drainage patterns and volumes by drainage structures at stream crossings and displacing and/or relocating sections of stream channels where needed;
- Construction and maintenance of temporary and permanent erosion control and stormwater management facilities;
- Mitigation and remediation measures to offset adverse impacts; and
- Right-of-way acquisition.

The potential downstream effects of the ARDS from these types of activities are described in **Section 8.1** of this technical report.

5.1.2 Induced Growth Effects

Induced growth effects are considered in this technical report under the premise that improvements evaluated with the build alternatives would increase highway capacity and regional access across the Chesapeake Bay, and thus, would result in reduced travel times between existing developed areas on the Western Shore and undeveloped and lesser developed areas in portions of the Eastern Shore in Maryland. Therefore, undeveloped and less developed areas on the Eastern Shore within a reasonable commute or distance to major employment centers on the Western Shore may be subject to induced residential (and associated commercial/retail) development due to the ARDS improvements.

This study's derivation of the reasonable commute distance areas, which became designated as Induced Growth Study Areas (IGSA), is described in **Section 5.3.2**. As that section describes, a separate IGSA was established for each of the ARDS; however, due to the similarities in traffic operations between Alternatives B and C and between Alternatives D, E, F, and G, three IGSAs have been established for analysis – one representing Alternative A (No-Build), one representing Alternatives B and C, and one representing Alternatives D through G. The build alternatives were grouped as such based on each grouping's similar lane capacity and comparative possibility to induce growth. Improved access to areas farther removed in distance from the areas encompassed by the build alternative LODs may cause induced growth effects on natural lands and vacant properties and conversion of existing development to more intensive land uses. The Bay Crossing Study analyzed potential induced growth effects, including:

- Project-influenced development effects on land use; and
- Effects of project-influenced development (land use changes on the natural and human environment).

The potential induced growth effects of the ARDS are described in **Section 8.2** of this technical report.

5.1.3 Aggregate Effects

Aggregate effects are the incremental effects to the natural and built environment, outside of direct effects, that are brought about by a proposed project or action, presented in the context of other past, present, and future actions within a foreseeable timeframe. Analyzing aggregate effects means considering and accounting for the positive and negative impacts of a proposed action to important natural resources, socioeconomic resources, and historic properties in the Analysis Area in combination with other public or private actions that could affect or have affected those same resources.

To document the aggregate effects for this study, the analysis was guided by the following questions:

1) What is the geographic area affected by the study?
2) What are the resources potentially affected within the geographic area?
3) What are the other past, present, and foreseeable actions that have or would impact these resources?
4) What is the magnitude of those impacts?
5) What is the overall impact on these various resources from the accumulation of the actions?

The aggregate effects analysis considered past projects and changes in land use, current local plans and projects, and long-range plans to evaluate past, present, and planned actions within a defined Analysis Area, the derivation of which is described in **Section 9.3** of this technical report. State transportation plans and local master plans were reviewed to identify planned growth areas to support population growth and protect resources, planned short and long-term infrastructure improvements and development projects in the Analysis Area. A transportation project is considered a "*foreseeable future action*" if it is identified in regional fiscally Constrained Transportation Plans – that is, future construction funds are set aside in the planning process. Long-Range Transportation Plans (LRTP) were reviewed to identify capital improvement projects for the Analysis Area's highway, transit, and active transportation systems that transportation agencies expect to be able to fund over the next 20-plus years.

5.2 Scoping

The MDTA published a NOI in the Federal Register on November 15, 2024, announcing the intent to prepare a Tier 2 EIS for the Bay Crossing Study. The NOI provided information on the Purpose and Need, the ARDS, existing environmental conditions, and potential effects. During the scoping period, which extended from NOI release to January 13, 2025, the MDTA conducted public engagement events and coordinated with federal, state, and local agencies and other stakeholders to obtain pertinent data and jurisdictional resource information, as well as to identify key issues regarding the potential environmental impacts for this study. Input from the public engagement and agency coordination were included in the evaluation of AFE where applicable. Data collected during the scoping phase also informed the development of the Analysis Area and temporal study boundary, as described below.

5.3 Analysis Area

The ARDS evaluated in this report include the No-Build Alternative and six build alternatives (**Figure 3-1**). The build alternatives are differentiated by the number of lanes each provides across the proposed Bay Bridge and on the approaches, as well as the future bridge location for each, relative to the current Bay Bridge location. They also differ in overall project length based on the location at which the proposed lanes tie into the existing lanes, as described in **Section 3**.

The Analysis Area used in this report was developed to define an area where existing conditions would be analyzed for socioeconomic resources, natural resources, and historic properties that could be affected by downstream effects, induced growth effects, and aggregate effects from the build alternatives.

The Analysis Area was developed as a union of the following sub-boundaries: the Area of Traffic Influence (ATI) based on traffic analyses (**Section 5.3.1**), areas where induced growth could occur (**Section 5.3.2**), U.S. Census Tracts (CT) to represent communities and socioeconomic information (**Section 5.3.3**), and watershed boundaries to represent natural resources (**Section 5.3.4**). Each of the geographies described below were overlaid spatially, and the overall Analysis Area was developed from these collective elements as described in **Section 5.3.5** and shown in **Figure 5-10**.

5.3.1 Area of Traffic Influence

The ATI used in the analysis is the geographic area within which Analysis Area roadways are expected to experience a considerable change in traffic volumes (10 percent increase in average daily traffic [ADT] and an additional 1,000 vehicles or more per day) due to improvements provided by Alternatives F and G (8/10/8). As compared to other ARDS, only Alternatives F and G were considered in developing the ATI boundary as those alternatives would have the largest effect on traffic volumes and therefore have the farthest-reaching ATI extents on the Eastern Shore. The ATI used was developed based on the SHA Maryland Statewide Transportation Model (MSTM). The MSTM was used to develop 2045 traffic volume forecasts for Alternative A (No-Build), for both average non-summer weekday (NSWD) conditions and average summer weekend day (SWED) conditions. As summarized in **Table 5-1,** comparison of the existing 2022 volumes to 2045 Alternative A (No-Build) volumes shows that daily volumes for Analysis Area roadways within the ATI are forecasted to increase by approximately 31 percent on typical NSWDs and by approximately 25 percent on typical summer weekends. This corresponds to an annual growth rate within this 23-year period of approximately one percent for typical NSWDs and approximately one percent for typical SWEDs. These forecasts are within the range of annual growth that is typical for this region.

Table 5-1: 2045 Traffic Volume Forecasts (No-Build Condition)

Day Type	Existing 2022	2045 No-Build	Percent Change (%)
Typical NSWD	69,588	91,150	31
Typical SWED	104,284	130,500	25

Source: Bay Crossing Study Tier 2 Traffic Analysis Technical Report

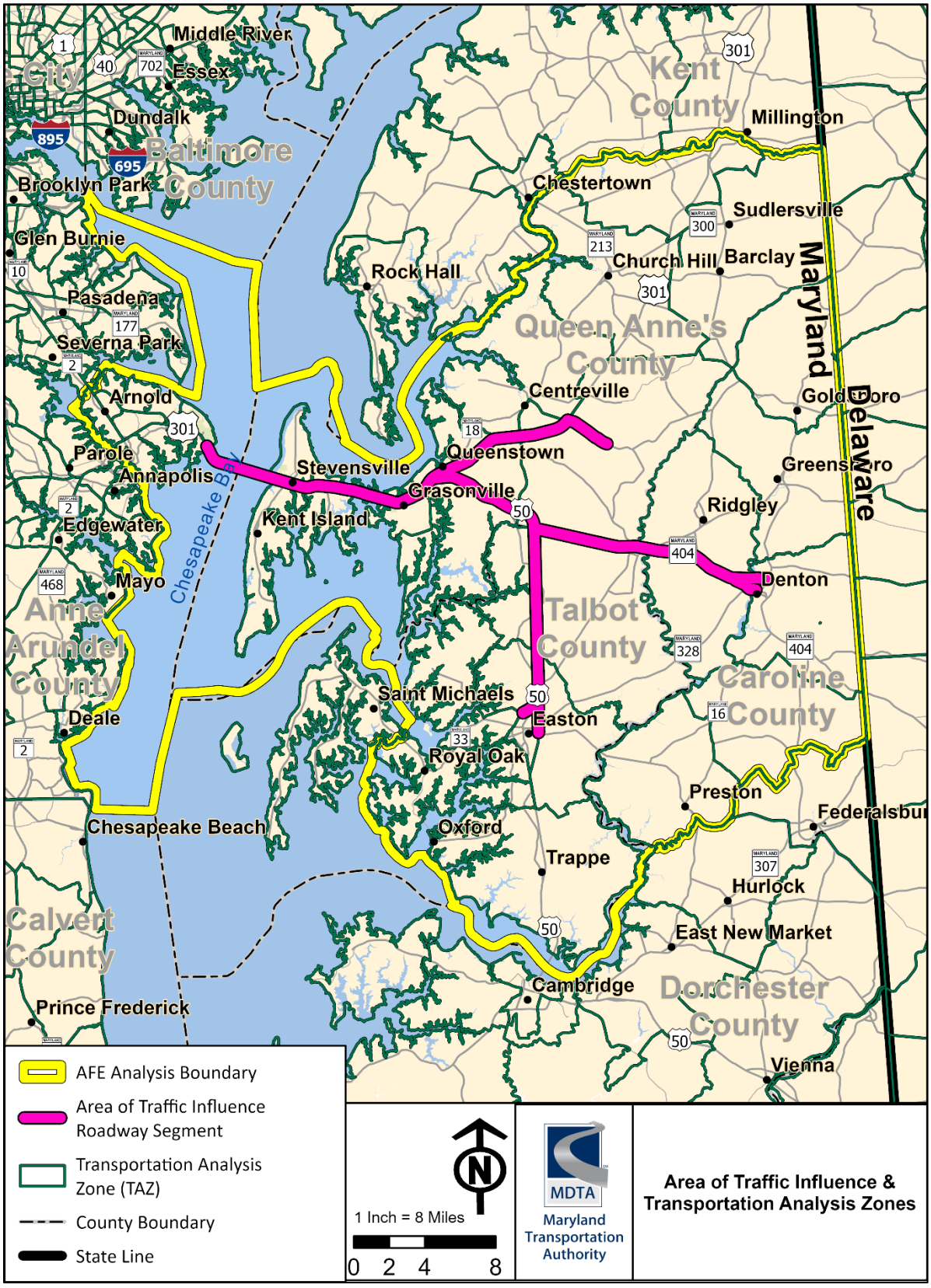
Figure 5-1 indicates the roadway segments for which an ADT increase of 10 percent and an increase of 1,000 vehicles or more in ADT would occur and therefore are part of the ATI for the improvements. All Transportation Analysis Zones (TAZ) from the MSTM that encompass these roadway segments were identified as belonging to the ATI and considered in the development of the overall Analysis Area as shown in **Figure 5-1**.

5.3.2 Induced Growth Study Areas

The induced growth analysis evaluated the likelihood and magnitude of future land development that could occur as a direct result of the ARDS. Traffic analysis was primarily used to determine the geographic area where induced growth could occur in the Analysis Area. This assessment was coupled with a land use and protected lands analysis to create a more comprehensive view of potential induced growth.

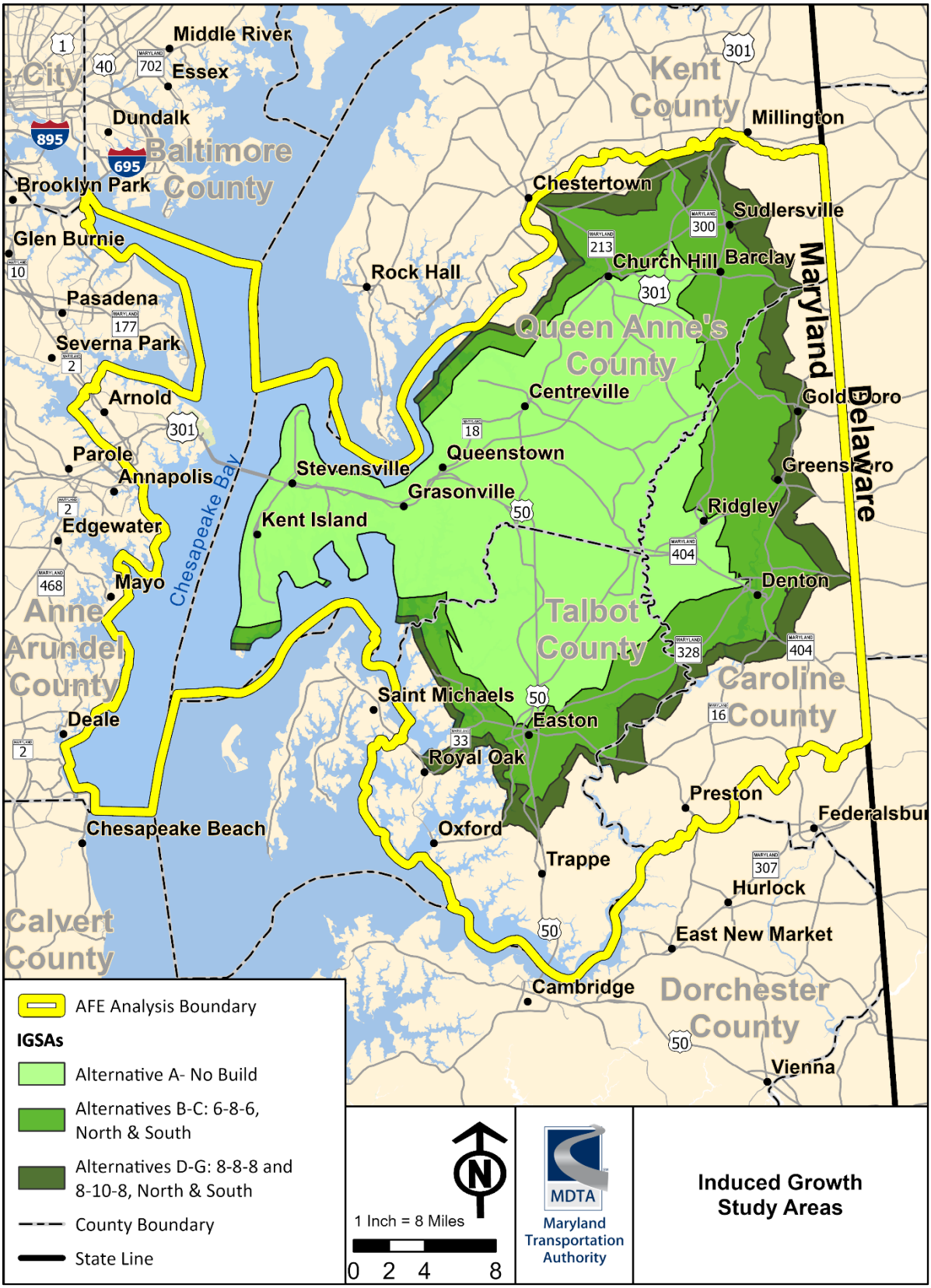
IGSAs were developed for Alternative A (No-Build), Alternatives B and C, and Alternatives D through G using automobile travel time estimation to establish the outermost area that could potentially experience induced growth from a modified Bay crossing (**Figure 5-2**). Building on a similarly conducted induced growth effects analysis conducted as part of the *Bay Crossing Study Tier 1 ICE Technical Report*, the Tier 2 Study analysis focused on areas of the Eastern Shore that would be within a reasonable commute distance from employment centers on the Western Shore with the ARDS. The Western Shore of Maryland contains an expansive array of employment centers; however, to reach any of those employment centers, virtually all commuters from the Eastern Shore need to travel through or near Annapolis to reach these places of employment.

Figure 5-1: Area of Traffic Influence & Transportation Analysis Zones



* For traffic crossing the existing Bay Bridge only

Figure 5-2: Induced Growth Study Areas



Therefore, to establish an outermost area encompassing a reasonable commute distance for Alternative A (No-Build), Alternatives B and C, and Alternatives D through G, a point at the city center of Annapolis on the Western Shore was assumed to be the destination for commuter travel. ESRI's roadway traffic network model was used to identify the area on the Eastern Shore within a 60-minute, free-flow traffic drive time (i.e., traffic that travels at the speed limit for the entire analysis segment) for Alternative A (No-Build), Alternatives B and C, and Alternatives D through G to/from Annapolis' city center. Areas where travel times from the Western Shore would be 60 minutes or less via the ARDS are considered most likely to experience induced growth effects.

The ESRI model allows for the placement of constraints on a given roadway segment, simulating roadway traffic operations that are less than "free flow." Traffic operations data for the ARDS were obtained from the *Chesapeake Bay Crossing Study Tier 2 Traffic and Transportation Technical Report*, and using the premise from the report that Alternatives D through G would each provide free-flow travel conditions within the limits of the ARDS, travel time "*penalties*" were assigned to the Alternative A (No-Build) and Alternatives B and C induced growth free-flow travel limits, assuming a diminished ADT would result with lesser or no additional travel lanes with these alternatives. A travel time boundary was not assigned to Alternatives D and E since their predicted ADT values were similar to Alternatives F and G. Therefore, Alternatives D through G were grouped together for purposes of the induced growth analysis.

Land use changes within the IGSAs can be affected by many factors, including economic conditions, new or expanded roadway access, local zoning and comprehensive planning, and statewide measures to protect rural and natural lands from development. As such, the induced growth effects analysis identified areas designated for growth within the IGSAs and those additional areas determined to be vulnerable to induced growth resulting from the ARDS. The areas formed by the intersection of the individual IGSAs with the vulnerable land areas were used to develop conclusions as to the impacts of induced growth potentially resulting from the ARDS.

5.3.2.1 Designated Growth Areas

Lands designated for future growth (designated growth areas) by government planning organizations are expected to experience growth through new development, infill, or redevelopment (consistent with local zoning and approved sewer tier maps). These areas are designated for growth to focus development away from existing sensitive resource lands that have social, historic, and/or natural resource values to Maryland and local communities.

Development has been concentrated in existing towns, cities, and designated growth areas, which have been expanded over time to accommodate growth. Determined through use of MDP data, counties and municipalities in the Analysis Area have established PFA boundaries to support growth within and adjacent to municipal boundaries and designated growth areas (See **Figure 5-3** for PFAs and municipal boundaries). Maryland has long recognized the greatest potential for changes in land use from any source of induced growth would occur in agricultural and natural resources land. Maryland's 2012 Septics Law requires counties and municipalities to identify land that has or is planned to have sewer infrastructure (Growth Tiers I and II), rural areas where septic systems are allowed (Growth Tier III) and lands to be conserved or preserved (Growth Tier IV) (MDP, 2025c). The Growth Tiers are shown in **Figure 5-4** and local growth planning is further described in **Section 6.1.5**.

For this study's induced growth analysis, currently developed lands, planned growth areas, and protected lands, as described below, were excluded from areas considered vulnerable to induced growth because in these areas, no unplanned land use change (i.e., natural to developed land) would occur as a result of the ARDS. While induced growth may occur in developed and planned growth areas as infill and redevelopment, these areas are targeted for growth and would occur regardless of an improved Bay Crossing. Although the type and intensity of redevelopment and infill may change as a result of an improved Bay Crossing, these areas were excluded from the induced growth analysis as these areas are intended for growth. Additionally, no distinction was made between developed and natural areas within planned growth areas. Land use changes through conversion of natural lands to developed lands was only considered for unprotected natural lands outside of planned growth areas. **Table 5-2** shows the acreages of the IGSAs for the No-Build Alternative, Alternatives B and C, Alternatives D through G, as well as areas that are already developed, or designated for future growth, and would not be vulnerable to unplanned induced growth effects in the Analysis Area. The location and extent of currently developed and designated growth areas within the Analysis Area are shown in **Figure 5-5**.

Table 5-2: Lands Considered not Vulnerable to Unplanned Induced Growth

Land Type	Alternative A: No-Build IGSA (Acres)	Alternatives B and C: IGSA (Acres)	Alternatives D Through G: IGSA (Acres)
Size of IGSA	240,938	367,432	428,410
Developed Land Use	27,203	42,114	48,590
Protected Lands[1]	108,815	176,563	210,590
Land within PFAs	18,004	30,838	33,064
Land within Municipalities	6,766	16,723	17,944
Designated Growth Tiers[2]:			
• Tier I (Existing sewer)	4,712	12,169	12,538
• Growth Tier II (Planned sewer)	5,640	16,202	19,444
Generalized Sewer Service Area Update (Existing, Planned, and Not Planned areas)[3]	17,328	27,424	29,247
Total Acreage of Developed, Protected, and Planned Growth Areas	137,389	222,259	261,745

Sources: Land types obtained from data provided in [1]MDP, 2025b, [2]MDP, 2025c and [3]MDP, 2025a.

Figure 5-3: Priority Funding Areas & Municipalities

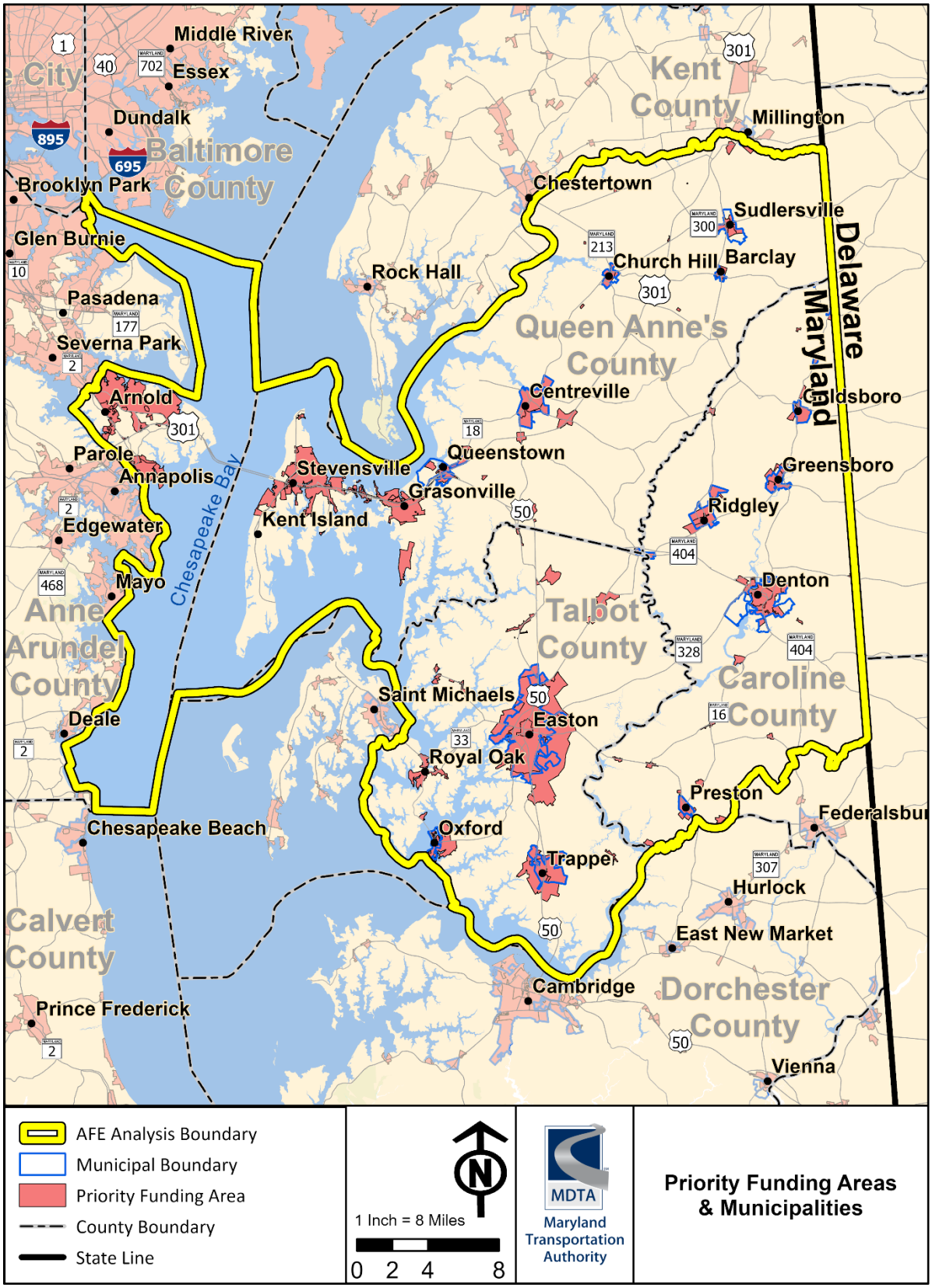


Figure 5-4: Septic Growth Tiers

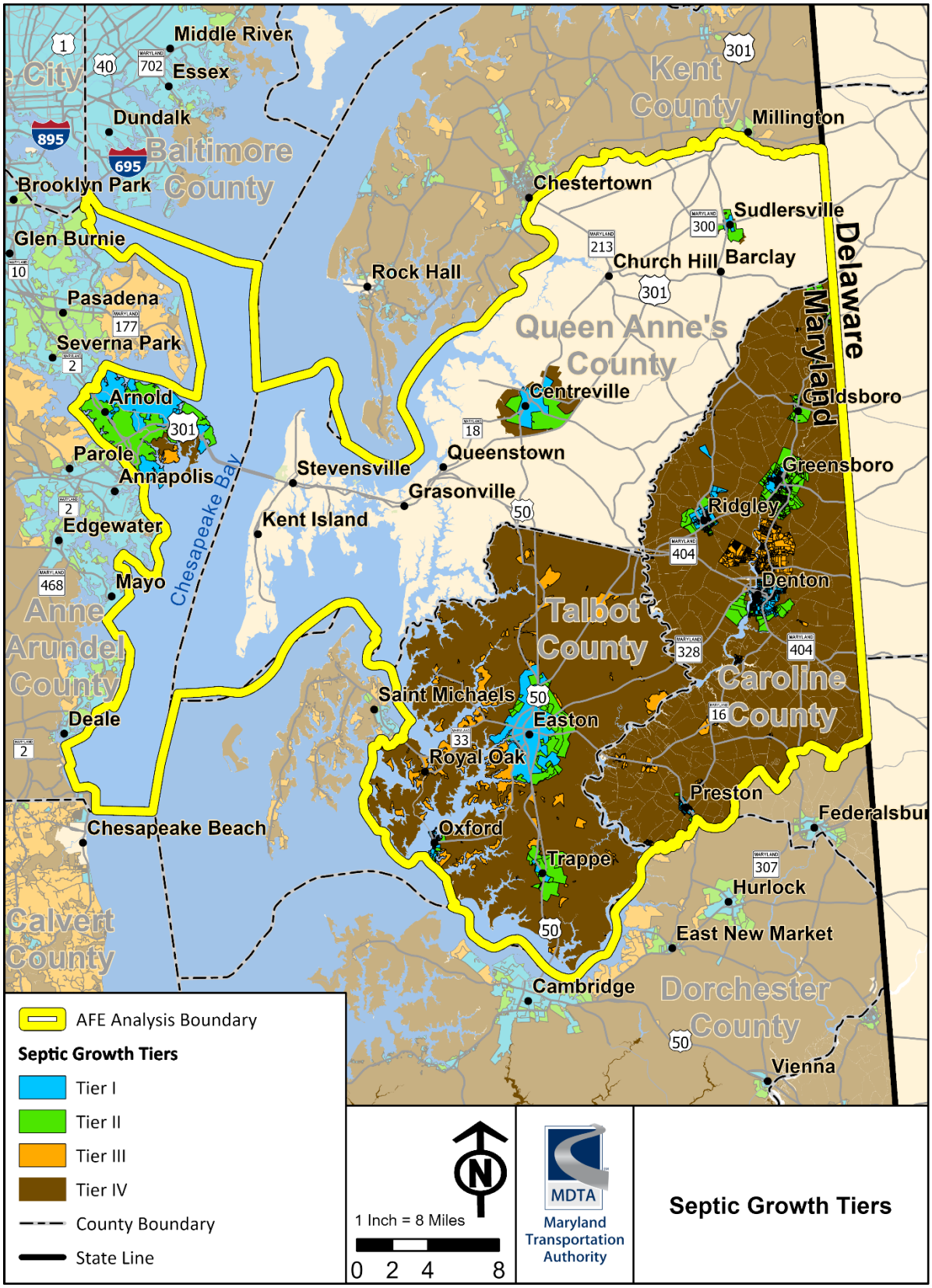
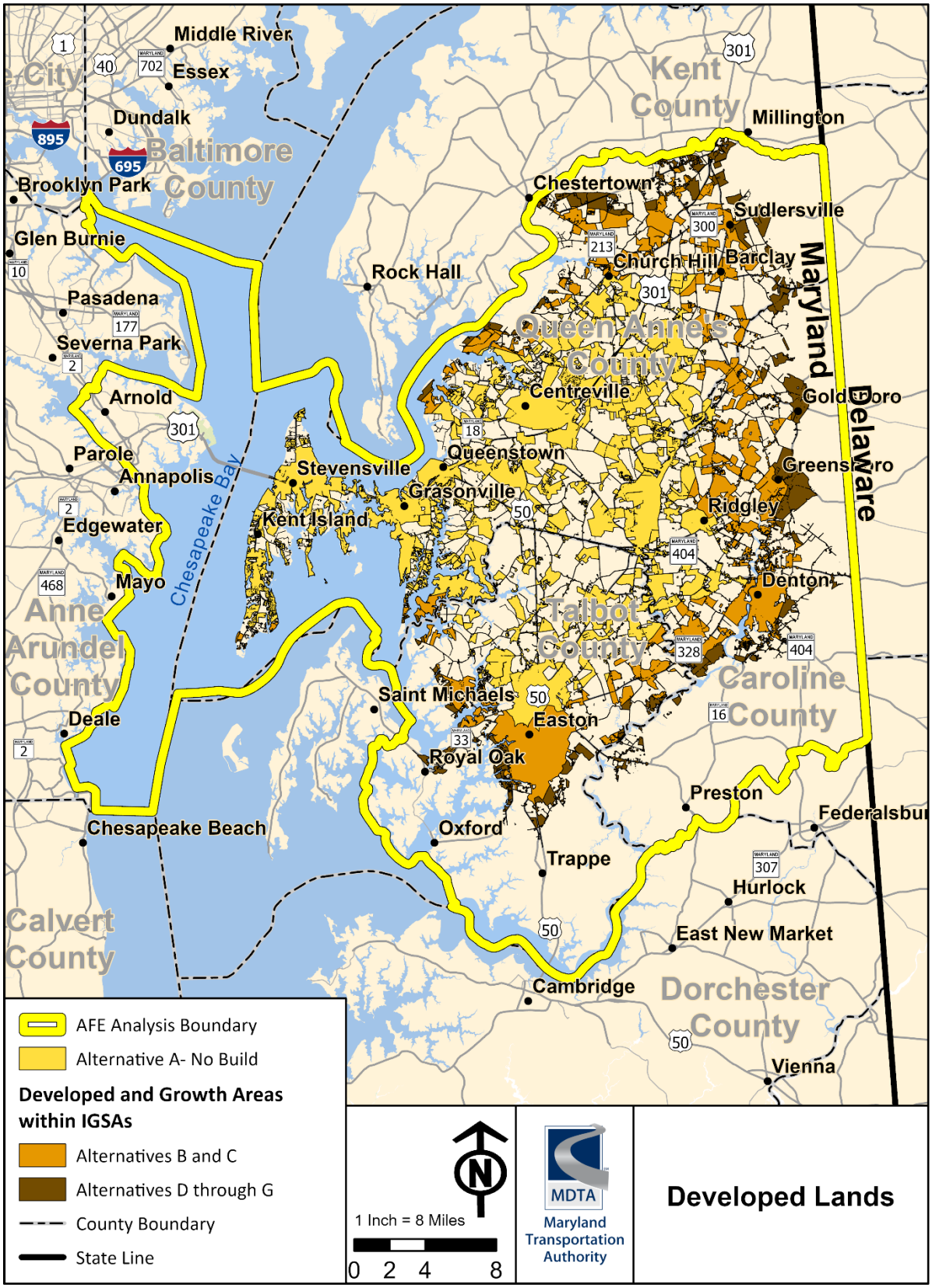


Figure 5-5: Developed Lands



The excluded protected lands from **Table 5-2** include the combined acreage for Maryland's Protected Lands GIS layers including MDNR-owned properties and conservation easements held by MDNR, MALPF, Rural Legacy Areas (RLA), Maryland Environmental Trust (MET), Coastal and Estuarine Conservation Program and private conservation easements, MHT Preservation Easements, local protected lands (i.e., parks), and Transfer of Development Rights properties (MDP, 2025b). These protected land areas are shown in **Figure 5-6**. As these lands are held in perpetual conservation easements and protected from development in some way, for the purposes of this study, they were considered not vulnerable to development and therefore would not be subject to induced growth effects.

5.3.2.2 Vulnerable Lands

Resources that may be vulnerable to land use changes associated with induced growth from the ARDS include forests, farms and rural settings, historic sites, and natural resources, such as wetlands, streams, floodplains, terrestrial and aquatic species, rare, threatened, and endangered species, and area-wide water quality. The induced growth effects analysis focused on these sensitive resources most susceptible to induced growth effects. These include existing agricultural and natural lands outside of planned growth areas that are not currently protected from land use development. Sources and methods used to identify these areas and those areas likely not susceptible to induced growth from the ARDS included:

1) The Chesapeake Bay Land Use and Land Cover dataset (CBP, 2023) (see **Figure 6-2**) was used as the basemap to obtain all areas mapped for natural and agricultural land that could be vulnerable to induced growth effects (from the 18-subclass dataset, the following were extracted as being potentially vulnerable to induced growth: Cropland, Pasture/Hay, Tree canopy (Other), Forest, Natural Succession, Harvested Forest and Wetlands (Riverine Non-Forested & Terrene Non-Forested).

2) Maryland's 2018 statewide land use map (MDP, 2024a) (see **Figure 6-3**) was used to remove currently 'developed lands' from the natural lands basemap, as land use intensification in these areas would occur in areas where environmental resources have already been degraded or eliminated. The developed sublayers removed included all Residential, Commercial, Extractive, Industrial, Institutional, Open Urban Land, and Transportation land uses.

3) Designated growth areas including PFAs, land within municipal boundaries and Maryland's Septic Growth Tiers I and II were then removed from the remaining natural lands basemap (see **Figure 5-3** and **Figure 5-4**).

4) The protected lands shown in **Figure 5-6** and listed in **Table 5-2** were then removed from the remaining natural lands basemap as they are likely not susceptible to induced growth.

Using the above, a vulnerable lands layer was produced, and it was intersected with the IGSA boundaries to obtain and compare the remaining acreages of resources vulnerable to potential induced growth effects for the ARDS following the removal of non-vulnerable areas. The identified vulnerable lands layer is shown in **Figure 5-7** and acreages of vulnerable land types within the IGSAs are listed in **Table 5-3**.

Figure 5-6: Protected Lands

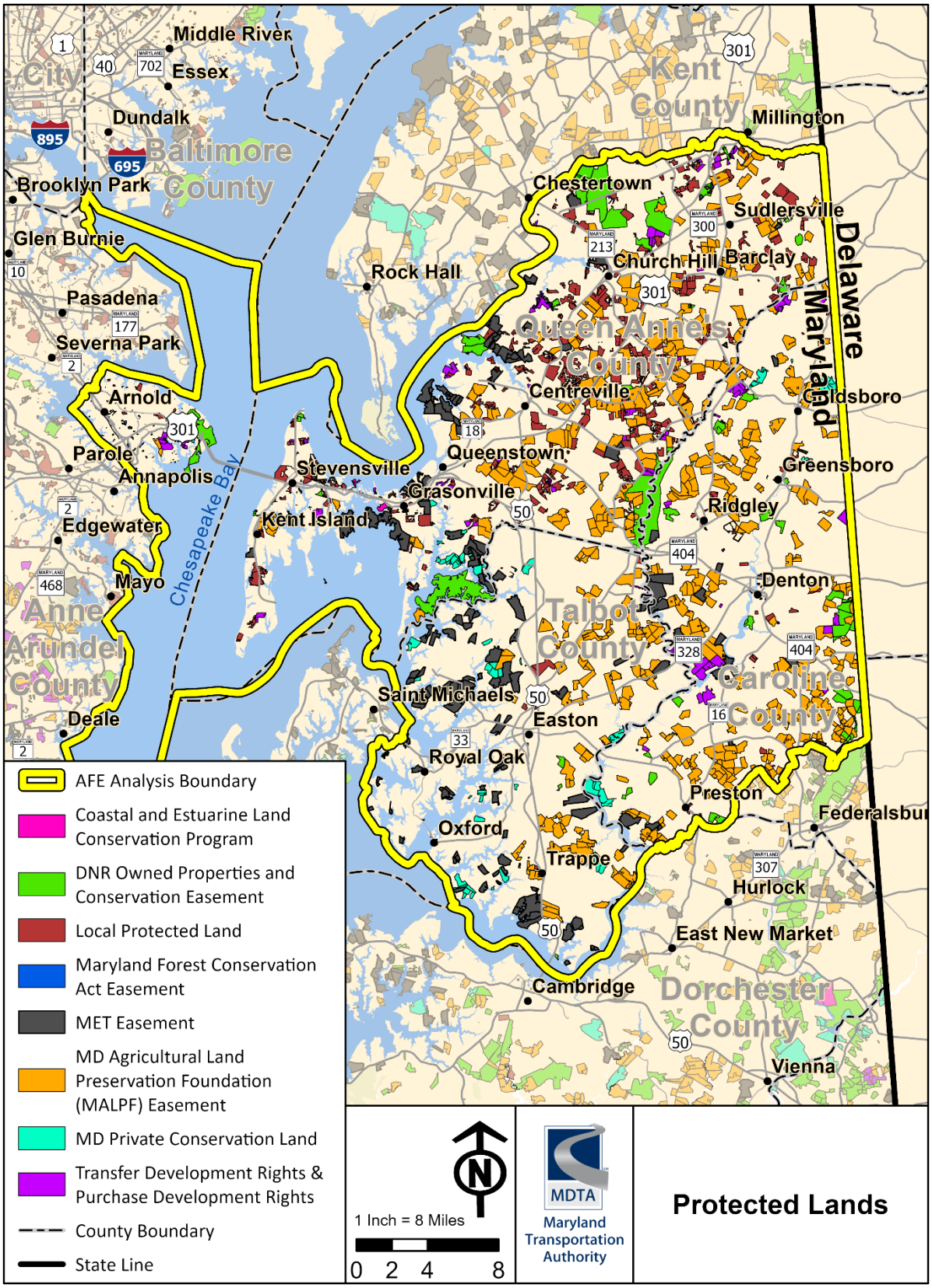


Figure 5-7: Vulnerable Lands within IGSAs

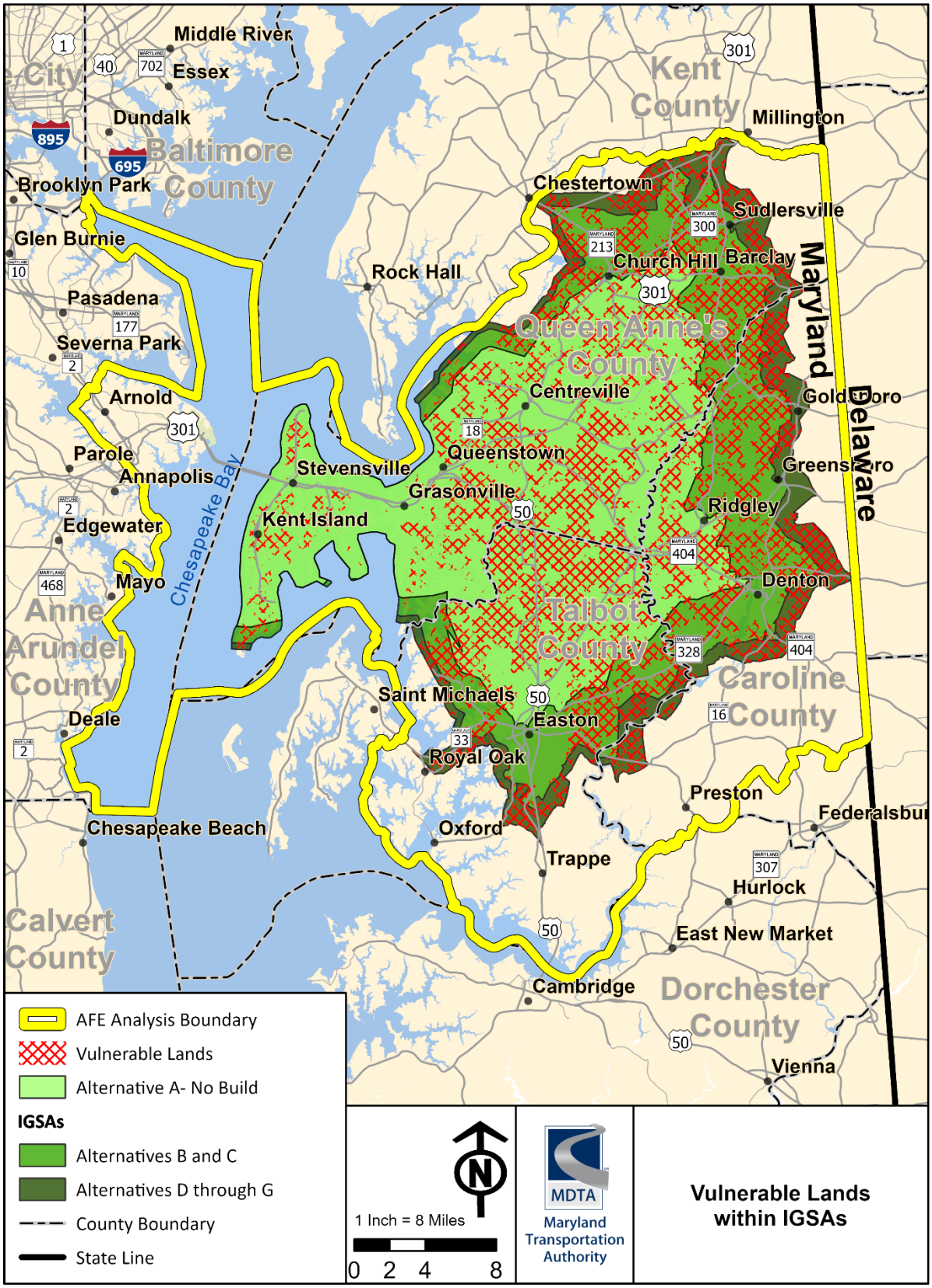


Table 5-3: Land Area Vulnerable to Induced Growth Effects

Land Type	Alternative A No-Build (Acres)	Alternatives B and C (Acres)	Alternative D Through G (Acres)
Forest, Harvested, Natural Succession, and Tree Canopy (other)	22,290	32,562	38,669
Agricultural (Cropland, Pasture/Hay)	54,626	78,449	88,221
Wetlands (Riverine Non-Forested & Terrene Non-Forested)	476	898	1,032
Total Vulnerable Land Area	77,392	111,909	127,922

Source: Natural and agricultural land cover locations obtained from CBP, 2023.

5.3.3 U.S. Census Tracts

U.S. CTs (2020 boundaries) overlapping Corridor 7 were considered in the development of the Analysis Area for determining the location or count of relevant cultural and socioeconomic resources, such as communities, community facilities, businesses and employers, housing, and population. CTs were used rather than block groups to conservatively capture larger areas accounting for potential AFE within the boundary. TAZs and CTs occupy similar, if not identical, geographical boundaries in most cases within the region. Thus, to maintain consistent demographic units, CTs were used more so than watershed boundaries to define the geographical extents of the Analysis Area to facilitate in-depth analysis efforts derived from CT and TAZ data. **Figure 5-8** shows the CTs in the Analysis Area.

5.3.4 Watershed Boundaries

Maryland's 8-digit watershed boundaries were considered in the development of the Analysis Area to assess effects to natural resources such as aquatic and terrestrial habitats and water resources. Maryland's natural resource GIS layers (from MDNR, MDP, USFWS, and MDE) are provided as statewide datasets. Watersheds were considered but do not provide a meaningful outer sub-boundary to obtain existing conditions information. Upon review of the combined boundaries, because the spatial limits of watershed boundaries are not congruent with the outer limits of all CT and TAZ boundaries, the CT and TAZ boundaries were prioritized for defining the Analysis Area to support demographic and travel analysis efforts. **Figure 5-9** shows the 8-digit watersheds that were otherwise considered to develop the Analysis Area.

5.3.5 Analysis Area Summary

Due to the proximity of employment centers and metropolitan areas such as Annapolis, Baltimore, and Washington, D.C., it is reasonable to expect development along the Western Shore to persist regardless of changes to the Bay Bridge crossing. Thus, the Analysis Area coincides with the Broadneck Peninsula along the Western Shore but is more expansive on the Eastern Shore to consider potential new development which may occur because of improved access from the Eastern Shore to employment center destinations along the Western Shore. The greatest potential for vulnerable lands impacts occurs on the Eastern Shore.

The ATI, IGSAs, CTs, and watershed boundaries were considered to develop the Analysis Area on the Eastern Shore. The outer boundary of all the CTs representing the TAZ and encompassing the IGSAs represents the spatial extents for which resource data is readily available.

Figure 5-8: Census Tracts

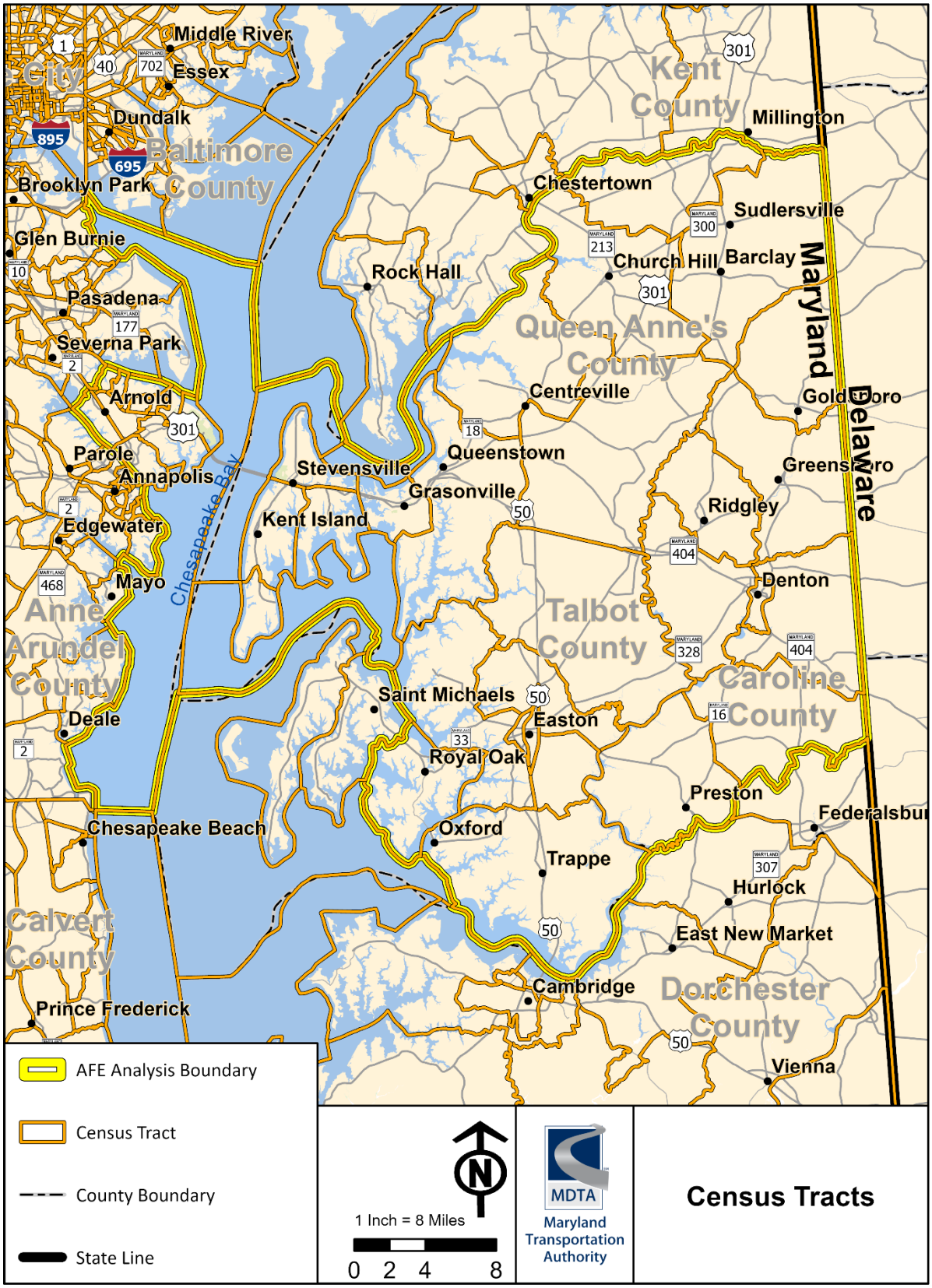


Figure 5-9: Watershed Boundaries

Demand for efficient access to highly concentrated residential, commercial, and employment centers such as Baltimore, Washington, D.C., and Annapolis would likely yield development pressures to areas closest to the location of the Bay Bridge along the Eastern Shore. To develop a reasonable Analysis Area along the Eastern Shore, all CTs within a 60-minute drive time from Annapolis (with Alternatives F and G) were selected and incorporated into this boundary. The Analysis Area (**Figure 5-10**) shows that the 60-minute drive time boundary covers more area than the ATI roadway segments and thus provided the most conservative extents for the resource inventory described in **Section 6**. **Table 5-4** shows the acreage and percentage of each county within the Analysis Area.

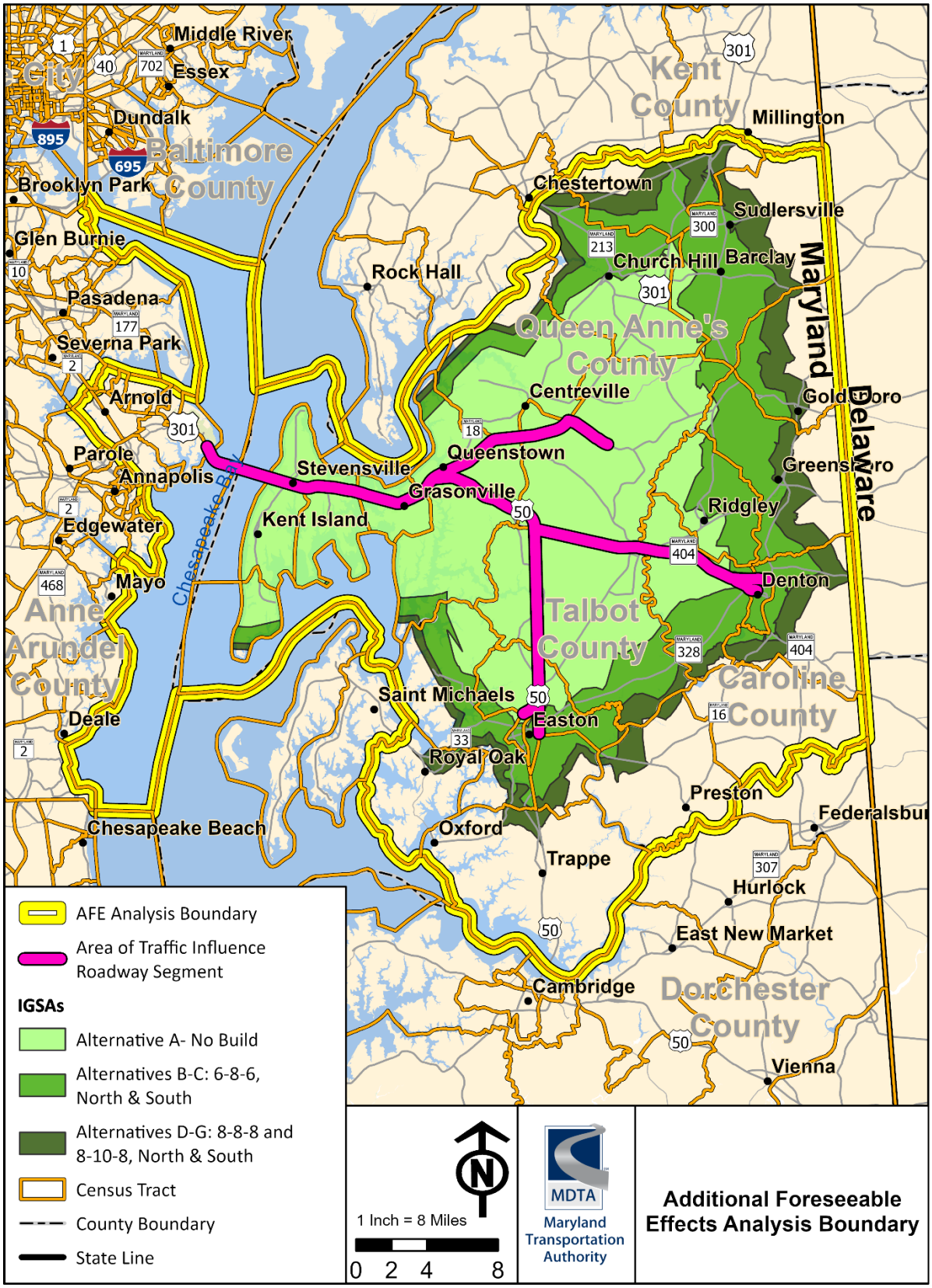
Table 5-4: Analysis Area Summary by County

County	Area (Acres)	Area (Percent)
Caroline	186,550	23.53
Queen Anne's	326,815	41.21
Talbot	182,290	22.99
Anne Arundel	97,329	12.27
Total	792,984	100

5.4 Temporal Boundary

The temporal boundary, or time frame of the analysis, was identified based on several factors including data availability, relevant historical trends and events, and the anticipated year of implementation for improvements being evaluated. The past temporal boundary was set as 1970, immediately prior to the expansion of the original bridge when a new westbound span opened in 1973. Past land use mapping is not available for 1970. The first statewide land use / land cover (LULC) map was published in 1973, and the first statewide wetlands inventory was conducted between 1981 and 1982 (cited as 1982 in this document). The future temporal boundary was set as 2045 to be consistent with available regional travel demand model forecasts and applicable Long-Range Transportation Plan time frames.

Figure 5-10: AFE Analysis Boundary



6 RESOURCE INVENTORY AND DATA COLLECTION

Table 6-1: Resource Data Sources and Analysis Methodology summarizes the key resources considered in this study, including socioeconomic resources, such as land use, land cover, community cohesion, community facilities, recreational facilities, businesses, and farmlands; natural resources, such as streams, wetlands, water quality, floodplains, wildlife and wildlife habitat, and threatened or endangered species; historic properties, such as archaeological and historic architectural resources; and a discussion of planning requirements for the Analysis Area.

This section also includes the information on resource planning, patterns, policies, and trends used to inform the AFE analysis. This information was used to establish a context for past, present, and future conditions within the Analysis Area, identify trends in land use planning, cultural and natural resources, and provide other important information needed to identify AFE.

Table 6-1: Resource Data Sources and Analysis Methodology

Resource	Data	Data Sources	Analysis Methodology
Socioeconomic Resources			
Communities, households, employers, agriculture, parks recreational facilities, PFAs	Land use, demographics, county, and municipal plans	MDP, Maryland iMAP, U.S. Census Bureau (USCB), U.S. Department of Agriculture (USDA), and various jurisdictions	GIS map and imagery overlay, analyze population and housing trends, plan reviews
Natural Resources			
Watersheds, wetlands, surface water / floodplains	Stream mapping, aerial imagery, land use data, watershed boundaries, floodplain mapping	MDNR, MDE, United States Army Corps of Engineers (USACE), USEPA and FEMA	Overlays of land use and historical imagery, trends analysis
Wetlands and aquatic Habitat	Wetlands and waters mapping, land use, and historical imagery	MDE, MDNR, USFWS, and MD iMAP	Overlays of land use and historical imagery, trends analysis
Forest	Resource mapping and historical imagery	MDNR, U.S. Forest Service (USFS), and USEPA CBP	Overlays of land use and land cover and trends analysis
Wildlife, habitat, and sensitive species	Resource mapping and imagery	MDNR, USFWS, and National Marine Fisheries Service (NMFS)	Overlays of land use and trends analysis
Historic Properties			
Historic structures/ districts and archeological sites	Historic maps and photos, land use maps, historical site records	MHT, National Register of Historic Places, and field evaluations	Overlays of land use surrounding historical sites and trend analysis

6.1 Socioeconomic Resources

Socioeconomic information used to inform the analysis of AFE included:

- Population and employment trends based on census and geographic data;
- Growth trends based on reports, historic maps, and aerial imagery; and
- Planning and forecasting documents concerning past, present, and future economic development, employment, land use, zoning, transportation, resource protection, and recreation.

Topics covered under socioeconomic resources included historic land use, existing LULC, county plans, PFAs, commuting patterns, communities, community facilities, housing, regional transportation plans, businesses and employers, and agriculture.

The Analysis Area encompasses numerous communities, priority funding and municipal areas, sensitive populations, and economic areas. Threats to Maryland's socioeconomic resources include changes in land use, residential and business displacements, loss of community cohesion, and lack of community facilities. Historical development in the Analysis Area has resulted in accelerated growth and development, displacements, and rapid economic growth. Today, the CMPs from Analysis Area localities define objectives, goals, or strategies to minimize sprawling development and land use conversion.

6.1.1 Land Use and Land Cover

Along the U.S. 50/301 corridor the built environment is shaped by the Chesapeake Bay and its tributaries. Prior to World War II, the area was predominantly agricultural with water-based industries. Farms were developed into residential communities, and commercial development followed along the main transportation corridors. Summer resort communities along the western edge of the Bay were converted to full time use, and new communities were constructed along the waterfront. Anne Arundel County has historically supported industry, military, and government institutions due to proximity to Washington, D.C.

The opening of the first span of the Bay Bridge in 1952 quickly changed the rural character of Queen Anne's County, as developers rushed to subdivide newly accessible waterfront land. The opening of the second span of the bridge in 1973, combined with continued growth in the region, brought a new wave of permanent residents to Queen Anne's County (those who were willing to commute long distances for work in exchange for a waterfront, home lifestyle).

Between 1980 and 2000, major investments were made to connect the Baltimore Beltway (I-695) and Capital Beltway (I-95/495) to Annapolis and the Eastern Shore, including construction of I-97 and conversion of at-grade signalized intersections to grade separated interchanges. Express EZPass toll lanes at the Bay Bridge toll plazas, creation of frontage roads for local business access, and increasing the number of lanes on U.S. 50/301 provided access to the Broadneck Peninsula for a reasonable commute time to Washington, D.C. (Anne Arundel County, 2019). These toll lanes have since been replaced with all electronic tolling on the eastbound span, reducing congestion and increasing the reasonable commute time to Washington, D.C.

The MDP created the first statewide LULC map in 1973. Maryland's Planning Policy enacted in 1992 directs for the wise use of land and protection of agricultural and forest lands. MDP compared 1973 and 2010 land development to population growth reported by the USCB decennial census (MDP, 2010). MDP reported that more than one million acres of agriculture

and forest land were developed statewide over the 37-year period. In its 2010 *Summary of Land Use Trends in Maryland*, the MDP reported that large-lot residential properties made up 30 percent of all developed areas in 1973 and had increased to 50 percent of all developed areas by 2010.

In their 2010 summary of land use trends report, MDP stated "*These land-use patterns have many social, environmental and economic consequences, including water quality impacts from proliferation of septic systems, increased impervious cover, the need for greater infrastructure investment to reach areas further from development centers, loss of natural resource-based economies, and the overall loss and fragmentation of resource lands making them less viable for farming and forestry*." MDP's 2010 LULC product was released in tandem with the 2010 report. **Table 6-2** shows the developed land acreage change from 1973 to 2010 presented in the MDP 2010 report and population change reported in MDP Census Data summary reports for the same period. Developed land acreage in Maryland increased from 10.5 percent to 26 percent of the total land area, a 145 percent increase, while the population increased by 47 percent.

Table 6-2: Population and Developed Land Acreage in Maryland, 1973 – 2010

Year	1973	2010	Change
Population[1]	3,923,897	5,773,552	1,849,655 (47%)
Developed Land (Acres)[2]	654,000 (10.5%)	1,664,238 (26%)	946,000 (145%)
Total Land Area (Acres)[3]	**6,255,251**		

Sources: [1]USCB, 1970 and 2010 (as reported by MDP); [2]MDP, 2010; [3]MDNR Forest Service, 2025.

Figure 6-1 and **Figure 6-2** show 10 LULC types for the Analysis Area in 1973 and 2010, respectively. **Table 6-3** shows agricultural land decreased by five percent (loss of ~18,000 acres) and forest land decreased by 11 percent (loss of ~19,400 acres) while residential land uses increased by 160 percent (~29,400 acres) in the Analysis Area between 1973 and 2010. A graphical comparison of these two datasets in GIS shows that much of the loss in forest land and agricultural land occurred in and around municipalities and along the U.S. 50/301 roadway on Kent Island and these uses were replaced by residential and commercial land uses.

Table 6-3: LULC Change from 1973 to 2010 in the Analysis Area

LULC Types	1973 Acres	2010 Acres	Change in Acreage (Percent Change) (1973-2010)
Agriculture	370,600 (47%)	352,600 (45%)	-18,000 (-5%)
Commercial	2,600 (0%)	4,300 (0%)	+1,700 (66%)
Forest	181,900 (23%)	162,600 (20%)	-19,400 (-11%)
Industrial	100 (0%)	900 (0%)	+800 (740%)
Institutional	1,300 (0%)	3,700 (0%)	+2,400 (191%)
Other	2,700 (0%)	5,400 (0%)	+3,100 (105%)
Residential	18,400 (2%)	47,800 (6%)	+29,400 (160%)
Water	202,300 (26%)	202,100 (26%)	-200 (<1%)
Wetlands	10,800 (1%)	10,800 (1%)	0 (<1%)
Barren Land	300 (<1%)	700 (<1%)	+400 (<1%)

Sources: MDP, 1973 & 2010; All numbers rounded to closest 100 acres or 1%.

Figure 6-1: Land Use / Land Cover 1973

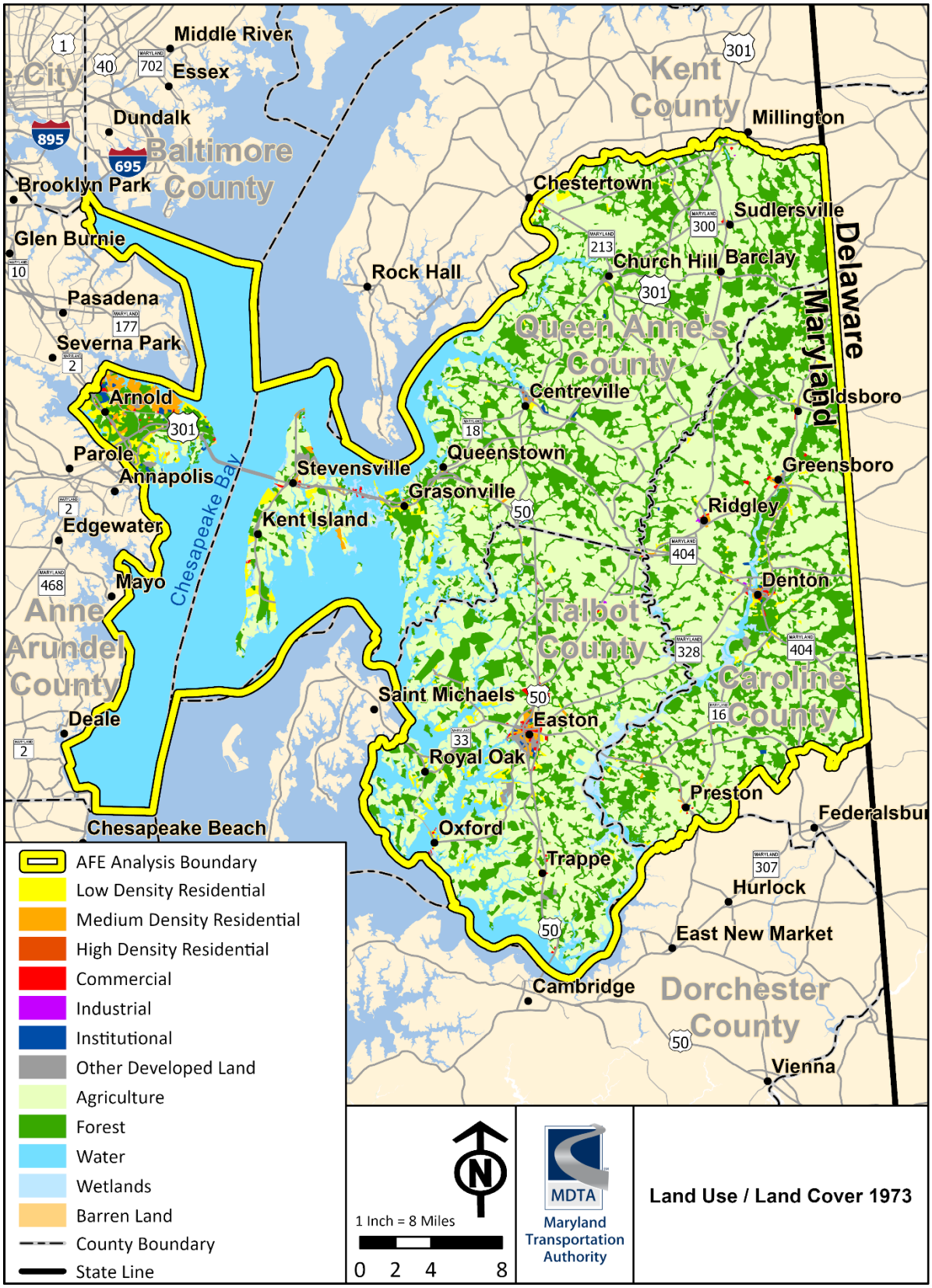
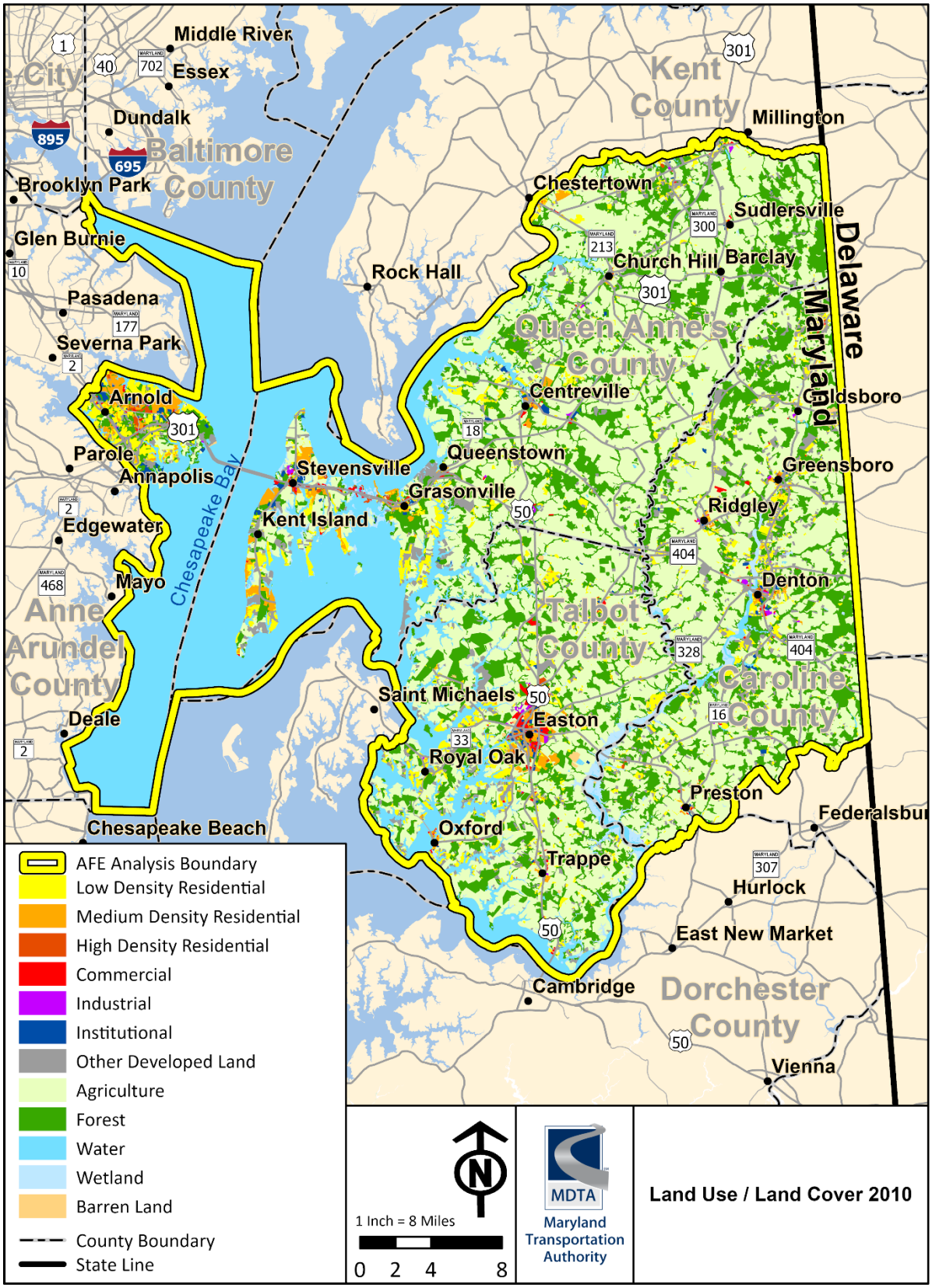


Figure 6-2: Land Use / Land Cover 2010



MDP's statewide 2018 land use map, published in December 2024, is an update to the previous land use map, however it is different because it shows developed lands based on their parcel polygons attributed with tax assessment data, and the CBP's 2017/18 LULC data (2022 edition). MDP cautions that the new product is not comparable with MDP's previous LULC products and should not be used to assess change over time. The 2018 land use map now includes agriculture, forest, and wetlands in the "*other land*" land use type (MDP, 2024a). **Table 6-4** lists acreages of land use types within the Analysis Area using the updated data and **Figure 6-3** shows developed land uses, including residential, commercial, institutional, industrial, transportation, extractive, open urban land, other land, and water. The total acreage of developed land types within the Analysis Area based on the 2018 land use map data is 72,600 acres (representing nine percent of the total Analysis Area). Separated by the Chesapeake Bay, within the Analysis Area, 10,075 acres on the Western Shore and 62,625 acres on the Eastern Shore are developed.

Approximately 46,200 acres (six percent of the land use in the Analysis Area) is residential (all four density levels combined) and transportation comprises approximately 15,400 acres (two percent). Commercial and institutional uses comprise approximately 6,600 acres (less than one percent each) and industrial, extractive, and open urban land uses comprise 4,400 acres (less than one percent each) in the Analysis Area. Approximately 208,000 acres is water (26 percent of the Analysis Area). Most of the open water consists of the Chesapeake Bay. Sixty-five percent of the Analysis Area (approximately 511,800 acres) is classified as "*other land*". The "other land" land use type includes unbuilt lots, rural land, single-family residential parcels greater than or equal to 20 acres in size, and undeveloped portions of large parcels containing urban uses and may include land that is developable or constrained from further development. Developed land uses in the Analysis Area typically occur along major transportation corridors and facilities connecting major metropolitan areas.

Table 6-4: MDP Land Use (2018) in the Analysis Area

Land Use	Acres	Percent of Analysis Area
Very Low Density Residential	5,100	<1
Low Density Residential	32,500	4
Medium Density Residential	7,400	<1
High-Density Residential	1,200	<1
Commercial	3,400	<1
Institutional	3,200	<1
Industrial	1,000	<1
Transportation	15,400	2
Extractive	500	<1
Open Urban Land	2,900	<1
Other Land	511,800	65
Water	208,500	26
Total	**793,000**	**100**

Source: Land use data obtained from MDP, 2024a. All numbers rounded to closest 100 acres or 1%.

The Chesapeake Bay LULC dataset (CBP, 2023) was used to determine acres of non-developed areas within the Analysis Area including forest and agricultural lands. These areas are shown as "*other land*" in the MDP 2018 statewide land use map.

Figure 6-4 shows the Chesapeake Bay land cover mapping created by the Chesapeake Conservancy, U.S. Geological Survey and University of Vermont Spatial Analysis Lab with funding from the CBP (CBP, 2023). The CBP 18-classification land cover data which includes forest land and two agricultural land types (cropland and pasture/hay), three types representing forest (Forest, Harvested, and Natural Succession), and tree canopy with natural understory is included as **Appendix A**. **Table 6-5** shows the CBP LULC 18 type classifications system, grouped into six categories representing developed and non-developed land types. Cropland and pasture/hay were used to identify "agricultural lands" in the Analysis Area.

The Chesapeake Bay LULC mapping shows that approximately 194,000 acres (25 percent) within the Analysis Area are forested and approximately 303,000 acres are cropland, pasture, or in hay production (38 percent of the Analysis Area). Tree canopy over altered lands (turf and impervious) comprises approximately 19,600 acres (two percent) and Impervious Surface and Developed Pervious/Other comprises another approximately 53,400 acres (seven percent) of the Analysis Area. Wetlands, including riverine non-forested, terrene non-forested, and tidal non-forested wetlands, comprise approximately 14,400 acres (two percent) and water comprises approximately 208,500 acres (26 percent). Excluding water, the largest land cover types in the Analysis Area are agriculture (38 percent) and forest (25 percent).

Table 6-5: Chesapeake Bay LULC (2018) in the Analysis Area

Land Cover	Acres	Percent of Analysis Area
Forest, Harvested, Natural Succession and Tree Canopy (other)	194,000	25
Cropland, Pasture/Hay (agriculture)	303,000	38
Tree Canopy over altered lands (turf and impervious)	19,600	2
Impervious Surface and Developed Pervious/Other	53,400	7
Wetlands	14,400	2
Water	208,500	26
Total	**793,000**	**100**

Source: Land cover data obtained from CBP, 2023. All numbers rounded to closest 100 acres or 1%.

6.1.2 Communities

The Analysis Area includes portions of Anne Arundel County on the Western Shore, Queen Anne's County (entirety), and large portions of Caroline County and Talbot County on the Eastern Shore. Municipalities within the Analysis Area are listed in **Table 6-6** and shown on **Figure 5-3**. There are no municipalities on the Western Shore within the Analysis Area.

6.1.3 Priority Funding Areas

Maryland's Economic Growth, Resource Protection, and Planning Policy (updated in 2025) and the 1997 PFAs Act identify areas prioritized for state land use decisions and investment to support future growth. The 1997 planning law recognizes the role local governments play to direct growth and conserve land and spending on infrastructure (MDP, 2019). Future growth can be guided to areas with or adjacent to existing infrastructure and to areas with higher density zoning to avoid development of natural areas. Directing future growth to existing towns and cities helps preserve the rural character, forests, and farms while still allowing development to occur.

Figure 6-3: Land Use 2018

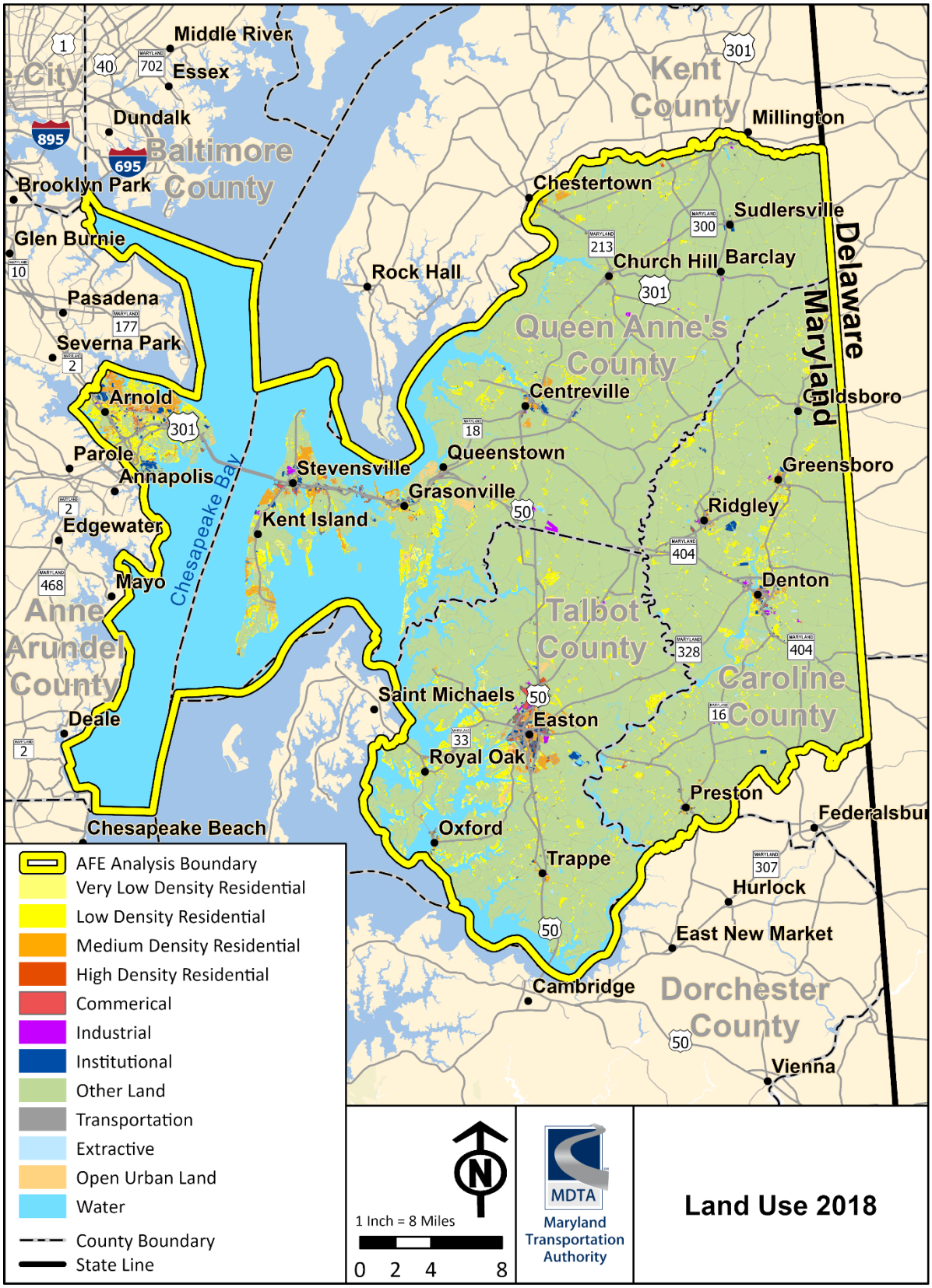


Figure 6-4: Land Cover 2018

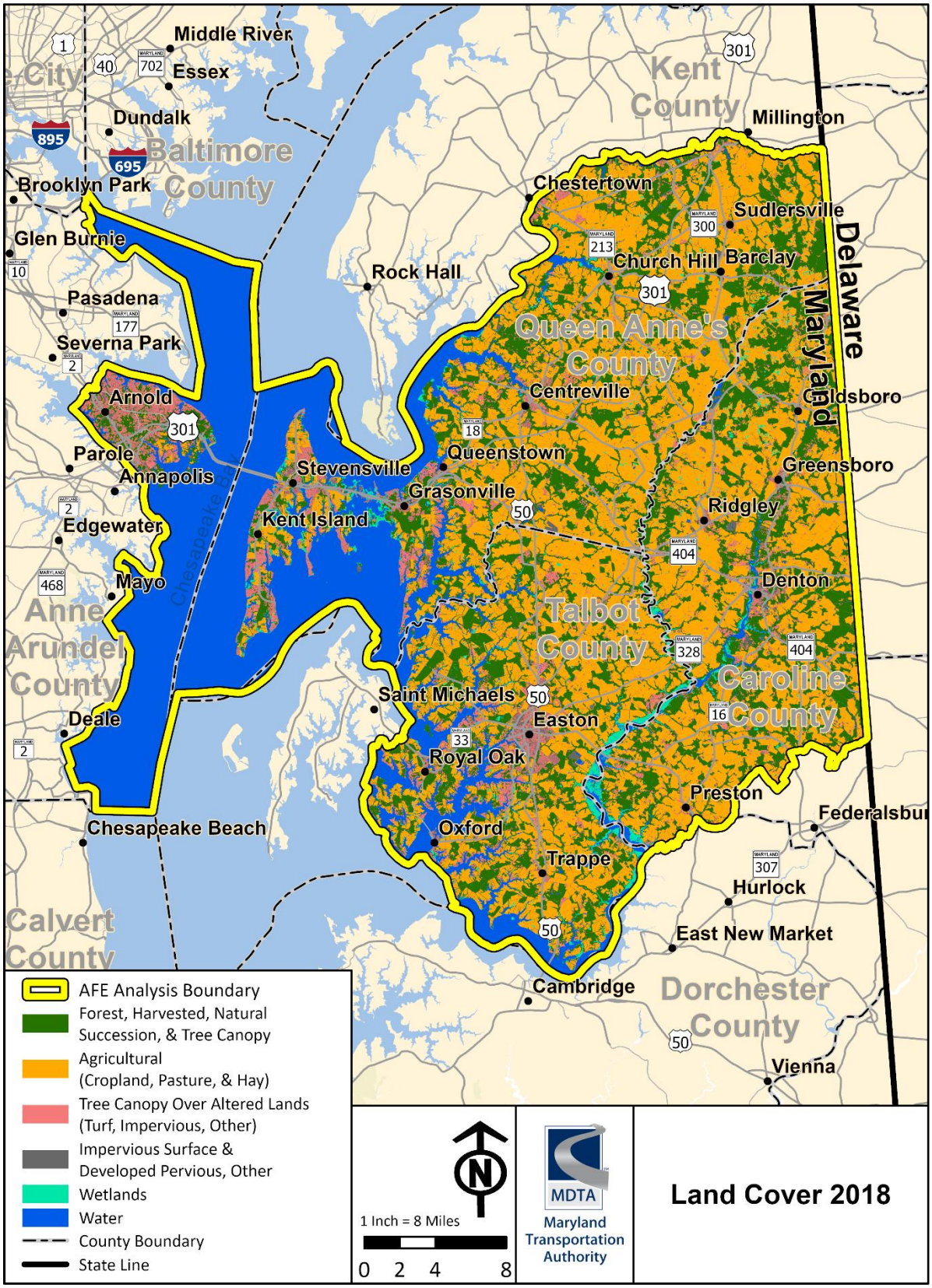


Figure 5-3 shows locations of PFAs and municipalities in relation to the Analysis Area. **Table 6-6** shows the acreage of PFAs within the Analysis Area, including municipalities. PFAs within the Analysis Area account for approximately 47,021 acres, with approximately 6,879 acres on the Western Shore and 40,142 acres on the Eastern Shore. A large portion of the land area on the Western Shore is within PFAs (32 percent). PFAs on the Eastern Shore are concentrated around municipalities and towns nearest to the Bay Bridge (Stevensville, Chester, Kent Narrows, Grasonville).

Table 6-6: PFA and Municipalities Acreage per County

Location	Municipality	Area (Ac)	PFA Area (Ac)	Percent within PFA
Analysis Area		792,984	47,021	6
Western Shore		97,329	6,879	7
Eastern Shore		695,655	40,142	6
County		**Municipality Area (Ac)**		
Queen Anne‘s	Barclay	167	167	100
	Centreville	1,741	1,741	100
	Church Hill	452	407	90
	Millington	63	41	65
	Queenstown	1,398	631	45
	Sudlersville	941	579	62
Queen Anne’s/ Caroline	Templeville	32	32	100
Queen Anne’s/ Talbot	Queen Anne	82	82	100
Caroline	Denton	3,494	2,018	58
	Goldsboro	507	507	100
	Greensboro	689	686	100
	Henderson	80	80	100
	Hillsboro	86	86	100
	Marydel	73	73	100
	Preston	360	348	97
	Ridgely	1,194	1,062	89
Talbot	Easton	7,382	7,361	100
	Oxford	475	362	76
	Trappe	1,665	1,665	100
Anne Arundel	None		6,879	
Municipality Total		20,881	17,923	86
Non-Municipality Total		772,103	29,098	4

Source: Municipal boundary limits obtained from MDP, 2024b

6.1.4 Local Plans

The Planning and Zoning Enabling Act (also known as Article 66B and now codified in the Land Use Article of the Maryland Code) provided "*visions*" to guide the growth of non-charter counties and municipalities.

Some key visions of this regulation include:

- Concentration of development within existing population centers;
- Resource protection;
- Stewardship of the Chesapeake Bay;
- Encouraging economic growth; and
- Sufficient public infrastructure for new growth development.

This Article necessitated development of a Comprehensive Plan (Master Plan) with defined content by counties and municipalities. Plans were to be reviewed and updated every 10 years. The most recent County Master Plans range in years from 2024 (Anne Arundel County) to 2010 (Caroline County). The Town of Easton is currently preparing its 2023 Master Plan which may be released in late 2025.

Master plans and area plans prepared by the counties and municipalities within the Analysis Area were reviewed to identify any specific transportation needs related to the Bay Bridge Crossing and planned improvements to U.S. 50/301, U.S. 50, and MD 404 (regional corridors to and from the Bay Bridge Crossing). The plans were reviewed for anticipated population increases, planned growth areas, and protection of resources (i.e., rural community setting, ecotourism, community cohesion and connectivity (for areas bisected by U.S. 50/301). **Table 6-7** lists the plans and transportation priority letters that were reviewed, detailing whether each plan specifically refers to the Bay Bridge Crossing, and briefly describes key issues identified in each plan. **Appendix B** provides detailed information included in the plans. Additional information on master plans and roadway recommendations is available in the *Socioeconomic and Land Use Technical Report*.

Table 6-7: Master Plans and Roadway Recommendations

Plan Name	Roadway Recommendations Pertinent to the Bay Crossing Study (YES/NO)	Key Issues
Anne Arundel County		
County Transportation Priority Letters (2022, 2024)	YES	2022: States that the most disruptive traffic in the County is on Route 50 East before the Bay Bridge and "*more can be done to prevent summer weekend eastbound travelers from attempting to bypass backups by using*" local neighborhood roads. Requested operational improvements to manage demand and supported funding for the MDTA NEPA Tier 2 Study. 2024: States that County is engaged in the Tier 2 study and noted studying community effects is critical; remains concerned about effects of summer weekend traffic using local roads and suggested congestion pricing.

Plan Name	Roadway Recommendations Pertinent to the Bay Crossing Study (YES/NO)	Key Issues
Anne Arundel County Region 4 Plan (2024)	YES	Strategies include: "*Coordinate with State and County agencies to ensure that Bay Bridge project alternatives include investments that minimize adverse impacts to surrounding communities and improve local mobility during and after construction*." Notes that U.S. 50/301 bisects the Broadneck Peninsula from Severn River to the Bay Bridge. Summer weekend traffic on U.S. 50/301 spills over onto local roads, which restricts resident access to/from their neighborhoods. See **Appendix B**.
Plan 2040: Anne Arundel County General Development Plan (Adopted 2021)	NO	States that targeted land development regulations will promote redevelopment of underutilized properties and retention of forests and farms.
Small Area Plans (SAPs) *Implementation Status Report*: Plan 2040 Background Report (2023)	YES	The Plan Concept includes planning for a significant increase in traffic on U.S. 50. Recommends that state and County officials and citizen representatives should plan for increased through traffic and protection of local roads from being used as alternative routes. Recommends maintenance and improvement of U.S. 50 service roads while preserving buffers and space for bike and pedestrian trails. Recommends improving the appearance of U.S. 50 with landscaping, particularly at intersections, on medians and at commercial establishments.
Move Anne Arundel! County Transportation Master Plan (2019)	YES	States that lane widening along the 19-mile-long U.S. 50/301 corridor from the Prince George's County line to the Bay Bridge through a combination of lane widening (from 6 to 8 lanes) is high priority. States that College Parkway between MD 2 and U.S. 50/301 is a high priority for investment to address traffic congestion and construct the Broadneck Peninsula Trail extension (to provide a transportation alternative).
Corridor Growth Management Plan (2012)	YES	Recommends widening U.S. 50 from six (6) to eight (8) lanes between I-97 and the Bay Bridge, including the Severn River Bridge (included in the Baltimore Metropolitan Council [BMC] Constrained Long-Range Plan). States that the MDTA should initiate necessary environmental and engineering studies to determine location and design feasibility of an additional Bay crossing.

Plan Name	Roadway Recommendations Pertinent to the Bay Crossing Study (YES/NO)	Key Issues
Queen Anne's County and Municipalities		
County Transportation Priority Letter (2022)	YES	The County submitted a Transportation Priority letter to the Maryland Department of Transportation (MDOT) listing funding for additional capacity for the Bay Bridge as its highest priority.
PlanQAC 2022 – Queen Anne's County CMP (2022)	YES	Recommends that the County (1) monitor and participate in the MDTA Bay Crossing Study NEPA Process; (2) provide alternative routes (i.e., local access and frontage points) for local restaurants and businesses, especially in areas around U.S. 50/301; and (3) improve MD 8 and its interchange with U.S. 50/301 with assistance from the State.
Kent Island Transportation Plan (2016)	YES	Various improvements identified at U.S. 50/301 including widening and new connections over the interstate to improve local north-south access.
Kent Narrows Community Plan (CP) (2022)	YES	Recommends improving and simplifying existing gateway signage at U.S. 50/301 exits 41 and 42 and identifying better options to control runoff from the Kent Narrows U.S. 50/301 Bridge.
Queenstown Trails Master Plan (2021)	NO	Recommends lobbying MDOT SHA to construct two (2) elevated pedestrian trail overpasses across U.S. 50/301.
Barclay CP (2006)	NO	Emphasizing that maintaining rural character, traditions, and a sense of community despite continual growth is important to the town. States that further development will look to promote growth that is consistent with these values.
Centreville CMP (2040)	YES	There are 10 roadway improvement projects highlighted. The largest of these projects would be the construction of a major collector that would connect MD 304, MD 213, and MD 18 through the planned growth area, diverting traffic from the growth area to MD 213 and MD 301.
Church Hill CMP (2010)	NO	Visions for future development involve a comprehensive transportation system that encourages the connection of future development to the existing town center. This seamless connection between residential areas and town centers using new local roadway networks will reduce local traffic having to divert to regional roads, and regional traffic will have less of an effect on local traffic movement.

Plan Name	Roadway Recommendations Pertinent to the Bay Crossing Study (YES/NO)	Key Issues
Queenstown CMP (2017)	YES	Improving access to Queenstown to and from the U.S. 50 corridor and separating regional and local traffic are two major transportation issues this plan seeks to address. The implementation of overpasses to be used by local traffic to access the U.S. 50/301 corridor and the expansion of U.S. 50 to a 6-lane highway are highlighted in this plan as potential solutions.
Sudlersville CMP (2014)	NO	Sudlersville is 35 minutes from the Chesapeake Bay Bridge, located at the intersection of MD Route 300 and MD Route 313. The outlook is to establish an efficient transportation network which allows automobiles and pedestrians alike to navigate through the town efficiently by combining land use and roadway system improvements. Like the rest of Queen Anne's County, Sudlersville has seen rapid growth over the past 50 plus years. The land use plan summary shows 450 acres for planned growth (47 percent of the total land use in the town).
Caroline County and Municipalities		
2010 Caroline County CMP	NO	The Plan highlights infrastructure and amenities improvements such as roads, schools, business centers, and public water and sewer. The primary land use goal is to preserve agriculture, natural resources, and the rural character of the County by directing future growth to existing population centers.
The Town of Denton 2020 Master Plan (2023)	NO	States that future planning will focus on efficient land use within the Denton Town Limits.
Goldsboro CMP (2009)	NO	The transportation issues highlighted in the plan include local roadway improvements, aesthetic streetscaping, highway flood/ drainage facilities, and a few additional, minor bridge crossings in the area. Longterm growth of Goldsboro consists mainly of development within the town's limits, with potential annexation areas shown on mapping.
Greensboro CMP (2010)	NO	States that Greensboro will institute transportation policies that support the Caroline County CMP, such as improving streets and sidewalks, developing nature trails, and promoting alternatives to motorized traffic.
Hillsboro CMP (2009)	NO	Hillsboro's primary goal for transportation is to provide *"an appropriate array of adequate community facilities and services required to maintain the public health, safety, and welfare of the residents of Hillsboro."* The town will improve existing streets and walkways and design new streets and sidewalks to improve circulation through the community.

Plan Name	Roadway Recommendations Pertinent to the Bay Crossing Study (YES/NO)	Key Issues
Ridgely CMP (2009)	NO	Ridgely's municipal growth areas total 916 acres, designated for major capital improvements. At the time of the plan's development, traffic in Ridgely was not of major concern, but the potential for that to change as the town grew was apparent. Heavy truck traffic from mining and landfill operations were seen as a potential factor for this increase. The popularity of beach travel could create a scenario where increased roadway capacity is needed.
Talbot County and Municipalities		
Talbot County Transportation Priority Letter (2024)	YES	Capacity and safety improvements along U.S. 50 are the highest priority. These improvements would lessen congestion on U.S. 50 and throughout Talbot County.
Talbot County CMP (2016)	NO	Land use policies seek to restrict economic development except for industries that are supportive of the rural and natural resource-based economy. The economic development targets of the plan are retention of the County's tourism industry, expansion of clean energy, expanding broadband, and attraction of retirees and professional/financial services.
Easton CMP (2010)	NO	The large number of major roadway arteries that intersect Easton have led to transportation concerns, mainly concerning U.S. 50 and connectivity between the local roadway network and the state roadway system. A potential solution was identified in the form of a bypass around Easton, east of current town limits and planned growth areas, avoiding U.S. 50. This would reduce traffic pressures and establish U.S. 50 as a local road for Easton.

6.1.5 Local Growth Management

The Septics Law protects rural land by limiting large-lot residential development on septic systems outside PFAs. The Septics Law requires mapping of future land development in "*tiers*" where sewer service exists (Tier I), sewer service is planned to support future growth (Tier II), large lot development of "*Rural Villages*" on septic are planned (Tier III) and conservation areas where no major subdivisions on septic are planned (Tier IV). Therefore, the Septics Law provides some protection against large-scale induced growth in Tier IV areas and those areas not currently served by public sewerage systems in counties that have not adopted the Tier Maps, such as Queen Anne's County as described below. However, as counties are permitted to change Tier Maps over time, future revisions may allow growth in areas currently mapped as Tier IV. Maryland's sewer tier designations are shown in **Table 6-8** (MDP, 2023). The septic tiers are shown in **Figure 5-4.**

Table 6-8: Sewer Service Tiers

Growth Tier	Definition
I	Currently served by sewer
II	Future growth areas planned for sewer
III	Large lot developments and rural villages on septic
IV	Preservation and conservation areas, no major subdivisions on septic

As of December 2022, Anne Arundel, Talbot, and Caroline counties had adopted Septic Tier Maps. The statewide growth tier map shows most of the lands in Caroline and Talbot counties are Tier IV, Preservation and Conservation Areas. Talbot County adopted its growth tier map in 2012, and it was incorporated into the 2016 Talbot County CMP (MDP, 2016). Talbot County confirmed its zoning does not permit high-density development (Talbot County, 2025). High-density development is allowed in municipalities, including Easton. Easton adopted growth tier maps in 2012 (MDP, 2012a). Easton has designated where growth would occur within its boundaries.

Caroline County adopted its growth tier map by resolution in 2014. The Town of Denton submitted its Growth Tier Map to MDP in 2012 (MDP, 2012b). The Denton Septic Tier Map shows land within its boundaries is designated Tier I and II, and areas surrounding the municipal boundary are Tier IVA (a municipal greenbelt with no planned sewer service). A large area located west of Denton is designated Tier IIA (Area not yet in the County Water/Sewer Plan).

In Queen Anne's County, most incorporated towns have adopted Tier Maps as part of their municipal growth elements required in local master plans. The Town of Queen Anne "*Growth Tiers for SB236*," shows all areas within the municipal boundary are designated Tier III (Large Lot Developments and Rural Villages on septic) and its growth tier map was adopted in 2013 (MDP, 2013b). Although Queen Anne's County did not adopt Tier Maps, the Septics Law prohibits major residential subdivisions in places outside of areas currently served by public sewerage systems.

The Town of Queenstown approved its growth tier map in 2012 (MDP, 2013c). The Sudlersville Growth Tier Map (2012) follows the requirements of the Septics Law of 2012 but does not reflect current zoning. Most of the land within the town boundary is designated as Tier I (town center) and Tier II (large adjacent parcels land), with three small parcels designated as Tier IV. Details about the growth goals for all municipalities, including those outside the IGSA boundary, are included in **Appendix B**.

6.1.6 Community Facilities

Community facilities evaluated in this analysis include parks and recreational facilities, schools, libraries, hospitals, post offices, fire stations, police stations, places of worship, community centers, emergency shelters, health departments, water and sewer facilities, roadway facilities, and others.

A total of 564 community facilities were identified as occurring within the Analysis Area. Many of these facilities are congregated around the municipalities and major towns within the Analysis Area. Near the Bay Bridge, many of these facilities are located around the U.S. 50/301 roadway. MTA bus lines and local transit lines run along many of the major arteries in the Analysis Area, which link together towns, such as Queenstown, Centreville, Easton, and Denton. These transit lines run through to the Western Shore as well, to connect both sides of the Analysis Area across Chesapeake Bay.

Parks are defined as lands that have been officially designated as such by a federal, state, or local agency. Data from several sources were used to inventory parks within the Analysis Area. These sources included federal, state, and county websites; associated GIS data; and aerial photography mapping programs such as Google Maps and ArcGIS. A GIS database of parklands and recreation areas was compiled with input from state agencies, local jurisdictions, and Metropolitan Planning Organizations. The Analysis Area includes 83 public parks and recreational facilities.

6.1.7 Population and Households

6.1.7.1 Population

According to data obtained from the USCB, each locality encompassed by the Analysis Area has experienced an increase in population since the 1970s (USCB, 2010; 2022). Anne Arundel County experienced a small decline in population between 2020 to 2022. Population changes between 1970 and 2022 for Anne Arundel, Caroline, Queen Anne's, and Talbot counties are reflected in **Table 6-10**. Population projections through the year 2045 were obtained from MDP and are shown in **Table 6-11**. Historical and forecasted population data from MDP (**Table 6-9** and **Table 6-10**) was only available at the county level and was compared to current, county-level USCB data. Note that the area represented by this data is larger than that of the Analysis Area, particularly on the Western Shore.

Between 1970 and 2022, the population in the lone Western Shore locality (Anne Arundel County) increased by 290,067 residents. Population in Eastern Shore localities (Queen Anne's, Talbot, and Caroline counties) increased by 59,414 residents, with Queen Anne's County experiencing the highest growth rate (approximately 173 percent). The overall growth rate from 1970-2022 in the Western Shore CTs slightly outpaced that of the Eastern Shore CTs, with 97 percent and 96 percent growth experienced, respectively (**Table 6-10**).

Table 6-9 shows population and housing numbers for the CTs that make up the Analysis Area. **Table 6-10** and **Table 6-11** show readily available population (historical, 2022 and 2045 forecasts) for the Analysis Area localities. Caroline County is expected to experience the highest percentage of projected population growth, followed by Queen Anne's County. Projected population growth from MDP was determined independently from the Bay Crossing Study, so it can be deduced that Bay Crossing Study project activities do not influence these population growth projections.

Table 6-9: Population and Housing within the Analysis Area (2022)

Location	Population	Households
Caroline County CTs	28,871	10,125
Queen Anne's County CTs	50,316	19,351
Talbot County CTs	31,752	13,469
Anne Arundel County CTs	44,498	15,852
CTs Total	**155,437**	**58,797**

Table 6-10: Historic Population Change (1970-2022)

Location	1970	1980	1990	2000	2010	2017	2022	Percent Change 1970 to 2022
Maryland	3,923,897	4,216,933	4,781,468	5,296,486	5,773,552	5,996,079	6,161,707	57
Change (percent)	N/A	7	13	11	9	4	3	
Eastern Shore								
Caroline County	19,781	23,143	27,035	29,772	33,066	32,785	33,320	68
Change (percent)	N/A	17	17	10	11	1	2	
Queen Anne's County	18,422	25,508	33,953	40,563	47,798	49,071	50,316	173
Change (percent)	N/A	39	33	19	18	3	3	
Talbot County	23,682	25,604	30,549	33,812	37,782	37,461	37,663	59
Change (percent)	N/A	8	19	11	12	1	<1	
Total	**61,885**	**74,255**	**91,537**	**104,147**	**118,646**	**119,317**	**121,299**	96
Change (Percent)	N/A	20	23	14	14	<1	2	
Western Shore								
Anne Arundel County	298,042	370,775	427,239	489,656	537,656	564,600	588,109	97
Change (percent)	N/A	24	15	15	10	5	4	

Sources: MDP, 2020; USCB, 2010; USCB, 2022

Table 6-11: Population Forecasts (2022 to 2045)

Location	2022 Population (USCB)	Forecast 2045 Population (MDP)	Forecast Increase (2022-2045)	Forecast Percent Increase (2022-2045)
Maryland	6,161,707	6,873,330	711,623	12
Caroline County, Maryland	33,320	44,500	11,180	34
Queen Anne's County	50,316	64,650	14,334	28
Talbot County	37,663	41,440	3,777	10
Eastern Shore Total	**121,299**	**150,590**	**29,291**	**24**
Anne Arundel County	588,109	645,190	57,081	10
Total	**709,408**	**795,780**	**86,372**	**12**

Sources: USCB, 2022; MDP, 2020

6.1.7.2 Households

Table 6-12 shows housing projections gathered from MDP for Analysis Area localities from 2022 through 2045. Housing data provided by MDP is only provided at the county level. Several municipalities with PFAs exist in Caroline and Queen Anne's counties. These areas would be subject to development, including an increase in households, regardless of improvements associated with the ARDS.

Table 6-12: Forecasted Households (2022 to 2045)

Location	Estimated 2022 Households (USCB)	Forecast 2045 Households (MDP)	Forecast Increase (2022-2045)	Forecast Percent Increase (2022-2045)
Maryland	2,318,124	2,573,675	255,551	11
Caroline County	12,013	16,525	4,512	38
Queen Anne's County	19,351	24,275	4,924	25
Talbot County	16,270	18,325	2,055	13
Eastern Shore Total	**47,634**	**59,125**	**11,491**	**24**
Anne Arundel County	221,704	245,600	23,896	10
Total	**269,338**	**304,725**	**35,387**	**13**

Sources: USCB, 2022; MDP, 2020

6.1.8 Businesses and Employers

Table 6-13 shows the top three employers, based on employee count, for each county in the Analysis Area. Improvements to travel time and accessibility to these businesses could result from improvements in the ARDS, which would affect employment opportunities for people who live farther away.

Table 6-13: Top Three Employers in the Analysis Area

Location	1st	2nd	3rd
Caroline County	Hub Group / Benedictine – Private school	Preston Automotive Group	Choptank Community Health System
Queen Anne's County	Paul Reed Smith Guitars	Chesapeake College	REEB Millwork
Talbot County	University of MD Shore Medical Center	Shore BancShares	Aphena Pharma Solution / ACTS Retire Life Community - Bayleigh Chase
Anne Arundel County	Northrop Grumman Corporation	Anne Arundel Community College	Anne Arundel Nursing Department

Sources: Maryland Department of Commerce, 2024a-d; Note: Excludes post offices, state and local governments, national retail, and national food service. Most Western Shore top employers are located outside of the Analysis Area.

Table 6-14 shows the total employment age population in 2022 within Analysis Area localities, at the CT level.

Table 6-14: Employment Age Population in Analysis Area (2022)

Location (Census Tracts)	Employment Age Population (age 16+)	In Labor Force	Not in Labor Force
Caroline County	22,895	14,739	8,156
Queen Anne's County	40,905	27,224	13,681
Talbot County	26,301	14,955	11,346
Anne Arundel County	34,410	23,783	10,627
Analysis Area Total	**124,511**	**80,701**	**43,810**

Source: USCB, 2022

Table 6-15 shows employment trends from 2010 to 2022 in the Analysis Area counties. Employment count in these counties increased by 30,671, or approximately nine percent, from 2010 to 2022. Of the Eastern Shore counties, employment increased the most (approximately eight percent) in Queen Anne's County. On the Western Shore, employment in Anne Arundel County increased the most of any locality in the Analysis Area (approximately 11 percent). Two counties experienced a decrease in employment from 2010-2022 (Talbot County and Caroline County).

Table 6-15: Employment Trends (2010-2022)

Location	Employed 2010	Employed 2017	Employed 2022	Employment Change (2010-2022)	Employment Percent Change (2010-2022)
Maryland	3,135,769	3,330,279	3,331,958	196,189	6
Total Study Counties	328,374	349,721	359,045	30,671	9
Eastern Shore					
Caroline County	16,159	15,674	16,020	-139	<-1
Queen Anne's County	24,211	25,556	26,180	1,969	8
Talbot County	18,287	17,863	17,056	-1,233	-7
Western Shore					
Anne Arundel County	269,717	290,628	299,789	30,072	11

Sources: USCB, 2010; USCB, 2022

Table 6-16 presents forecasted total employment from 2022 to 2045 for the county-level jurisdictions in the Analysis Area. Employment in the Analysis Area counties is expected to increase by approximately 16 percent, with a 26 percent increase in the Eastern Shore counties and a 14 percent increase in the Western Shore County (Anne Arundel). Caroline County on the Eastern Shore would have the highest predicted percentage of employment growth (34 percent), although the forecasted total number of employed people would be much greater on the Western Shore.

Table 6-16: Forecasted Employment (2022-2045)

Location	2022 Employment	Forecasted 2045 Employment	Forecasted Employment Change (2022-2045)	Employment Percent Change (2022-2045)
Maryland	3,331,958	3,609,310	277,352	8
Total Study Counties	359,045	416,130	57,085	16
Eastern Shore				
Caroline County	16,020	21,430	5,410	34
Queen Anne's County	26,180	33,200	7,020	27
Talbot County	17,056	20,020	2,964	17
Eastern Shore Counties Total	**59,256**	**74,650**	**15,394**	**26**
Western Shore				
Anne Arundel County	299,789	341,480	41,691	14

Sources: USCB, 2022; MDP, 2020

6.1.9 Agriculture

Agriculture is a major economic driver in all Analysis Area counties (Anne Arundel, Queen Anne's, Caroline, and Talbot counties). The USDA conducts their Census of Agriculture once every five years to analyze land use, ownership, characteristics, production, income, and expenditures for farmland within individual counties (USDA, 2022). The USDA data was used in this analysis; however, it should be noted that the information gathered for this section is only available at the county level and represents a larger land area than that contained within the Analysis Area.

The market value of crops produced in Analysis Area counties reached just over $334 million in 2022, with approximately 94 percent of the value of crops being grown on the Eastern Shore (USDA, 2022). Queen Anne's County and Caroline County ranked in the top five in the state for crop market value produced with Queen Anne's County topping the list. The value of livestock, poultry, and the products they produce followed a similar trend with a total market value of over $455 million from Analysis Area counties, and approximately 99 percent of the products coming from the Eastern Shore counties containing the Analysis Area. Combined, the value of the crops, livestock, poultry, and their products exceeded $789 million in 2022 (USDA, 2022). **Table 6-17** shows the market value of agricultural products in U.S. dollars (USD) produced in Analysis Area counties in 2022.

Table 6-17: Agricultural Product Market Value (2022)

County	Crop Value (USD)	Livestock, Poultry, and their Products Value (USD)	Total Value (USD)
Caroline County	100,819,000	270,515,000	371,334,000
Queen Anne's County	145,799,000	137,536,000	283,335,000
Talbot County	67,495,000	42,210,000	109,705,000
Anne Arundel County	19,946,000	5,522,000	25,468,000
Total	**334,059,000**	**455,783,000**	**789,842,000**

Source: USDA, 2022

Figure 6-4 shows cropland and pasture/hay agricultural land within the Analysis Area. This is especially prevalent on the Eastern Shore, where farmland and agriculture are essential to local economies and Maryland's statewide agricultural economy. Agricultural Census data from the USDA was gathered for the years 2012, 2017 and 2022 for the counties within the Analysis Area.

As listed in **Table 6-18**, more than 1,000 farms were in the Analysis Area counties, primarily on the Eastern Shore, during the period of analysis. From 2017 to 2022, the Eastern Shore saw no significant changes in the number of farms, while the Western Shore (Anne Arundel County) saw an approximately 16 percent increase. Caroline County was the only county that saw a loss in the number of farms since 2017. The amount of farmed land acreage has also varied by county since 2017. The acreage of farmland decreased by approximately four percent on the Eastern Shore and increased by approximately 33 percent on the Western Shore from 2017 to 2022.

Table 6-18: Total and Per Farm Overview (2017 to 2022)

Locality	Number of Farms			Change since 2017 (Percent)	Farmland (Acres)			Change since 2017 (Percent)
	2012	2017	2022		2012	2017	2022	
Eastern Shore								
Caroline County	658	588	525	-11	150,357	128,052	111,470	-13
Queen Anne's County	530	483	505	+5	156,941	163,001	162,145	-1
Talbot County	328	317	357	+13	119,481	93,622	96,228	+3
Total	**1,516**	**1,388**	**1,387**	**-<1**	**426,779**	**384,675**	**369,843**	**-4**
Western Shore								
Anne Arundel County	381	390	454	+16	28,111	27,003	36,003	+33
Total	**1,897**	**1778**	**1,841**	**+4**	**454,890**	**411,678**	**405,846**	**-1**

Source: USDA, 2022

6.1.10 Commuting Patterns

This section presents data on recent commuting patterns in the region. Commuting data are relevant to induced growth as it is important to understand how people travel to and from their places of employment. The commuting data discussed below were used in the development of the IGSAs.

Commuter and worker profile data from the USCB (OnTheMap) shows that in 2022, in the Analysis Area, there were more workers (individuals) commuting in and out of the area than who lived and worked within the Analysis Area (**Table 6-19**). This trend was true at the county level as well, where most people in the Analysis Area worked in one county and lived in another. The number of in-commuters and out-commuters for each county in the Analysis Area exceeded the number of those who lived and worked within the same county. The Washington, D.C., Annapolis (including Parole), and Baltimore metropolitan areas are the largest major population and employment centers in the region, and these areas draw workers from surrounding localities, including from the Eastern Shore.

Table 6-19: Regional Commuting Statistics (2022)

Locality (County)	Employed in Locality/ Living Outside	Employed in Locality/ Living Inside	Living in the Locality/ Employed Outside	Locality Jobs Filled from Outside (%)	Employed But Working Outside Locality (%)
Analysis Area	23,704	22,341	50,021	52	69
Eastern Shore					
Caroline County	5,634	3,539	13,134	61	78
Queen Anne's County	8,247	6,146	18,109	57	75
Talbot County	10,373	6,432	10,309	62	62
Western Shore					
Anne Arundel County	165,639	97,322	159,113	63	62

Source: USCB, 2022

Table 6-20 presents commute travel times from the USCB for 2017 and 2022 for the Washington-Baltimore-Arlington DC-MD-VA-WV-PA Combined Statistical Area (CSA). The table shows that approximately 86 percent of commuters in the CSA travelled less than 60 minutes to work in 2022.

Table 6-20: Commute Travel Time per County

Commute Travel Time	County	Percent of Commuters		Percent Change 2017-2022
		2017	2022	
0 – 29 Minutes	Anne Arundel	53.7	53.5	-0.2
	Caroline	51.9	48.4	-3.5
	Queen Anne's	44.1	50.1	6.0
	Talbot	70.2	69.9	-0.3
	CSA	46.9	48.4	1.5
30 – 44 Minutes	Anne Arundel	23.0	23.6	0.6
	Caroline	23.0	27.4	4.4
	Queen Anne's	20.4	16.9	-3.5
	Talbot	11.2	11.3	0.1
	CSA	24.8	25.1	0.3
45 – 59 Minutes	Anne Arundel	10.4	10.6	0.2
	Caroline	9.8	10.3	-0.5
	Queen Anne's	14.6	12.9	-1.2
	Talbot	4.2	6.7	2.5
	CSA	12.6	12.2	-0.4
60+ Minutes	Anne Arundel	12.8	12.3	-0.5
	Caroline	15.4	14.0	-1.4
	Queen Anne's	20.9	20.1	-0.8
	Talbot	14.4	12.0	-2.4
	CSA	15.6	14.2	-1.4
Total of commuters under 60 Minutes	**Anne Arundel**	**87.1**	**87.7**	**0.6**
	Caroline	**84.7**	**86.1**	**1.4**
	Queen Anne's	**79.1**	**79.9**	**-0.8**
	Talbot	**85.6**	**87.9**	**2.3**
	CSA	**84.3**	**85.7**	**1.4**

Source: USCB, 2022 (American Community Survey Data)

6.1.11 Regional Transportation Plans

The BMC Regional Transportation Board planning area includes Anne Arundel and Queen Anne's counties. The most recent regional transportation plans are *Maximize2045: A Performance-Based Transportation Plan* and *Resilience 2050: Adapting to the Challenges of Tomorrow*. *Maximize 2045* was used to match the temporal boundary of the AFE analysis (1970-2045).

Maximize2045 is the 2019 LRTP for the Baltimore region including Anne Arundel and Queen Anne's counties in the Analysis Area. Published in 2019, the plan establishes the region's broad transportation goals and strategies which would guide transportation investments over the life of the plan (2024-2045) (BMC, 2018).

Maximize2045 contains a list of the major surface transportation projects the region expects to implement in the period from 2024 to 2045. The transportation plan identifies the Bay Crossing Study and notes that the MDTA is conducting a study that would result in the identification of a preferred corridor alternative to address congestion at the Bay Bridge and evaluation of its financial feasibility. The Bay Crossing improvements are included in the plan as an illustrative project which could be incorporated into *Maximize2045* should future funds become available. Eight other major capital projects included in the plan occur in the Analysis Area. These projects are listed in **Table 9-2**.

Resilience 2050 is the 2023 LRTP for the Baltimore Regional Transportation Board (BRTB) planning area. This plan includes a mix of projects that enhance the region's transportation system; these plans may receive federal funding beginning in 2028 through 2050 (BRTB, 2023).

6.2 Natural Resources

The *Natural Environmental Technical Report* provides the regulatory context and methodology used to analyze direct effects of the ARDS on natural resources. The resources evaluated in the AFE Analysis include terrestrial and aquatic resources, such as forests, protected lands, wetlands, streams and floodplains, wildlife habitat, and threatened or endangered species. Readily available comparison data was used to evaluate resources within the Analysis Area.

The Analysis Area encompasses numerous classes of natural communities, including mesic forests, maritime forests, alluvial wetlands, non-alluvial wetlands, tidal wetlands, and riverine aquatic beds (MDNR Wildlife and Heritage Service [WHS], 2016). Threats to Maryland's wildlife include changes in land use, modification of natural systems, pollution, biological resource use, resource management, and displacement by non-native invasive species (plant and wildlife) (MDNR, 2020). Historic development in the Analysis Area has resulted in loss of natural areas, wildlife, and wildlife habitat, and has caused negative impacts to water quality. Today, CMPs from Analysis Area localities define objectives, goals, or strategies to minimize loss and degradation of environmental resources, such as forest lands, wetlands, streams and rivers, water quality, floodplains, and wildlife habitats.

6.2.1 Water Resources

Surface water resources within the Analysis Area include watersheds, wetlands, rivers and streams, nontidal and tidal floodplains, and the Chesapeake Bay. The Chesapeake Bay watershed has been the subject of regional restoration efforts since the early 1980s. The CBP leads the CBA goal implementation teams, including habitat, healthy watersheds, land use methods and metrics and options, protection and restoration of vital habitats (tree canopy, forest

buffers, wetlands, submerged aquatic vegetation [SAV]), water quality, land conservation, and watershed ecological resiliency.

6.2.1.1 Watersheds

Evaluation of natural resources in this technical report uses the state-designated eight-digit watershed boundaries used in reports published by MDNR and MDE to describe historical "*baseline*" wetlands and Maryland Wetland Program Plans. To provide geographical context, the major six-digit watersheds and the smaller eight-digit watersheds are shown **Table 6-21**. The Analysis Area is within the West Chesapeake Bay, Patapsco River, Chesapeake Bay Proper, and Chester River six-digit watersheds and includes portions of twenty-one eight-digit watersheds as shown in **Figure 6-5**.

The National Coastal Zone Management Program (CZMP) is authorized by the CZMA of 1972, amended by the Coastal Zone Act Reauthorization Amendments of 1990, and is administered by the National Oceanic and Atmospheric Administration (NOAA) (15 CFR Part 930). The purpose of the CZMA is to protect coastal resources. Under the CZMA, direct federal actions, federal licensing or permit projects, and federal assistance activities with reasonably foreseeable coastal effects must be consistent with the enforceable policies of a state-approved CZMP. Maryland's CZMP is administered by MDNR, in partnership with MDE, to ensure federal activities are consistent with Maryland's coastal resource objectives and policies. The Analysis Area is entirely within Maryland's coastal zone. The methods for CZMA consistency review are described in the *Natural Environmental Technical Report*.

6.2.1.2 Wetlands

Wetlands provide socioeconomic benefits such as providing habitats for important game fish and wildlife and supporting hunting, fishing, and other recreational activities. Wetlands also perform useful functions such as storing and conveying surface water runoff and flood waters, improving water quality by filtering nutrients from runoff, conveying surface water to groundwater recharge areas, providing shoreline protection, and providing critical habitat for aquatic and terrestrial species. The MDE's Wetlands and Waterways Protection Program protects Maryland wetlands and waterways from loss and degradation (MDE, no date [n.d.]).

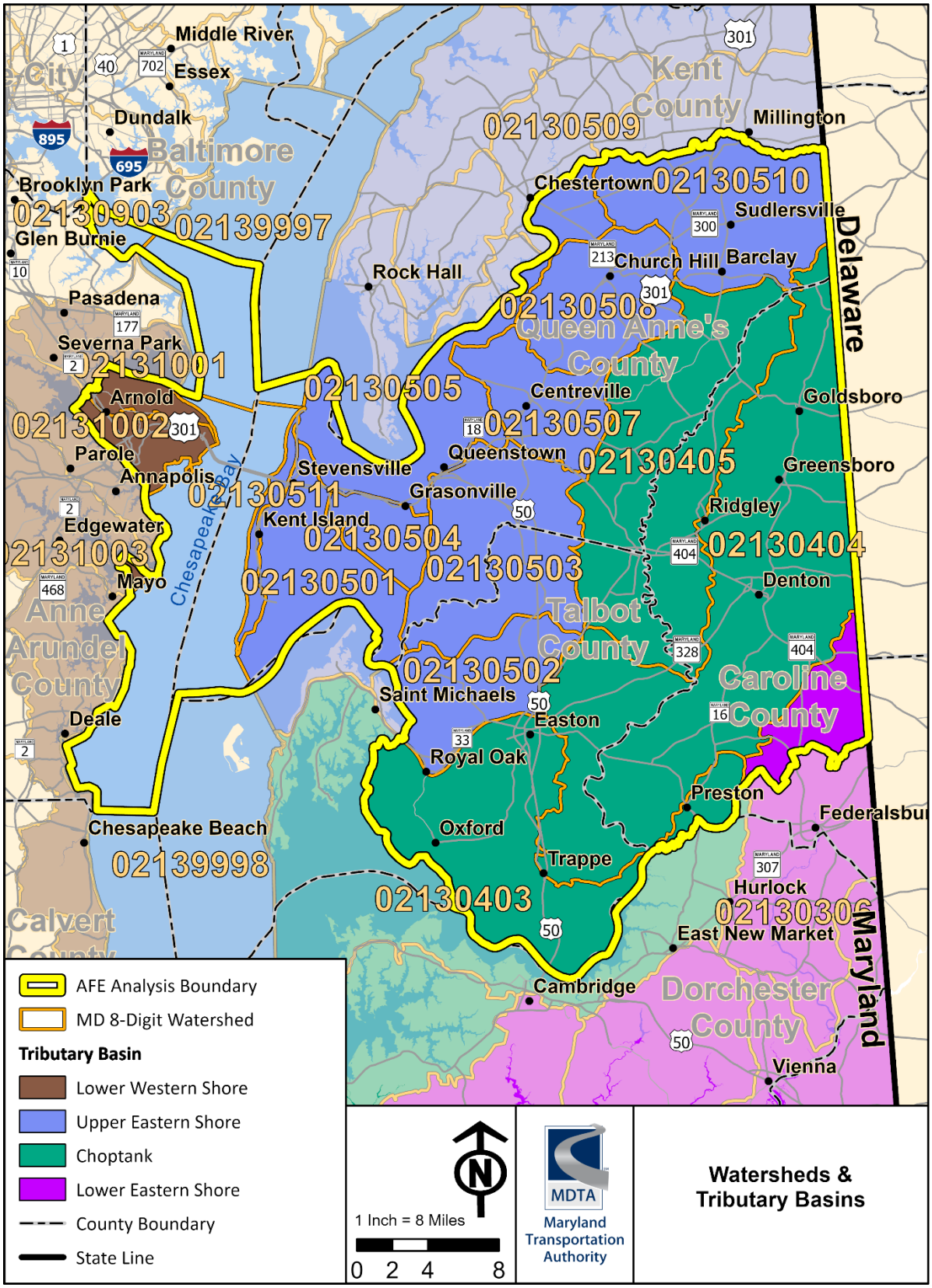
Maryland implemented its tidal wetlands regulatory program in 1972 and the nontidal wetlands regulatory program in 1991, following passage of the NWPA (1989). The NWPA parallels aspects of Section 404 of the CWA by restricting activities that could adversely impact nontidal wetlands or waters of the state. The NWPA requires mitigation (replacement) or compensation (payment into a mitigation fund) for unavoidable wetland losses.

In 2003, the MDE Nontidal Wetlands and Waterways Division published the Maryland State Wetland Conservation Plan to coordinate existing wetland programs, data, and resources to achieve Maryland's 'no net loss' goal for wetland acreage and function. The 2003 Plan and two subsequent Maryland Wetland Program Plans (2016 – 2020 and 2021 – 2025) were funded by the USEPA State Wetland Development Program Development Grants (MDE, 2003, 2018, and 2021). The 2003 Plan describes historical statewide wetland losses and presents wetland acreage as of 1981/1982 by vegetation types and deep-water habitat acreage for all Maryland counties, published in *Wetlands of Maryland* (Tiner and Burke, 1995).

Table 6-21: Eight-Digit Watersheds within the Analysis Area

Six-digit Watershed Name	Eight-digit Sub-watershed Name	Analysis Area (Acres)	Impervious Surface (Percent)	Designated Stream Use Class
West Chesapeake Bay (021310)	Severn River (02131002)	11,939	2	I; II
	Magothy River (02131001)	8,011	1	I; II
	West River (02131004)	58	0	N/A
	South River (02131003)	1,067	0	N/A
Patapsco River (021309)	Baltimore Harbor (02130903)	3,962	0	N/A
Chesapeake Bay Proper (021399)	Middle Chesapeake Bay (02139997)	23,664	3	N/A
	Lower Chesapeake Bay (02139998)	79,198	10	N/A
Chester River (021305)	Kent Island Bay (02130511)	5,755	0	I; II
	Eastern Bay (02130507)	36,244	5	I; II
	Kent Narrows (02130504)	12,646	2	I; II
	Wye River (02130503)	56,997	7	I; II
	Upper Chester River (02130510)	52,821	7	I; II
	Middle Chester River (02130509)	8,892	1	I; II
	Lower Chester River (02130505)	37,082	5	I; II
	Southeast Creek (02130508)	35,457	4	I; II
	Corsica River (02130507)	25,298	3	I; II
	Miles River (02130502)	31,789	4	I; II
Choptank River (021304)	Tuckahoe Creek (02130405)	98,286	12	I; II
	Upper Choptank River (02130404)	163,690	21	I; II
	Lower Choptank River (02130403)	81,055	10	I; II
Nanticoke (021303)	Marshyhope Creek (02130306)	19,066	2	I

Figure 6-5: Watersheds & Tributary Basins



Tiner and Burke estimated that as of 1995 between 45 and 65 percent of Maryland's original wetlands had been developed. Much of the loss was attributed to draining wetlands for agriculture. The authors noted acres of palustrine wetlands were conservative, especially on the Eastern Shore, due to temporarily flooded and seasonally saturated conditions that make certain wetlands difficult to identify during drier portions of the year (**Table 6-22**).

Table 6-22: Historical Wetlands within the Analysis Area Counties (1981/82)

Location	Estuarine (acreage)	Palustrine (acreage)	Riverine, Lacustrine, Marine (acreage)	1982 Total Acreage
Caroline	2,121	28,027	366	30,514
Queen Anne's	8,453	24,040	18	32,511
Talbot	9,781	9,993	193	19,967
Anne Arundel	2,774	13,202	180	16,156
Total	**23,129**	**75,262**	**757**	**99,148**

Source: Tiner and Burke, 1995

The 2003 plan reported Maryland's regulatory programs had greatly reduced wetlands losses and resulted in net wetland gains through small and scattered compensatory mitigation projects. The purpose of this plan was to describe immediate, intermediate, and long-term needs to manage wetland resources statewide. Goals of the plan were to develop an updated wetland baseline (current acreages), assess current and potential wetland threats and trends, increase effectiveness of regulation and management of wetlands and to identify wetlands that are a priority for preservation and restoration, and increase participation in wetlands preservation, restoration, enhancement, and stewardship.

The 2016 – 2020 Plan (MDE, 2018) noted annual loss of tidal wetlands was less than one acre per year, and mitigation and enhancement were resulting in a net gain in tidal wetlands. Because of its proven track record of protection and restoration projects over a 23-year period, MDE is seeking approval to operate its existing in-lieu fee (ILF) program to be consistent with the federal Mitigation Rule (MDE, 2025). Maryland's planning and regulatory agencies (MDP, MDNR and MDE) work collaboratively to ensure no net losses of wetlands and to protect and restore wetland ecosystems.

In 2018, MDE estimated there were approximately 757,000 acres of mapped vegetated wetlands statewide. The majority were palustrine wetlands, followed by estuarine wetlands. Palustrine wetlands include forested, shrub, emergent (tidal and nontidal) and nontidal bogs, fens, and vernal pools. MDE reported approximately 240,000 acres of estuarine vegetated wetlands in 2010. The highest concentrations of wetlands occurred on the Eastern Shore (MDE, 2021a). Goals of the latest plan (2021 – 2025) are to:

- Increase the efficiency and effectiveness of wetlands regulation and management in Maryland;
- Develop better tools and methods which will provide critical baseline information on wetland extent, condition, and function to improve wetland management decisions;

- Ensure restoration and preservation efforts provide the greatest water quality, native habitat and associated ecosystem service benefits for the financial resources expended, through science-guided practices and priorities, ongoing stewardship and effective partnerships; and
- Improve the process for water quality certification reviews.

Maryland and the other Chesapeake Watershed Agreement partners (Virginia, Pennsylvania, West Virginia, Delaware, New York, and Washington, D.C.) also set a goal to create or reestablish 85,000 acres of tidal and nontidal wetlands, enhance the function of 150,000 acres of degraded wetlands, and conserve 225,000 acres of wetlands by the year 2025. In Maryland, wetland creation, restoration, and enhancement are undertaken by state, federal, and local agencies with willing landowners. From 1998-2019, Maryland reported gains of approximately 215,935 acres of wetlands restored, created, or enhanced (MDE, 2021a).

MDNR wetlands mapping within the Analysis Area counties is from aerial imagery flown between 1992 to 1995 (MDNR, 1993). The most recent National Wetlands Inventory (NWI) data was obtained from the USFWS (October 2024) and used for the respective wetland analyses discussed in this technical report. Acres of MDNR and NWI wetlands by type within the Analysis Area are shown in **Table 6-23.**

NWI-mapped wetlands are shown in **Figure 6-6**. **Table 6-23** shows that approximately 95,413 acres of tidal and nontidal wetlands were identified within the Analysis Area, including 75,720 acres (10 percent) of forested and scrub/shrub wetlands, 9,479 acres (one percent) of estuarine (tidal) wetlands and 3,500 acres (<1 percent) of freshwater emergent wetlands. Wetlands and deepwater areas make up approximately 39 percent of the Analysis Area's total acreage (792,984 acres) per the NWI data used.

Table 6-23: Wetlands in the Analysis Area

Waterbody Classification	MDNR Wetlands (Acres)	MDNR Wetlands in Analysis Area (Percent)	NWI Wetlands (Acres)	NWI Wetlands in Analysis Area (Percent)
Estuarine and Marine Deepwater (Chesapeake Bay)	203,946	26	204,488	26
Estuarine and Marine Wetland	10,600	1	9,479	1
Freshwater Emergent Wetland	2,902	<1	3,500	<1
Freshwater Forested/Shrub Wetland	49,824	6	75,720	10
Other	2,585	<1	6,714	1
Freshwater Pond	2,579	<1	3,218	<1
Lake	360	<1	687	<1
Riverine	1,606	<1	3,340	<1
Total Analysis Area Wetlands	**274,402**	**35**	**307,148**	**39**

Sources: MDNR, 1992 – 1995 and USFWS, 2024

Nontidal Wetlands of Special State Concern (WSSC) have unique ecological value, often in which rare, threatened, or endangered (RTE) species or a unique habitat may be present. WSSC exhibit exceptional ecological and educational value and, in many cases, contain the last remaining populations of native plants and animals that are threatened with extinction in the state. MDE regulates activities in WSSC, including a 100-foot buffer, to protect these wetlands from the impacts of development. WSSC are protected and are specifically listed in COMAR Title 26, Subtitle 23, Chapter 06, Sections 01 & 02. The acreage of WSSC within each county and the total WSSC within the Analysis Area are reported in **Table 6-24** and shown on **Figure 6-6** (MDNR, 2019i). WSSC account for less than one percent of the Analysis Area's total acreage.

The majority of WSSC (1,018 acres, or approximately 46 percent) within the Analysis Area are located in Caroline County and are further removed from the Bay Bridge.

Table 6-24: Wetlands of Special State Concern within the Analysis Area

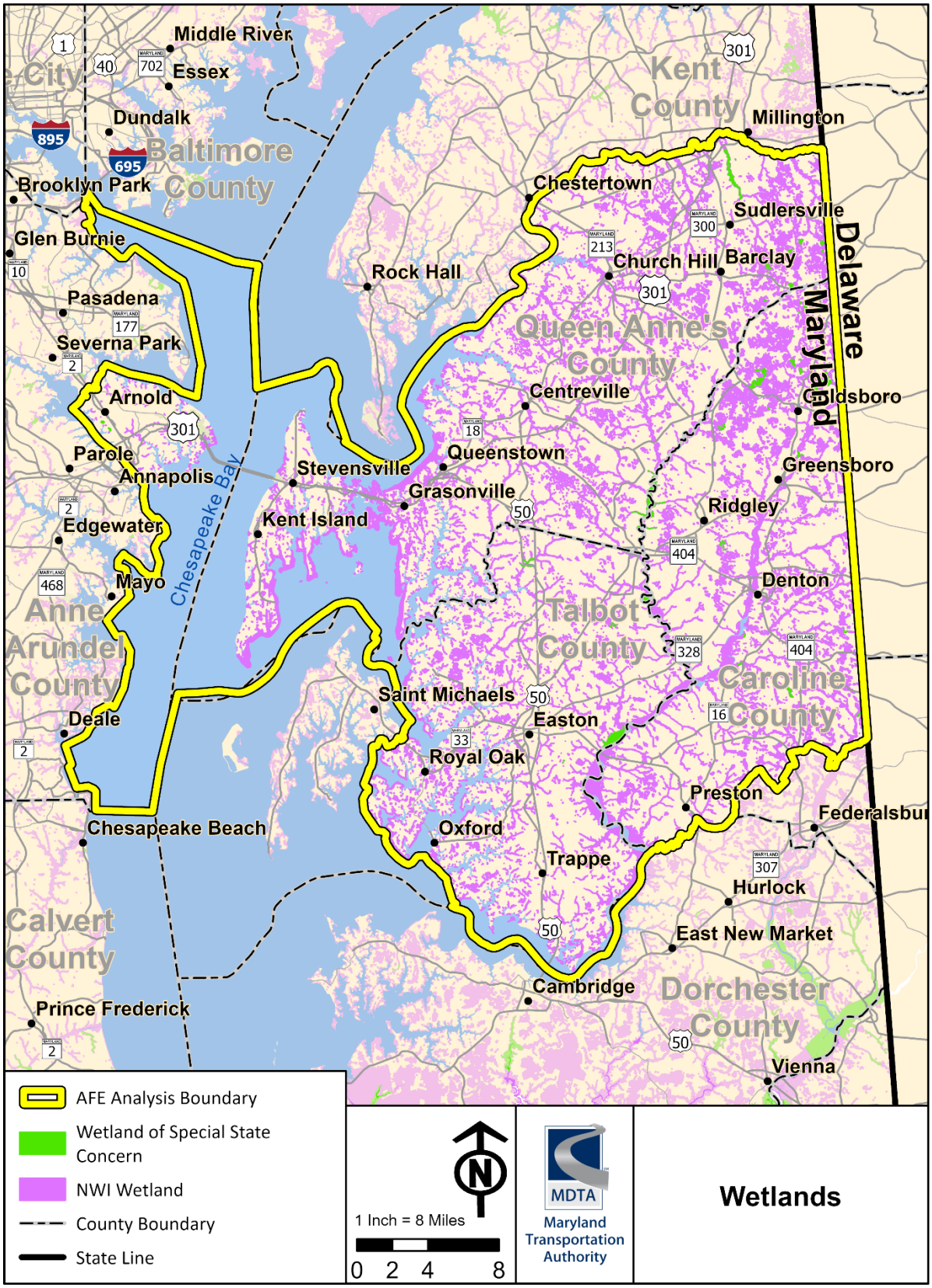
County	Acres	Analysis Area (Percent)
Caroline	1,018	46
Queen Anne's	793	35
Talbot	399	18
Anne Arundel	27	1
Total	**2,236**	**100**

Source: MDNR, 2019i

The state of Maryland regulates permanent and temporary impacts to the 25-foot nontidal wetland buffer and a 100-foot buffer around WSSC. Impacts to wetlands are regulated by the USACE, USEPA, and MDE. Mitigation may be required for permanent impacts to tidal wetlands. Mitigation can be in the form of permittee-responsible mitigation; use of a tidal wetland mitigation bank; or payment into the Tidal Fund. Mitigation for tidal wetland loss is considered in order of preference: restoration, in-kind creation, out-of-kind creation, enhancement of existing tidal wetlands; and monetary compensation to the Wetlands Compensation Fund (an MDE-approved mitigation mechanism).

When nontidal wetland or waterway impacts are considered more than minimal, they must be mitigated through restoration or other environmentally beneficial projects. Wetland and waterway compensatory mitigation efforts would be required for unavoidable adverse impacts due to construction of a build alternative. The type and amount of mitigation would be coordinated directly with the USACE and the MDE's Nontidal Wetlands Division, Mitigation and Technical Assistance Section to discuss mitigation requirements once detailed impacts are quantified for a selected alternative. Approved mitigation banks or permittee-responsible mitigation may be used where appropriate.

Figure 6-6: Wetlands



6.2.1.3 Surface Waters

Maryland's surface waters include the Chesapeake Bay, Coastal Bays, Atlantic Ocean, and more than 10,000 miles of rivers and streams. Maryland has no natural lakes. Rivers and streams within the Analysis Area include tidal, nontidal, fresh brackish, and warmwater. There are no coldwater fisheries in the Analysis Area (MDNR, 2016).

Throughout Maryland and the Analysis Area, numerous streams and rivers have been impacted by growth and development. Streams and waterways have been filled in, dammed, realigned and channelized, dredged, lined with concrete associated with bridge and culvert construction, and stream banks hardened with riprap and other materials. To those waterbodies affected, these impacts have eliminated or reduced waterbody functions and values, including natural flood control, nutrient recycling, groundwater recharge, and sustaining the biological productivity of downstream rivers and estuaries. These functions and values are important for waterbodies to provide habitat for plants, animals, and microorganisms in the form of shelter, food, protection from predators, fish passage, and spawning locations and nursery areas.

Table 6-25 shows the amount of waterways mapped by the USFWS NWI, including estuarine and marine deepwater (the Chesapeake Bay), freshwater ponds, lakes, and rivers in the Analysis Area. Approximately 26 percent (204,488 acres) of surface waters identified in the Analysis Area are estuarine and marine deepwater areas and less than one percent are freshwater ponds (3,218 acres), lakes (687 acres), or riverine resources (3,340 acres).

Table 6-25: NWI Waterbodies Classification within the Analysis Area

Waterbody Classification	Acreage	Percent of Analysis Area
Estuarine and Marine Deepwater	204,488	26
Freshwater Pond	3,218	<1
Lake	687	<1
Riverine	3,340	<1
Total	**211,733**	**27**

Source: USFWS NWI, 2024

Section 401 and Section 402 of the CWA regulate water quality of waterbodies and streams. Maryland has adopted water quality standards to enhance and protect water resources and meet the requirements of the federal CWA. The water quality standards designate uses for the waters of the state and set criteria to protect and maintain water quality for these "*designated uses*." Maryland's surface water database with designated uses for all streams was used to determine the linear miles of rivers and streams in the Analysis Area. As shown in **Table 6-26**, approximately 1,955 linear miles of rivers and streams are within the Analysis Area; 1,914 linear miles are designated use I (nontidal), and 41 linear miles are use II (tidal). Designated use I waterways are used for water contact recreation, and protection of nontidal warmwater aquatic life. Designated use II waterways support estuarine and marine aquatic life and shellfish harvesting.

Table 6-26: MDE Surface Waters Within the Analysis Area

Type	Linear Miles (# of segments)	Designated Use Class I (mi)	Designated Use Class II (mi)
Rivers & Streams	1,955 (9,326)	1,914	41

Source: MDE, 2019

Maryland has also designated certain surface waters of the state as Tier II (High Quality) waters, based on monitoring data documenting water quality conditions that exceeded the minimum standard necessary to meet designated uses. Through federal and Maryland regulations, antidegradation protections apply to ensure that these high-quality waters are maintained. These high-quality waters (streams and catchments) are designated as having assimilative capacity (AC) available or having no AC available. AC is measured as the difference between the index of biotic integrity (IBI) scores at the time of designation and the water quality baseline level outlined in COMAR. If current IBI scores are above the AC threshold, the stream is considered healthy, and AC is available. If IBI scores drop below the threshold, the stream quality has been depleted by conditions beyond natural circumstances, and no AC is available (MDE, 2021b).

Table 6-27 shows that approximately 67 linear miles of Tier II streams occur in the Analysis Area. These Tier II streams segments are found within seven of the 21 eight-digit watersheds that intersect the Analysis Area. Eighteen of the 38 Tier II stream segments have AC to absorb additional pollutants from upstream uses without degrading their high-quality designations.

Table 6-28 shows that approximately 205,642 acres of Tier II catchments occur in the Analysis Area (26 percent of the total Analysis Area acreage). These catchments are found within eight of the 21 eight-digit watersheds that intersect the Analysis Area. Fewer than half (13 of 36) of the identified Tier II catchments (approximately 97,227 acres or 47 percent) have adequate AC capacity to absorb additional pollutants and 22 catchments (approximately 108,415 acres or 53 percent) do not. **Figure 6-7** shows the identified rivers, streams, Tier II stream segments, and catchments occurring in the Analysis Area.

Table 6-27: High Quality Tier II Streams by Eight-Digit Watershed in the Analysis Area

Eight-Digit Watershed	Tier II Stream Segments (Linear Miles)	No AC (# of Segments)	AC (# of Segments)
Upper Chester River (02130510)	11	6	1
Southeast Creek (02130508)	13	1	6
Upper Choptank (02130404)	16	5	3
Corsica River (02130507)	7	1	3
Tuckahoe Creek (02130405)	12	4	4
Wye River (02130503)	7	3	0
Lower Choptank (02130403)	1	0	1
Total	**67**	**20**	**18**

Source: MDE, 2022

Figure 6-7: Waters

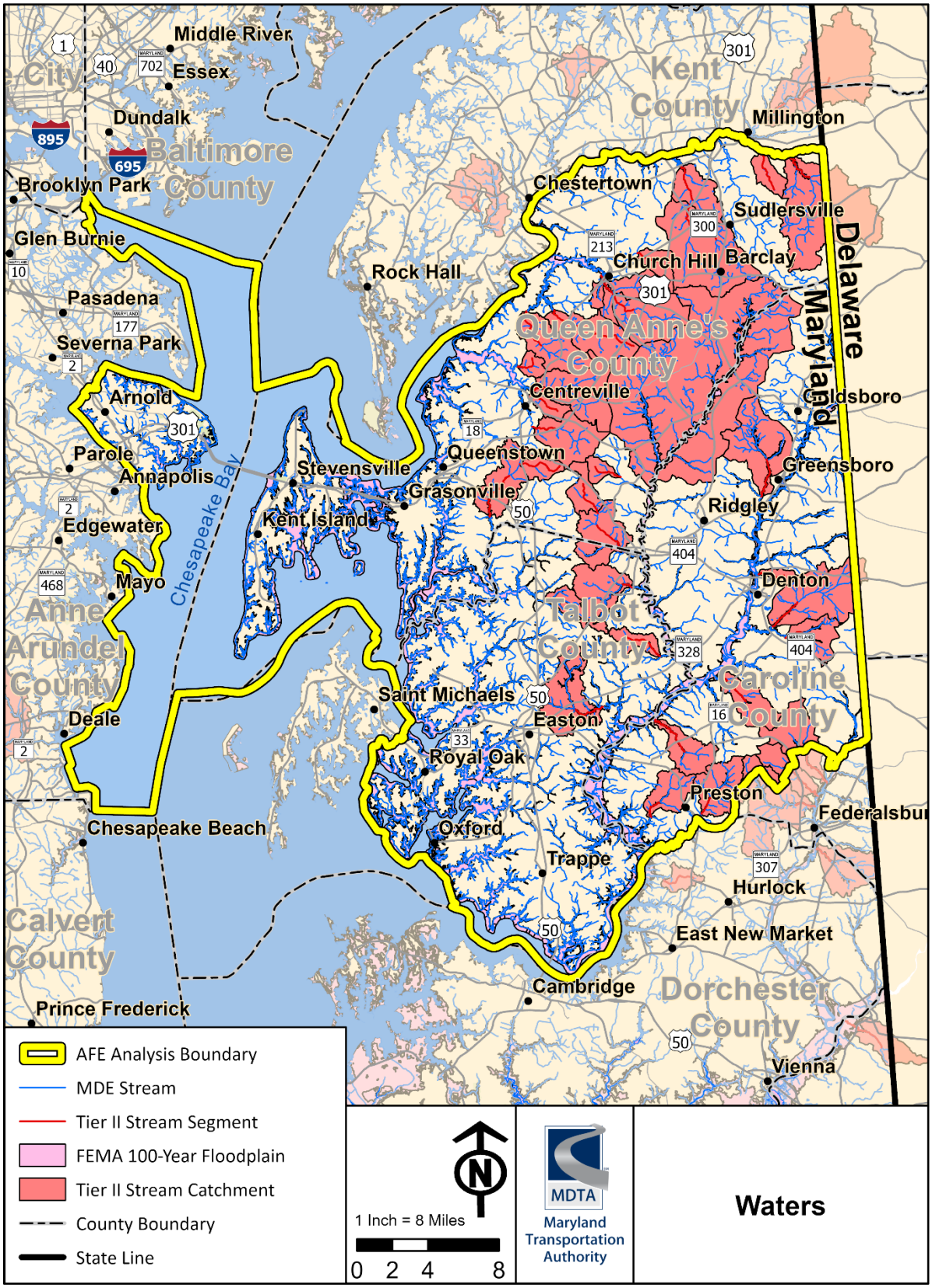


Table 6-28: High Quality Tier II Catchments by Eight-Digit Watershed in the Analysis Area

Eight-Digit Watershed	Catchment Acres (# of Catchments)	Acres with no AC (# of Catchments)	Acres with AC (# of Catchments)	Percent of Watershed with AC
Upper Chester River	36,906 (4)	36,906 (4)	0 (0)	0
Southeast Creek	36,791 (6)	29,958 (4)	6,833 (2)	19
Upper Choptank	36,720 (8)	22,389 (6)	14,331 (2)	39
Corsica River	13,669 (4)	6,108 (2)	7,561 (2)	55
Tuckahoe Creek	62,850 (6)	7,069 (2)	55,781 (4)	88
Wye River	7,905 (3)	3,146 (2)	4,759 (1)	60
Marshyhope Creek	6,527 (3)	2,839 (2)	3,688 (1)	57
Lower Choptank	4274 (1)	0 (0)	4,274 (1)	100
Total	**205,642 (35)**	**108,415 (22)**	**97,227 (13)**	**N/A**

Source: MDE, 2022

6.2.1.4 Floodplains

Undeveloped floodplains provide temporary storage of floodwater, moderate peak storm flows, maintain water quality by filtering sediment and pollutants, prevent soil erosion, serve as groundwater recharge areas, and provide essential habitat for wildlife. Floodplains also provide recreational opportunities and aesthetic benefits. Floodplains and associated wetlands should be preserved and enhanced (MDE, n.d.). Floodplains in the Analysis Area include nontidal floodplains along rivers, creeks and streams, tidal floodplains subject to regular high tides and coastal floods during storms, and coastal high hazard areas where shorelines are subject to high velocity wind and wave action. Development along rivers and waterways reduces the ability of these lands to absorb floodwaters during storm events, leading to more frequent and extreme flood events. Floodplains are protected through federal EO 11988: *Floodplain Management* (1977) and COMAR 26.17.04, *Construction in Nontidal Waters and Floodplains*. All Maryland counties and 92 municipalities participate in the National Flood Insurance Program (NFIP), which is overseen by FEMA and administered at the state and local levels. Tidal floodplains are protected and managed through Maryland's Tidal Wetlands Act and CBCA Program. FEMA's statewide National Flood Hazard GIS layer, obtained from the Map Service Center, was used to determine the location and extent of 100-year floodplains within the Analysis Area (FEMA, 2024).

Figure 6-7 shows the location and extent of identified 100-year floodplain regulated through the NFIP program within the Analysis Area. **Table 6-29** shows that an estimated 79,457 acres of 100-year floodplains occur within the Analysis Area.

The highest concentrations of identified floodplains are located on the Eastern Shore, primarily within Talbot and Queen Anne's counties. The broad, expansive floodplains within these areas are a result of their low-lying, flat topography. These areas are especially susceptible to flooding associated with tide and storm surge. Distribution of identified floodplains along the Western Shore is relatively uniform along tributaries to the Chesapeake Bay.

Table 6-29: FEMA floodplain within the Analysis Area

County	Acres	Analysis Area (Percent)
Caroline	13,888	2
Queen Anne's	31,304	4
Talbot	30,271	4
Anne Arundel	3,993	<1
Total	**79,457**	**10**

Source: FEMA, 2024

Floodplains are often sought as prime building locations due to their location along waterways providing preferred scenic/aesthetic views for home sites. Past development often replaces natural floodplains with impervious and developed areas which can increase downstream flooding and erosion (National Wildlife Federation [NWF] n.d.). Information on the historical development and loss of floodplains within the Analysis Area was not readily available for the BCS.

The NWF reports that FEMA's NFIP program encourages and subsidizes development within FEMA mapped 100-year floodplain (purchase of flood insurance is required for properties within the floodplain). Local implementation of Maryland's floodplain ordinances and development review by the CBCA Program provide additional protection to nontidal and tidal floodplain in the Analysis Area. The CBCA is described in **Section 6.2.2.1 Terrestrial Habitat**.

6.2.2 Wildlife and Habitat

Due to the broad use of available habitat by terrestrial and aquatic wildlife, numerous federal and state agencies may be involved in the regulation of potential habitat impacts. The USFWS and MDNR act as consulting agencies under the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), and provide environmental analysis of projects or permit applications. **Section 6.2.3 Threatened and Endangered Species** of this report contains regulatory specifics pertaining to threatened and endangered species.

6.2.2.1 Terrestrial Habitat

The composition of land cover directly affects natural communities, wildlife, and species biodiversity; therefore, lands with natural cover such as forested land, shrubland, and wetlands provide greater ecological values to the landscape than developed lands and are sensitive to loss through land development.

The dominant forest groups in the Analysis Area are oak/hickory, loblolly/shortleaf pine, and oak/gum/cypress. Oak/hickory forests are scattered throughout Maryland (62 percent of all Maryland forests) and account for the most acreage of forest type in Anne Arundel, Queen Anne's, and Caroline counties. Loblolly/shortleaf pine forests consist of approximately 13 percent of Maryland's total forested area, and most occurs in the Upper and Lower Coastal Plain (including the Analysis Area), due to loblolly pine dominated plantations and is the most abundant forest type in Talbot County. The oak/gum/cypress forest group comprises approximately five percent of Maryland's total forested area and they are most abundant along the lower Western and Eastern Shores of the Chesapeake Bay. Oak/gum/cypress forests are often flooded during the growing season (USDA, 2013 and MDNR, 2016). The Chesapeake Bay region's forests protect water quality, offer habitats for fish and wildlife, improve air quality, encourage recreation, and enhance the economy (Sprague et al., 2006).

The USFS has conducted and prepared Forest Inventory and Analysis (FIA) surveys and reports since the 1930s. The FIA reports for Maryland in 2008, 2011, and 2016 were reviewed for this AFE analysis. In 2008, the USFS reported a consistent decrease (approximately 16 percent) in forested land in Maryland since 1964. The USFS attributed changes in forested land to patterns of population growth, the availability of open land for development, conservation policies and agricultural land reverting to forests (USFS, 2008). In the most recent (2016) *Forests of Maryland* report, the FIA noted little change in statewide forest land acreage since 2008, with similar forested land area amounts noted in 2011 and 2016.

Maryland's *2020 Forest Action Plan* reported historical forested area loss by county between 1986 and 2018. **Table 6-30** shows that of the four counties in the Analysis Area; the greatest losses occurred in Anne Arundel County (approximately 63 percent). On the Eastern Shore, Talbot County increased its forested land area by approximately 21 percent while Queen Anne's County lost approximately 13 percent of its forested land and Caroline County lost approximately five percent. In 2018, the combined acreage of forested land within the Analysis Area's counties was approximately 216,983 acres of the total land area (881,556 acres), or approximately 25 percent forested.

Table 6-30: Acres of Forested Land by County 1986 – 2018

County	Land Area (Acres)	1986	1999	2008	2018	Percent Change (1986 - 2018)
Caroline County	204,890	59,790	49,352	71,284	56,606	-5
Queen Anne's County	238,214	72,919	47,801	70,144	63,096	-13
Talbot County	172,250	41,938	57,856	43,944	50,948	21
Anne Arundel County	266,202	126,451	85,475	69,523	46,333	-63
Total	**881,556**	**301,098**	**240,484**	**254,895**	**216,983**	**-28**

Sources: MDNR, 2020 Forest Action Plan Part I, and the USFS FIA.

Enacted in 1991, the Maryland FCA was passed to minimize the loss of forest resources during land development by requiring identification and preservation of forest land with sensitive resources including steep slopes, highly erodible soils, hydric soils, streams, and wetlands as part of project reviews for permitting. The FCA requires local governments to establish and implement local forest conservation programs that review and approve site plans and establish perpetual FCA easements with the end goal of no net loss of forests statewide. The most recent MDNR FCA Easements mapping shows 510 acres of FCA easements on 233 properties within the Analysis Area (MDNR, 2020). Forested areas within FCA easements can be developed through an amended Forest Conservation Plan. Approval of an amended plan requires replacement of the impacted forest.

Between 1993 and 2007, MDNR reviewed proposed development projects that encompassed 199,925 acres of forests through FCA regulations (COMAR 08.19). Project approvals resulted in retention of 120,638 acres of forested land, clearing of 71,885 acres, and planting of 21,461 acres of new forested land statewide (MDNR, 2007). The 2024 Maryland Forest Resource Fact Sheet shows that 2.4 million of Maryland's 6.2-million-acre land area are forested.

MDNR Greenprint online identifies those forests which are important to water quality (a.k.a. Forests of Recognized Importance [FORI]) which are forested 100-foot buffers around streams feeding municipal drinking water reservoirs, streams that support trout species, Tier II High Quality Waters, and stronghold watersheds (specially designated for aquatic species protection). There are approximately 17,862 acres of FORI in the Eastern Shore portion of the Analysis Area (**Table 6-31**) (MDNR, 2019d). There are approximately 179,900 acres of forested land within the Analysis Area according to CBP Chesapeake Conservancy data. **Figure 6-8** shows the location and extent of FCA easements, FORI, and forested land cover in the Analysis Area.

Table 6-31: Forest Resources within the Analysis Area

Resource	Acres	Portion of Analysis Area (Percent)
Forest	179,900	23
Land in a FCA Easement	510	<1
FORI	17,862	2

Sources: MDNR – FORI, 2019, FCA Easements, 2020, and CBP and Chesapeake Conservancy, 2023.

Maryland's green infrastructure (GI) is a network of undeveloped lands that are the state's natural support system (MDNR and MD iMAP, 2017). The largest areas of contiguous forested land (i.e., unfragmented by developed uses) within the Analysis Area occur on the Eastern Shore in Caroline and Queen Anne's counties. Tuckahoe State Park contains one of the largest areas of contiguous forests in the Analysis Area. The Western Shore contains a few large, forested areas in Sandy Point State Park and the Holly Beach Farm property. Large contiguous forests, and smaller areas containing natural cover, support a diverse array of species and ecosystem functions. Low vegetation areas predominately consist of agricultural lands, and these dominate the land cover on the eastern side of the Chesapeake Bay in Queen Anne's, Caroline, and Talbot counties.

Maryland's Critical Area Act (1984) was passed to protect and manage development of all lands in the state within 1,000 feet of the Mean High-Water line of tidal waters or the landward edge of tidal wetlands and all waters of and lands under the Chesapeake Bay and its tributaries. The CBCA Commission was established to develop and implement land use programs designed to minimize adverse effects on water quality and habitats, while also accommodating growth and its induced growth effects on the environment. Lands within the Critical Area are designated either as Intensely Developed Areas (IDA), Limited Development Areas (LDA), or Resource Conservation Areas (RCA). Priorities within IDAs include improving water quality, since so much of the land is already developed. Development is restricted within RCAs to maintain natural land cover types and protect habitat and ecological functions. Rare habitats, for both plants and animals, are regulated within the Critical Areas including colonial bird nesting areas, waterfowl staging areas, tidal wetlands, anadromous fish spawning areas, and other local areas are also protected. **Figure 6-9** shows the distribution of CBCA IDAs, RCAs, and LDAs and **Table 6-32** shows the amounts of CBCA IDA, LDA, and RCA within the Analysis Area.

Table 6-32: CBCA in Analysis Area

CBCA Type	Acreage	Percentage of Analysis Area
Intensely Developed Area	3,035	<1
Resource Conservation Area	92,869	12
Limited Development Area	18,899	2
Total	**114,803**	14

Source: MDNR, 2021a, 2022 – accessed from MD iMAP

Figure 6-8: Tree Canopy & Protected Forest Land

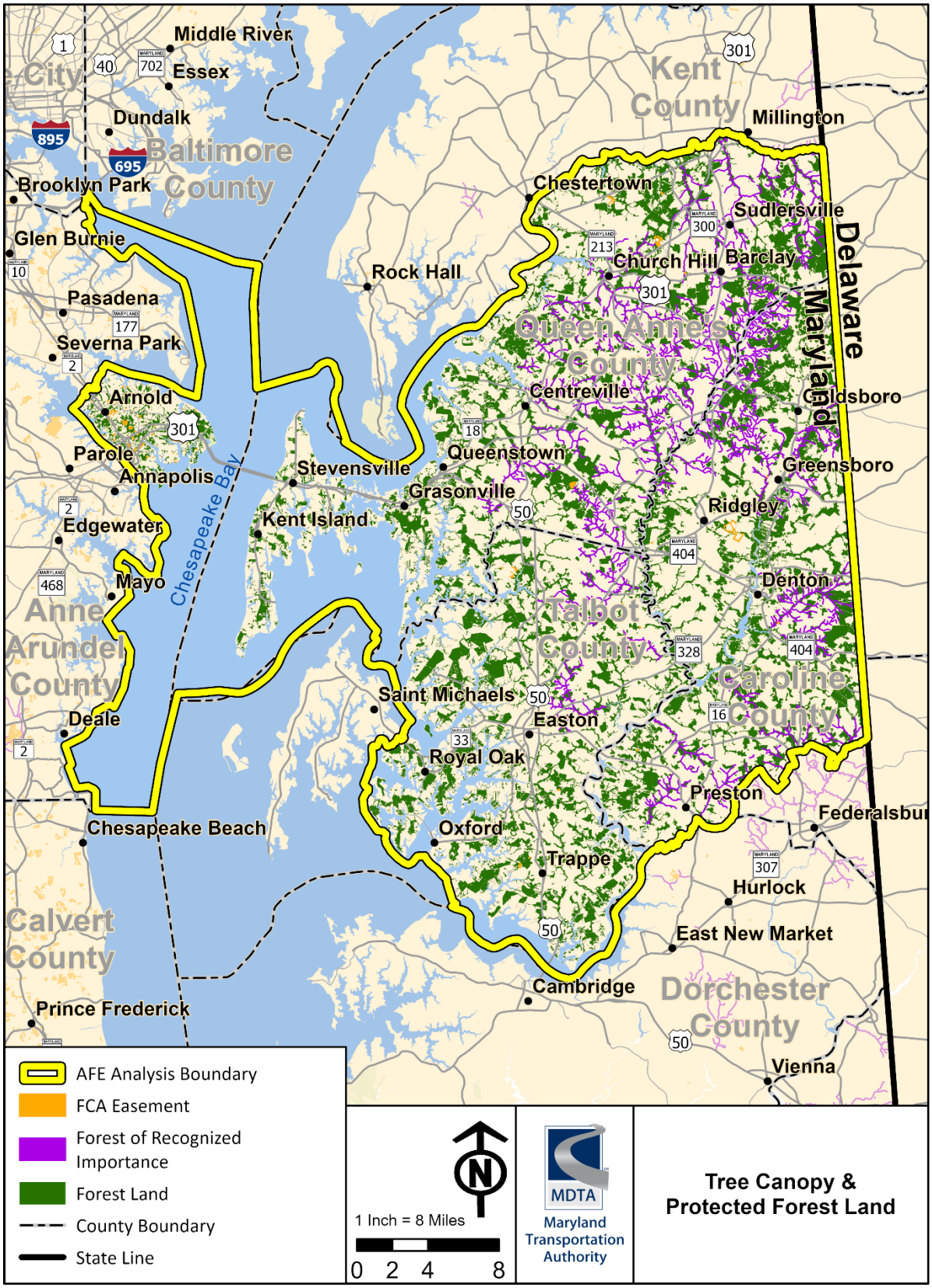
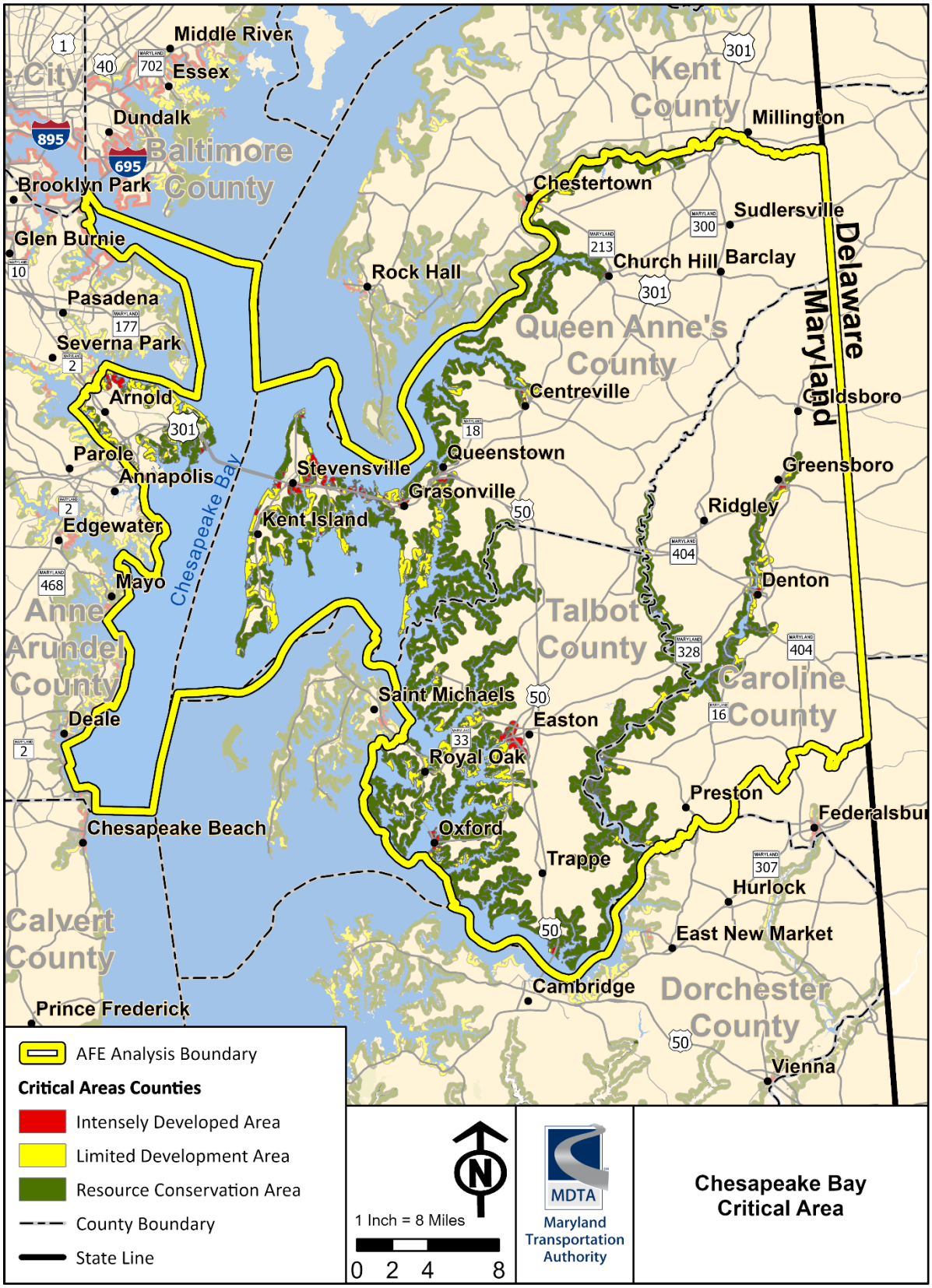


Figure 6-9: Chesapeake Bay Critical Area



Forest Interior Dwelling Species (FIDS) are regulated as a protected resource within the Critical Area (COMAR 27.01.09.04). FIDS require large forest areas (i.e., interior forest) to breed successfully and maintain viable populations. FIDS include migrating songbirds and long-distant migrants such as tanagers, warblers, and vireos; resident species; and short distance migrants including woodpeckers, hawks, and owls. Potential FIDS habitat includes riparian forests that are at least 300 feet in width and that occur adjacent to streams, wetlands, or the Chesapeake Bay shoreline, and other forest areas used as breeding areas by forest interior dwelling birds (MDNR, 2000). Approximately 26,240 acres in the Analysis Area is designated as potential FIDS habitat.

For this study, unique and sensitive areas are defined as habitats and biological resources that have special environmental attributes worthy of protection and retention. Maryland's GreenPrint Program was established to "*preserve the most ecologically valuable natural lands in Maryland*" (MDNR, n.d.) These areas include unfragmented natural areas, called "*hubs*," defined as contiguous forest blocks and wetland complexes of at least 250 acres, rare or sensitive species habitats, biologically important rivers and streams, and existing conservation lands managed for natural values. "*Corridors*" are linear stretches of land, at least 1,100 feet wide, which follow the best ecological or most natural routes between hubs. Areas of disconnect between the hubs and corridors are called "*gaps*" (MDNR, 2016).

Unique and sensitive areas mapped by MDNR include potential FIDS habitat, Targeted Ecological Areas (TEA), Sensitive Species Project Review Areas (SSPRAs), and Natural Heritage Areas (NHAs). TEAs in Maryland are lands of high ecological value that have been identified as conservation priorities by the MDNR for natural resource protection. These areas, which include GI hubs and corridors, represent the most ecologically valuable areas in the state. TEAs are preferred for conservation funding through Program Open Space. SSPRAs represent the general locations of documented rare, threatened, and endangered species in Maryland, and include a large boundary buffer around documented habitat to prevent deliberate destruction or unintended impacts. NHAs are areas that contain one or more threatened or endangered species or wildlife species in need of conservation and exhibit a blend of unique geological, hydrological, climatological, or biological features that are considered among the best examples of that habitat or feature in Maryland.

MDNR GIS layers hosted by MD iMAP were used to calculate the acreages of potential FIDS habitat, TEAs, and SSPRAs within the Analysis Area and these areas are displayed in **Figure 6-10**, **Figure 6-11**, and **Figure 6-12**, respectively. The Analysis Area contains approximately 182,416 acres of potential FIDS habitat (MDNR, 2012). There have been no updates to the potential FIDS GIS layer since it was published in 2012 (MDNR WHS, 2025). Potential FIDS habitat within the CBCA is regulated through project review by the Critical Area Commission.

Approximately 116,053 acres of SSPRA occur in the Analysis Area, with the majority in Caroline, Talbot, and Queen Anne's counties (MDNR, 2021b). Projects within SSPRA require coordination with MDNR WHS as part of project review and permitting, to prevent encroachment on habitat if possible and to implement Best Management Practices (BMPs) during construction activities.

Figure 6-10: Forest Interior Dwelling Species

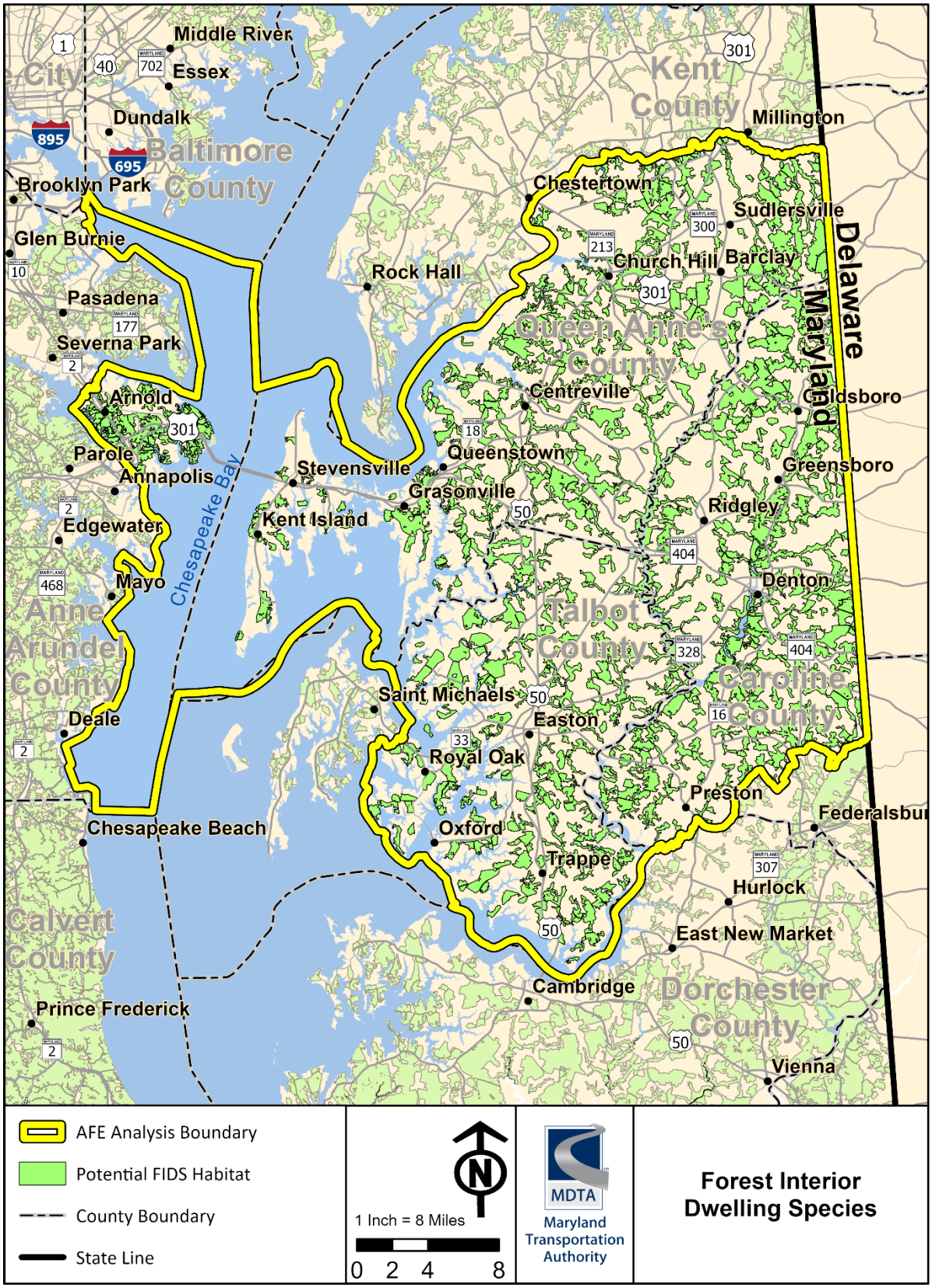


Figure 6-11: Targeted Ecological Area

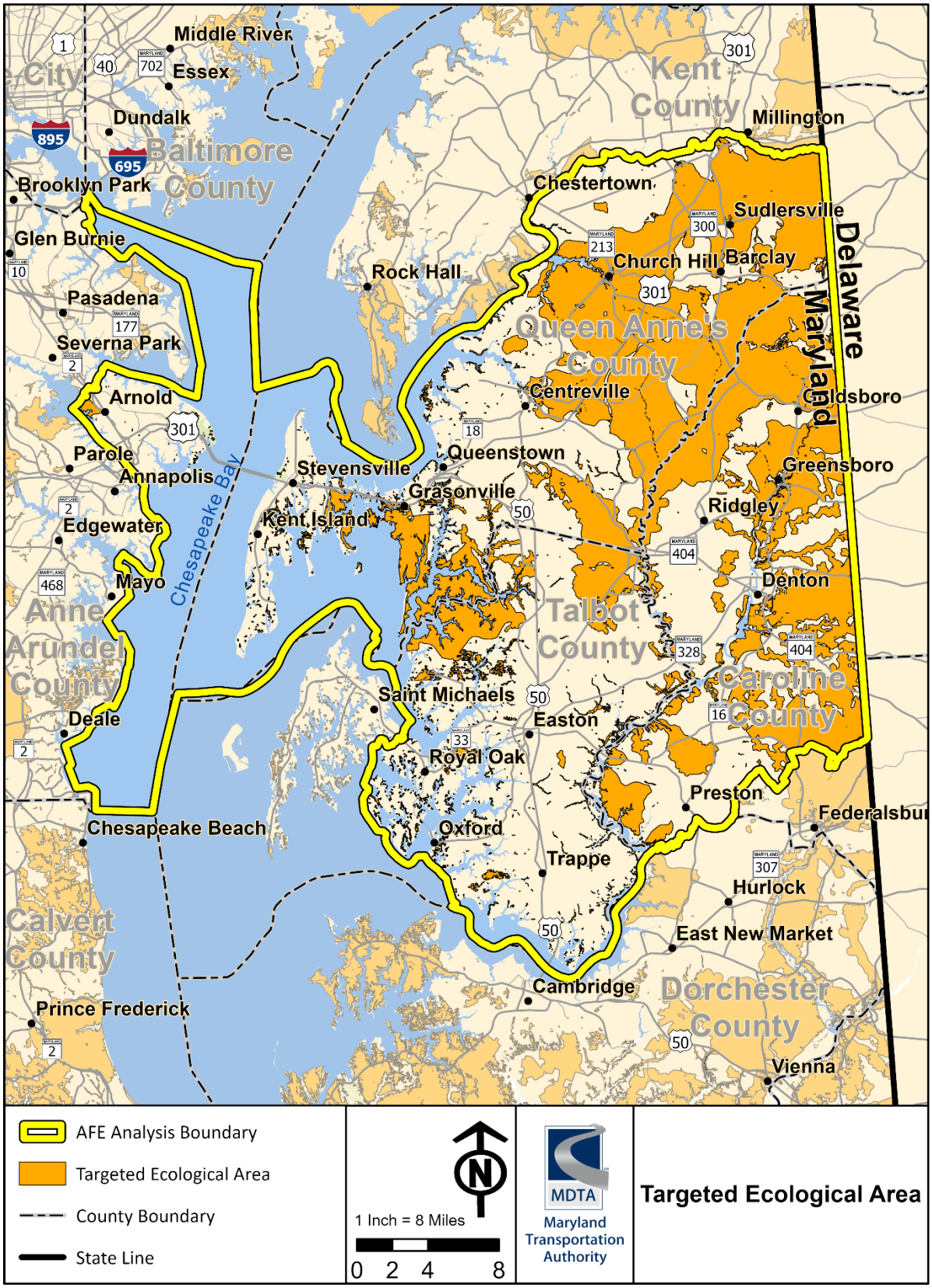
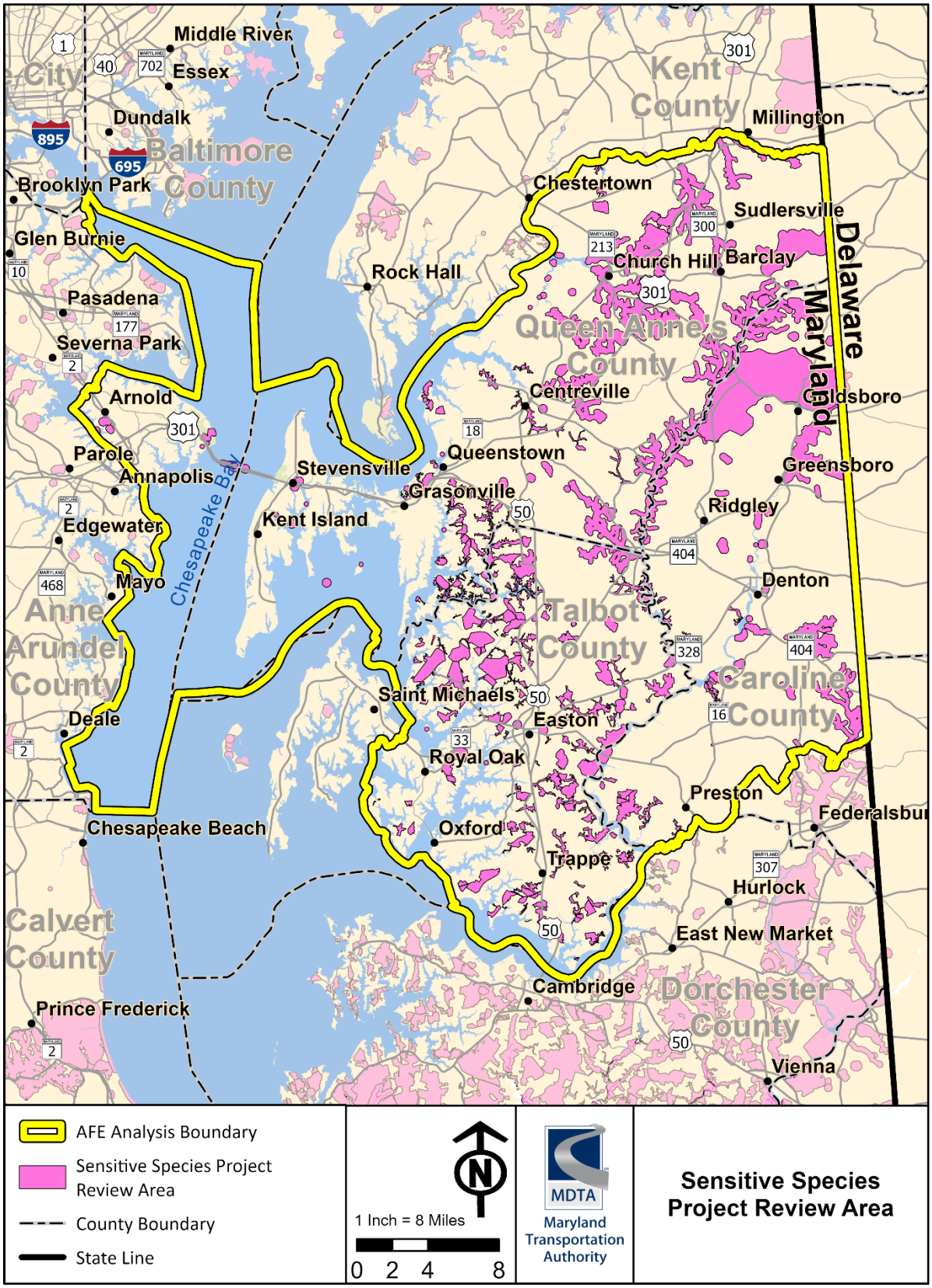


Figure 6-12: Sensitive Species Project Review Area



Approximately 264,189 acres of TEAs occur in the Analysis Area (MDNR, 2019c). TEAs are prioritized for the use of Program Open Space funding because these lands have the highest ecological value in the state. There are no mapped NHAs within the Analysis Area. **Table 6-33** shows the acreage and percentages of these Unique and Sensitive Areas within the Analysis Area. TEA, SSPRA, and potential FIDS boundaries overlap each other, therefore a total acreage of these resources in the Analysis Area is not provided.

Table 6-33: Unique and Sensitive Areas in the Analysis Area

Resource	Acreage	Percentage of Analysis Area
Potential FIDS Habitat	182,416	23
Sensitive Species Project Review Areas	116,053	15
TEAs	264,189	33

Sources: MDNR and MD iMAP 2017, 2021, and 2019, respectively.

Maryland's Program Open Space law was passed in 1969, and various federal, state, and local programs support land preservation. The goal of Maryland's land preservation, resource conservation, and recreation programs is to conserve the most important rural and natural resource lands and resource-based industries; provide access to recreational opportunities and to protect natural environments of Maryland. MDNR-managed lands found during the review include Sandy Point State Park and Kent Island Research Wildlife Management Area. MDNR also recently acquired Holly Beach Farm, which would be maintained as a Natural Resource Management Area.

The MDP manages several 'protected lands' mapping layers (GIS) including MALPF easements, RLAs, MDNR-owned Properties and Conservation Easements, MET, and MHT Preservation Easements, private conservation lands, local protected lands (including parks) and federal lands (MDP, 2024c-g and ArcGIS Hub, 2025). Map updates vary by each GIS layer.

Roughly one-third of the total land area within the Analysis Area (approximately 268,444 acres on 1,315 properties) is protected from development. These protected lands (**Figure 5-6**) include state and local parks, natural resource management areas and wildlife management areas, conservation easements, agricultural land preservation and historic preservation sites. There are no federally owned properties mapped within the Analysis Area. **Table 6-34** shows the acreage and percentage of each protected land type within the Analysis Area.

Table 6-34: Protected Lands in the Analysis Area

Resource	Number of Resources	Analysis Area (Acres)	Analysis Area (Percent)
Maryland Agricultural Land Preservation Foundation Easements	506	79,817	10
RLAs	5	95,973	12
MDNR-owned Properties and Conservation Easements	99	18,548	2
MET Easements	232	24,169	3
MHT Preservation Easements	41	1,381	0
Private Conservation Lands	63	4,965	0
Local Protected Lands	369	25,146	3
Federal lands	0	0	0
Total Protected Lands	**1,315**	**268,444**	**33**

Maryland's GI network of hubs and corridors was updated and enhanced using the CBP and Chesapeake Bay Conservancy LULC mapping (2017-2018) (MDNR, 2024c) and is now called the Habitat Connectivity Network (HCN) hosted on MDNR GreenPrint. Hubs are now mapped as upland, wetland, and aquatic. Upland refers to areas of forest blocks at least 50 acres in size with a minimum of 10 acres of contiguous interior forest. Wetland hubs are contiguous wetlands at least 50 acres in size.

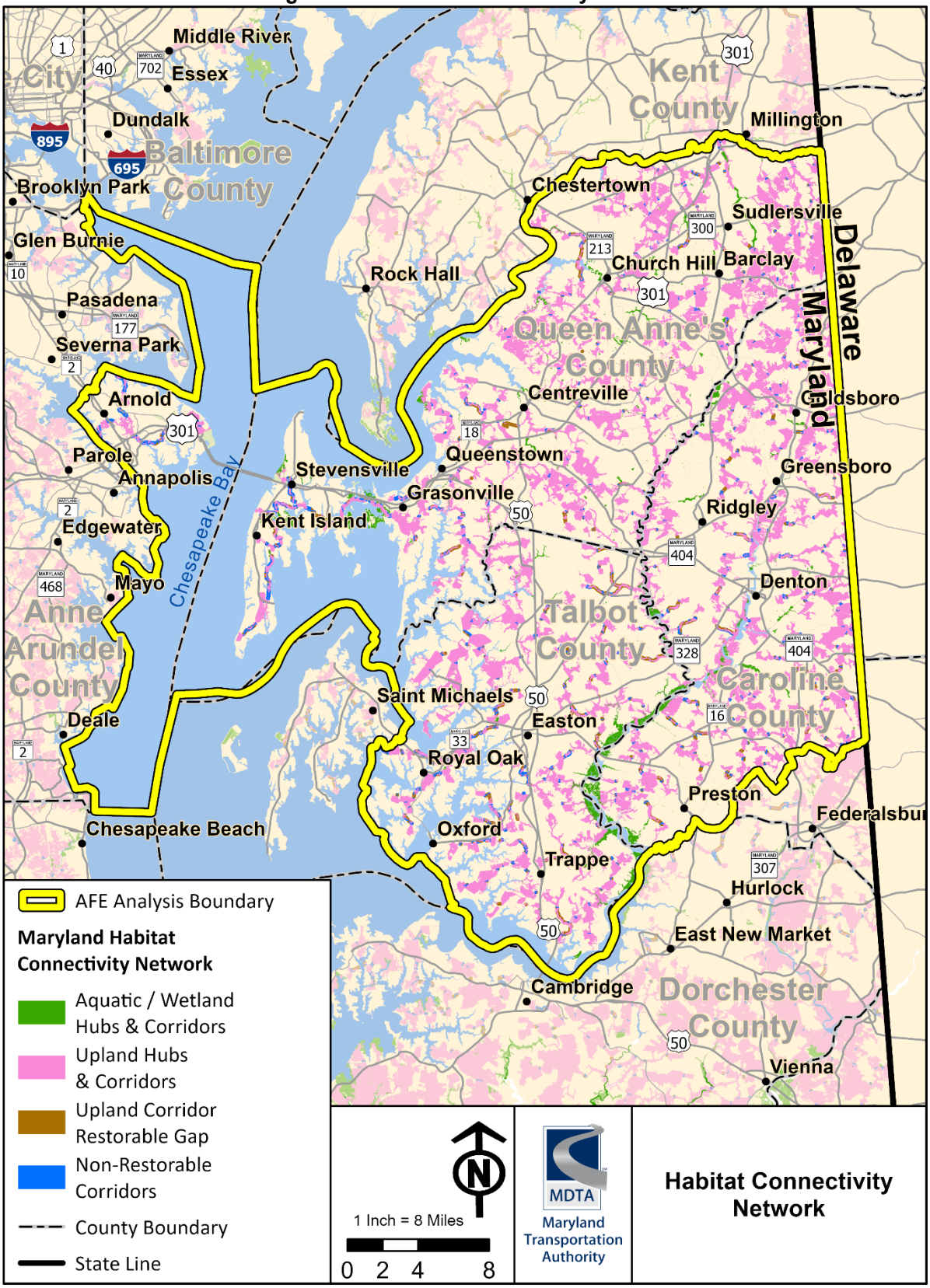
Aquatic hubs refer to waterways that meet specific ecological criteria, including resources in Tier II catchments, watersheds with trout, or those with Anadromous Fish spawning segments; large wetland complexes (with at least 250 acres of unmodified wetlands); important animal and plant habitats of at least 100 acres, including rare, threatened, and endangered species locations, unique ecological communities, and migratory bird habitats; relatively pristine stream and river segments (which, when considered with adjacent forests and wetlands, are at least 100 acres) that support trout, mussels, and other sensitive aquatic organisms; and existing protected natural resource lands which contain one or more of the above (for example, state parks and forests, National Wildlife Refuges, locally owned reservoir properties, major stream valley parks, and Nature Conservancy preserves). Aquatic and upland corridors refer to the linear areas that allow flora and fauna to move between hubs. These corridors are broken out into three categories; natural, which exist through natural land use classes; restorable gaps, which are not ideal for movement between hubs but could be good for restoration; and non-restorable gaps, which are comprised of impervious surfaces, roads, or buildings and is not suitable for wildlife movement (MDNR, 2024c). **Figure 6-13** shows the HCN types and **Table 6-35** shows the acreage of each HCN type within the Analysis Area.

Table 6-35: Habitat Connectivity Network in Analysis Area

HCN Type	Acreage	Analysis Area (Percent)
Aquatic Hub	2,075	<1
Aquatic Corridor – Natural	804	<1
Wetland Hub	5,601	1
Total - Aquatic HCN	**8,480**	**1**
Upland Hub	126,377	16
Upland Corridor – Natural	8,713	1
Upland Corridor – Restorable Gap	9,049	1
Total - Upland Hubs and Corridors	**144,139**	**18**
Non-restorable – Aquatic Corridor	2	<1
Non-restorable – Upland Corridor	1,188	<1
Total - Non-Restorable in HCN*	**1,190**	<1
Total HCN*	**153,809**	**19**

** Total HCN does not include "non-restorable corridors" Source: MDNR, 2024c*

Figure 6-13: Habitat Connectivity Network



6.2.2.2 Aquatic Habitat

Aquatic wildlife and habitat in the Analysis Area have also been historically impacted, as discussed above for wetlands, streams and rivers, and forested areas. Changes in water quality have impacted aquatic wildlife by disturbing migration and reproduction of certain species; increasing turbidity that impacts light levels in water affecting wildlife; and reducing aquatic wildlife populations. Impacts on aquatic habitat are regulated at the federal, state, and local level. These regulations aim to minimize and mitigate adverse impacts through design modifications, BMPs, restoration and enhancements.

Water quality in the Analysis Area has declined due to past population growth and development. Increases of impervious surfaces in the Analysis Area, especially on the Western Shore, have resulted in an increase in the velocity and volume of surface runoff entering the surrounding waterbodies. This has led to increased erosion, sedimentation, and more pollutants being deposited into nearby waters. Ground disturbances from development and agriculture have exposed soils to water erosion and reduced filtering vegetation, increasing sediment deposition into nearby waterbodies. Fertilizers and pesticides from agriculture, along with livestock byproducts, end up in stormwater runoff which can cause algal blooms that deplete the water of oxygen, affecting the survival of aquatic life. Agriculture is found on both sides of the Bay, though it is much more prevalent on the Eastern Shore.

The CBP is an organization that is working to restore the bay water quality standards, under the directive of the CBA established in 2014 (Chesapeake Progress). Water quality attainment monitoring by the CBP has been conducted since 1985 and accounts for a variety of different environmental factors that can affect water quality. Their 2020-2022 monitoring results for the Chesapeake Bay did meet water quality standards, which was an improvement in comparison to the 2019-2021 water quality report (Chesapeake Progress, 2022). MDNR's "*Eyes on the Bay*" Program is also run by the CBP and provides water quality monitoring for the Chesapeake Bay. Dissolved oxygen (DO) is used as one of the main indicators for water quality. DO levels below 5 mg/l (milligrams per liter) can begin to affect sensitive species, including fish, and levels below 2 mg/l indicate hypoxic conditions (causing harm or death to many aquatic species). DO hypoxia reports from 2021-2024 indicate a positive DO trend for Chesapeake Bay, showing that the percentage of water in Chesapeake Bay considered to be hypoxic was generally below average during these monitoring years (MDNR, 2024a).

The MDNR conducts the Maryland Biological Stream Survey (MBSS) to determine the biological conditions in streams throughout the state. The MBSS evaluates fish, benthic (i.e., bottom of waterbody) macroinvertebrates, and aquatic habitat using IBI for both fish (FIBI) and benthic macroinvertebrates (BIBI) and a combined IBI score. The Bay Crossing Study Tier 1 *ICE Technical Report* presented results of the MBSS Round Three survey conducted in 2009, that indicated that stream habitat conditions within the ICE Analysis Boundary were less degraded on the Upper Eastern Shore, and the most degraded on the western side of the Bay (MDNR, 2011).

The results were summarized for the Tributary Basins within the Analysis Area shown in **Figure 6-14**. Fifty-seven percent of areas surveyed in the Lower Western Shore had Very Poor or Poor BIBI scores and 43 percent had fair scores. Twenty-eight percent of areas in the Upper Eastern Shore had Very Poor or Poor BIBI scores and 27 percent had Good scores. Fifty-nine percent of areas in the Choptank had Very Poor or Poor BIBI scores and 16 percent had good scores. The report identifies the top five stressors responsible for degrading Maryland's streams as: urban

land use greater than five percent, no riparian buffer, channelization, nitrate-nitrogen greater than 5 milligrams per liter (mg/l), and DO less than 3 mg/l.

The MBSS Round Four report (2024) details the changes in biological indicators and water quality and describes trends observed over a twenty-year comparison period at sites that were monitored during Rounds One through Four. The Round Four findings were that while overall stream health measured using BIBI scores had not substantially changed, statewide, the percentage of certain sensitive macroinvertebrate taxa was lower. For FIBI the abundances of all fish species, except for non-native species had declined at the reference sites. Over the 20-year survey period, non-native fish species increased, some rare, threatened, and endangered (RTE) species increased and RTE species were lost from certain Maryland streams. However, a negative change in stream health (IBI) was not documented.

The MBSS Stream Health Index Interactive Map was used to obtain stream ratings for 22 monitoring sites sampled between 2021 and 2023 in Analysis Area watersheds. **Table 6-36** shows the 8-digit watersheds, MBSS Site Name, an assigned Map ID number keyed to **Figure 6-14** and the combined IBI score and rating for each site. Sixteen of the 22 sites were rated as Poor (approximately 73 percent), two were rated Fair (approximately nine percent) and four were rated as Good (approximately 18 percent). The monitoring sites are shown on **Figure 6-14** using the Map ID Number in **Table 6-36**. Sites in the Tuckahoe Creek watershed had the best FIBI and BIBI scores compared to the rest of the Analysis Area eight-digit watersheds. The rating is based on the Index of Biological Integrity Overall, approximately 73 percent of the survey sites within the Analysis Area show less than optimal water quality scores.

Fish species observed at these monitoring sites in the Analysis Area include the eastern mudminnow (*Umbra pygmaea*), redfin pickerel (*Esox americanus*), bluegill (*Lepomis macrochirus)*, brown bullhead (*Ameiurus nebulosus)*, blacknose dace (*Rhinichthys atratulus*), redbreast sunfish (*Lepomis auritus*), pumpkinseed sunfish (*Lepomis gibbosus*), and green sunfish (*Lepomis cyanellus*). **Table 6-32** shows MBSS water quality scores for each survey site within the Analysis Area. When compared to MDE's high quality waters, some of these MBSS sites are associated with the Tier II high quality stream segments.

Figure 6-14: Maryland Biological Stream Survey

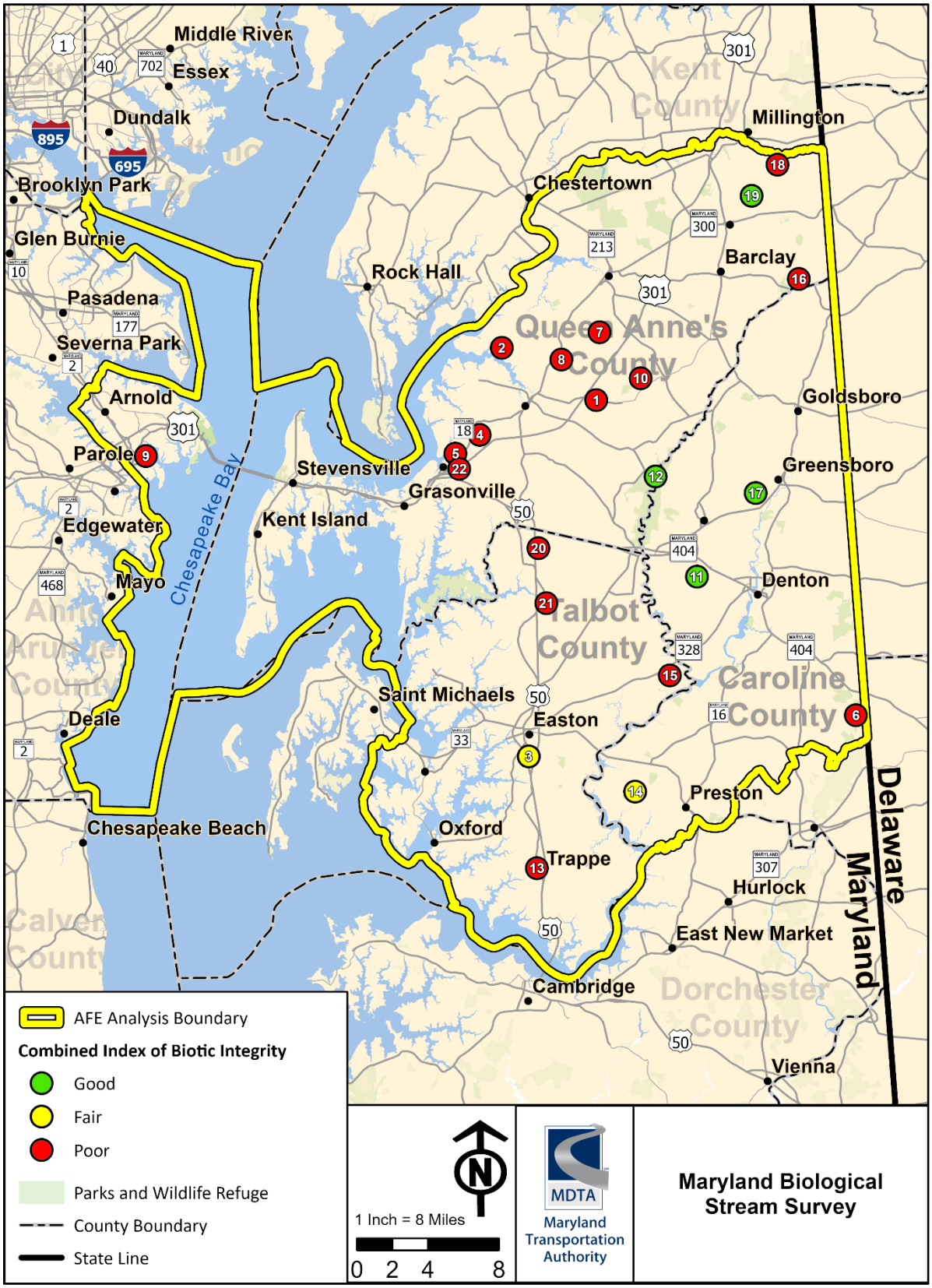


Table 6-36: MBSS 2021-2023 Survey Results

8-Digit Watershed	Map ID Number	Site Name	County	Combined IBI	Rating
Corsica River	1	CORS-101-R-2021	QA	1.86	Poor
Corsica River	2	CORS-102-S-2023	QA	1.88	Poor
Lower Choptank River	3	LOCK-320-R-2023	TA	3.02	Fair
Lower Chester River	4	LOCR-101-R-2021	QA	1.57	Poor
Lower Chester River	5	LOCR-110-R-2022	QA	1.29	Poor
Marshyhope Creek	6	MACK-114-R-2022	CA	1.57	Poor
Southeast Creek	7	SEAS-112-R-2022	QA	2.43	Poor
Southeast Creek	8	SEAS-223-R-2023	QA	2.69	Poor
Severn River	9	SEVE-201-R-2021	AA	2.55	Poor
Tuckahoe Creek	10	TUCK-202-R-2021	QA	2.81	Poor
Tuckahoe Creek	11	TUCK-212-R-2022	CA	4.14	Good
Tuckahoe Creek	12	TUCK-523-R-2023	QA	4.07	Good
Upper Choptank	13	UPCK-111-R-2022	TA	1.86	Poor
Upper Choptank	14	UPCK-113-S-2022	CA	3.02	Fair
Upper Choptank	15	UPCK-211-R-2022	TA	2.71	Poor
Upper Choptank	16	UPCK-228-R-2023	QA	2.86	Poor
Upper Choptank	17	UPCK-403-R-202	CA	4.5	Good
Upper Chester River	18	UPCR-101-R-2021	QA	2.36	Poor
Upper Chester River	19	UPCR-212-R-2022	QA	4.43	Good
Wye River	20	WYER-102-R-2021	TA	2.57	Poor
Wye River	21	WYER-311-R-2022	TA	2.14	Poor
Wye River	22	WYER-320-R-2023	QA	2.14	Poor

Source: MDNR, 2023c

The Magnuson-Stevens Fisheries Conservation and Management Act (reauthorized in 2007) governs marine fisheries conservation and management in federal waters through fishery management plans developed by NOAA NMFS (NOAA Fisheries) in collaboration with regional Fishery Management Councils. The Reauthorization Act authorized the Community-based Restoration Program administered by NOAA NMFS to restore fisheries and coastal habitats. Information from NOAA NMFS for the Mid-Atlantic and New England Fishery Management Council shows Essential Fish Habitat (EFH) exists in the Analysis Area (**Figure 6-15**) for the species shown in **Table 6-37**. EFH is defined as waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. The mapped EFH boundary for some species as shown in **Figure 6-15**, and totaled in **Table 6-37**, may be refined based on waterway salinities and species-specific preferred habitat conditions.

Figure 6-15: Aquatic Habitat

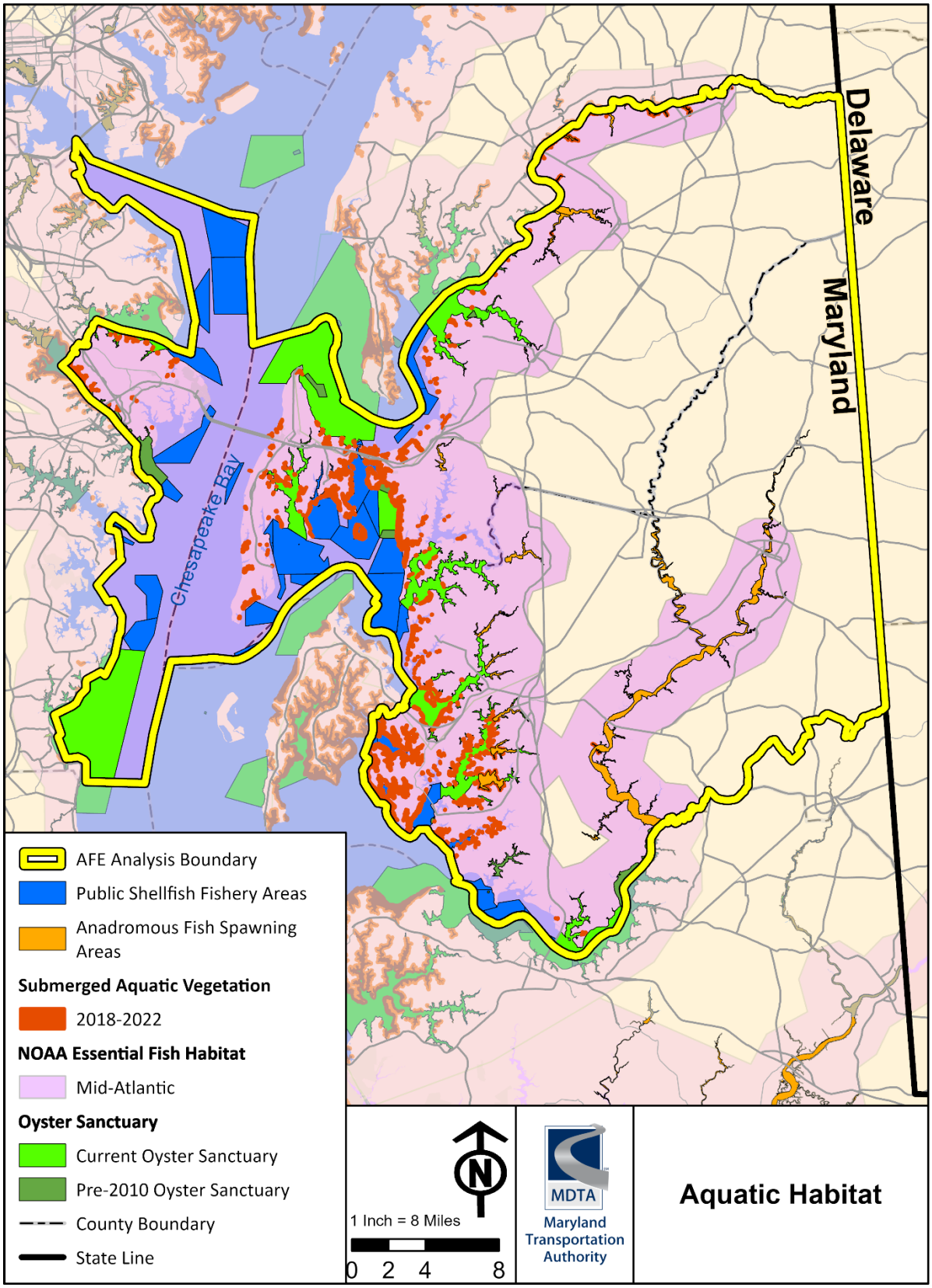


Table 6-37: Essential Fish Habitat and Identified Species

Species	Life Stages	Acres of Habitat in the Analysis Area
Atlantic Butterfish (*Peprilus triacanthus*)	Adult, Egg, Juvenile, and Larvae	244,605
Black Sea Bass (*Centropristis striata*)	Adult and Juvenile	244,577
Bluefish (*Pomatomus saltatrix*)	Adult and Juvenile	455,329
Clearnose Skate (*Raja eglanteria*)	Adult and Juvenile	455,336
Scup (*Stenotomus chrysops*)	Adult and Juvenile	244,577
Summer Flounder (*Paralichthys dentatus*)	Adult, Juvenile, and Larvae	455,329
Windowpane Flounder (*Scophthalmus aquosus*)	Adult and Juvenile	455,336

Source: NOAA, 2025; Notes: Many of these habitats for the different species overlap heavily, so the total habitat acreage greatly exceeds that of the Analysis Area.

Anadromous fish are fish that migrate from saltwater to freshwater to spawn. Anadromous fish spawning habitat is also present in the Analysis Area. Available GIS data was used to show spawning habitat for anadromous fish within the AFE boundary. The anadromous fish spawning area has a threshold of 10 percent impervious surface cover in adjacent watersheds to protect fish spawning habitat. Anadromous fish spawning habitat and species are shown in **Figure 6-15.** Acreages of spawning area for River Herring, American Shad, Striped Bass, Yellow Perch, and White Perch is shown in **Table 6-38.** The majority of spawning areas for each species are located in the Choptank and Tuckahoe rivers; 1,897 acres for both the River Herring and American Shad, 2,244 acres for White Perch, 779 acres for Yellow Perch, and 4,196 acres for the Striped Bass.

Federal agencies are required to consult with NOAA NMFS on proposed actions that may adversely affect EFH. In addition, the Fish and Wildlife Coordination Act, as amended in 1964, requires that all federal agencies consult with NOAA NMFS, USFWS, and state wildlife agencies when proposed actions might result in modification of a natural stream or body of water that supports EFH.

Habitat Areas of Particular Concern (HAPCs) are types of EFH that provide extremely important ecological functions or are especially vulnerable to degradation. The HAPC designation can help prioritize conservation efforts. Regional Fishery Management Councils are encouraged to identify HAPCs, based on important ecological functions; the extent to which the habitat is sensitive to human-induced environmental degradation; threats to the habitat by development activities; and the rarity of the habitat type. Submerged aquatic vegetation (SAV) is designated by the Mid-Atlantic Fisheries Management Council as a HAPC for summer flounder. SAV are rooted aquatic plants that provide food and shelter for a variety of aquatic biota including fish, crabs, ducks, and geese. SAV benefits also include trapping and absorbing pollutants and excess nutrients. Areas containing SAV are regulated as special aquatic sites under Section 404 of the CWA. SAV is the only HAPC in the Analysis Area.

SAV areas located in the Analysis Area were identified through use of data obtained from the MDNR. Data was retrieved from MDNR's aerial survey conducted in 2018 through 2022, (MDNR, 2018-2022). The Analysis Area contains approximately 5,194 acres of SAV beds within that 5-

year period (MDNR, 2018-2022). The highest density of SAV beds occur within Talbot County's Broad Creek, Edge Creek, Irish Creek, and the Ted Avon River.

The Chesapeake Bay Benthic Habitat layer obtained from MD iMAP (published 2015), is the most recent mapping available showing natural and man-made oyster reef habitat in the Chesapeake Bay from 1842 to 2014 (MDNR, 2015). The information was provided to MDNR from NOAA NMFS. The mapping shows that the majority of the benthic habitat in the Analysis Area is located within the Eastern Bay, Lower Chester River, and Lower Chesapeake Bay eight-digit watersheds (**Figure 6-15**). Impacts to aquatic resources are measured in terms of surface waters (tidal areas), Chesapeake Bay benthic habitat, SAV, horseshoe crab habitat, public shellfish fishery areas (PSFA), oyster sanctuaries, historic oyster bottom, and anadromous fish spawning area. **Figure 6-15** shows EFH, SAV, anadromous fish spawning areas, PSFA, current oyster sanctuaries and pre-2010 oyster sanctuaries in the Analysis Area. **Table 6-38** shows the acreage of the previously mentioned aquatic resources within the Analysis Area. Many of these aquatic resources overlap each other when shown on mapping, so the total resource acreage would exceed that of the Analysis Area. Many of the anadromous fish spawning areas overlap as well, so the combined acreage represents the total land area covered and will be less than the total acreage of each individual species spawning area added together. To account for the overlap of many of these aquatic resources, the total area within the Analysis Area covered by any of these aquatic resources was calculated. Approximately 202,529 (26 percent) acres of the Analysis Area is covered by at least one of the aquatic resources listed below.

Table 6-38: Aquatic Resources in the Analysis Area

Resource Type	Acreage	Percentage of Analysis Area
Benthic Habitat	105,958	13
Essential Fish Habitat	201,747	25
Submerged Aquatic Vegetation	5,194	<1
Public Shellfish Fishery Areas	46,047	6
Oyster Sanctuaries	60,670	8
Historic Oyster Bottom	67,811	9
Anadromous Fish Spawning Area	10,269	1
• American Shad	5,129	<1
• River Herring	5,129	<1
• Striped Bass	5,349	<1
• White Perch	4,426	<1
• Yellow Perch	957	<1
Analysis Area Total	**792,984**	**100**
Resource type	**Linear Miles**	**Percentage of Analysis Area**
Horseshoe Crab Habitat	9	N/A

Source: MDNR and NOAA from MD iMAP.

Fishery managers began comprehensive and coordinated management of oysters throughout the Chesapeake Bay with the adoption of the *Chesapeake Bay Oyster Management Plan* (CBP, 1989), subsequent revisions in 1994 (CBP, 1994), and 2004 (CBP, 2004), and with an amendment to the COMAR in 2010 (Maryland Register, 2010). In addition, commitments made in the Chesapeake 2000 Agreement (CBP, 2000), 2009 *Programmatic Environmental Impact*

Statement (USACE, 2009), 2010 *Maryland's 10-Point Oyster Restoration Plan* (MDNR, 2010b), 2014 CBA (CBP, 2014), and 2019 *Draft Maryland Oyster Management Plan* (MDNR, 2019b) (published in the Maryland Register on June 21, 2019) include efforts to rebuild the Chesapeake Bay's native oyster resources. A key element of this rebuilding effort has been the establishment and monitoring of oyster sanctuaries in Chesapeake Bay. Sanctuaries, many of which contain natural oyster bars, are currently distributed throughout the Analysis Area in embayments of Chesapeake Bay including near the Chester River, Eastern Bay, and tributaries including Magothy River, Severn River, Corsica River, Choptank River, Tred Avon River, Miles River, and Wye River (**Figure 6-15**).

PSFA in Chesapeake Bay are established areas that contain natural oyster bars, reserved for commercial oyster harvest (MDNR, 2023d). A large portion of the PSFA in the Analysis Area are located south of Kent Island and along the western portion of the Chesapeake Bay. PSFA is present below the existing Bay Bridge crossing near Sandy Point State Park and continues south. Natural oyster bars that are not located within PSFA are also present along the eastern end of the existing Bay Bridge crossing near Terrapin Nature Park. Additional oyster habitat in the Analysis Area within the Chesapeake Bay and/or tidal tributaries include historic and current (year 2000 to present) oyster planting areas, historic oyster bottoms, natural oyster bars, and oyster sanctuaries.

Horseshoe crab habitat within the Analysis Area was located by MDNR fisheries services and eventually mapped using GIS services. These habitats were ranked by MDNR biologists, applying the highest rank to spawning areas and the lowest rank to adult habitat with a depth below three feet (MDNR, 2019). Several areas of higher ranked habitat can be found along the shoreline on either side of the Bay Bridge in the Analysis Area; including areas such as Mezick Pond and Terrapin Nature Park.

6.2.2.3 Invasive Species

According to EO 13112, invasive species are non-native plant, animal, or microbial species that cause, or have the potential to cause, economic or ecological harm, or harm to human health (United States, 1999). EO 13112 requires federal agencies to not authorize, fund, or carry out actions that it believes are likely to cause or promote the introduction or spread of invasive species in the United States, with certain exceptions. EO 13751 amends EO 13112 and directs actions to continue coordinated federal prevention and control efforts related to invasive species (United States, 2016).

State and local governments also regulate invasive plant and animal species in the Analysis Area to prevent the spread of harmful wildlife species and noxious weeds and plants deemed to be detrimental to the human and natural environment. According to MDNR, invasive or exotic species observed within Maryland surrounding, or in the Chesapeake Bay, include: purple loosestrife (*Lythrum salicaria*), common reed (*Phragmites australis)*, water chestnut (*Trapa natans*), emerald ash borer (*Agrilus planipennis*), blue catfish (*Ictalurus furcatus*), flathead catfish (*Pylodictis olivaris*), northern snakehead (*Channa argus*), grass carp (*Ctenopharyngodon idella*), Chinese mitten crab (*Eriocheir sinensis*), red swamp crawfish (*Procambarus clarkii*), southern white river crawfish (*Procambarus zonangulus*), virile crayfish (*Orconectes virilism*), Asiatic clam (*Corbicula fluminea*), mute swan (*Cygnus olor*), and nutria (*Myocastor coypus*) (MDNR, 2019h). Other species reported within the Early Detection & Distribution Mapping System (EDDMapS) for the areas of Maryland containing the Analysis Area include the Japanese honeysuckle (*Lonicera*

japonica), Japanese knotweed (*Reynoutria japonica*), and tree-of-heaven (*Ailanthus altissima*) (EDDMapS, 2019).

6.2.3 Threatened, Endangered, and Special Status Species

Past and present development and agriculture impacts to plant and wildlife habitat, overexploitation of plants and wildlife, and introduction of exotic invasive species have been the principal factors contributing to reducing certain species to extinction or levels of concern for their continued existence (Evans, 2013). The ESA and subsequent amendments and regulations define basic protections for federally-listed wildlife and plants that are considered threatened or endangered. Section 7(a)(1) requires all federal agencies to carry out programs for the conservation of listed species, and Section 7(a)(2) requires the agencies to ensure their activities are not likely to jeopardize the continued existence of federally listed species or destroy or adversely modify designated critical habitat. The law also covers the protection of habitat identified as critical for protected species' survival, and applies to all federal, state, and privately-authorized projects or actions in the Analysis Area that potentially affect threatened and endangered species. USFWS and NOAA NMFS are responsible for listing, protecting, and managing federally-listed threatened and endangered species. Federal agency consultation with USFWS and/or NOAA NMFS regarding impacts to threatened and endangered species and critical habitat would occur specific to the federal agency's "*action area*". The Analysis Area was used to identify potential threatened and endangered species for the purposes of this report but would not be considered the "*action area"* relative to the Bay Crossing Study for use in USFWS and NOAA NMFS consultation.

Federally-listed threatened or endangered species reported to occur in the Analysis Area are considered sensitive resources. These species were identified by reviewing the USFWS Information for Planning and Consultation (IPaC) database (USFWS, 2025a-h) and NOAA's Section 7 Mapper (NOAA, 2022). **Table 6-39** lists the protected species considered for potential occurrence within the Analysis Area. No federally designated critical habitat was identified in the Analysis Area using the IPaC database or NOAA's Section 7 Mapper.

The NOAA Section 7 Mapper provides the locations of Section 7 Consultation Areas where listed species are potentially affected within a river/estuary/marine zone. The Consultation Areas specify which life stages and behaviors may be affected. The location and extent of these Consultation Areas, within the Analysis Area, are provided in **Figure 6-16**. Sturgeon Consultation Areas occur throughout the Analysis Area, and sea turtle Consultation Areas occur throughout the Bay, and its tidal tributaries.

The MDNR WHS reviews projects through the Environmental Review system, which is the state's primary method used to ensure that actions authorized, funded, or carried out by other state agencies do not jeopardize the continued existence of listed species. Coordination with the MDNR WHS was conducted on January 18, 2024, for the Bay Crossing Study Corridor 7 study area, so these results do not represent all of the Analysis Area. A list of RTE species deemed potentially impacted by WHS was incorporated into **Table 6-40.**

Along with the species listed below, there are other resources noted by WHS to be considered. Several great blue heron (*Ardea herodias)* colonies were documented in the area and are afforded protection within the CBCA (MDNR WHS, 2024). Several Waterfowl Concentration Areas were noted as well. These areas were found along the shore of Whitehall Creek, Meredith Creek, Prospect Bay, and both ends of the Bay Bridge.

Table 6-39: Federal Threatened and Endangered Species in the Analysis Area

Species	Status	Date listed	Source
Northern long-eared bat (NLEB) *(Myotis septentrionalis)*	Endangered	11/29/2022	IPaC
Dwarf wedgemussel *(Alasmidonta heterodon)*	Endangered	03/14/1990	IPaC
Canby's dropwort *(Oxypolis canbyi)*	Endangered	02/25/1986	IPaC
Tricolored bat *(Perimyotis subflavus)*	Proposed Endangered	09/14/2022	IPaC
Eastern black rail *(Laterallus jamaicensis ssp. jamaicensis)*	Threatened	11/09/2020	IPaC
Puritan tiger beetle *(Cicindela puritana)*	Threatened	08/07/1990	IPaC
Monarch butterfly *(Danaus plexippus)*	Proposed Threatened	12/12/2024	IPaC
Shortnose sturgeon *(Acipenser brevirostrum)*	Endangered	10/15/1966	NOAA Section 7 Consultation Area
Atlantic sturgeon *(Acipenser oxyrhynchus oxyrhynchus)*	Endangered	02/06/2012	NOAA Section 7 Consultation Area
Kemp's ridley sea turtle *(Lepidochelys kempii)*	Endangered	12/02/1970	NOAA Section 7 Consultation Area
Leatherback sea turtle *(Dermochelys coriacea)*	Endangered	06/02/1970	NOAA Section 7 Consultation Area
Green sea turtle *(Chelonia mydas)*	Threatened	1978; updated 05/06/2016	NOAA Section 7 Consultation Area
Loggerhead sea turtle *(Caretta caretta)*	Threatened	07/28/1978	NOAA Section 7 Consultation Area

Sources: USFWS, 2019b and NOAA, 2019a

The existing Bay Bridge structure provides habitat for several bird species. Specifically, the pier islands and structures under the bridge are known breeding grounds for great egret, snowy egret, cattle egret, black-crowned night-heron, and American peregrine falcon. Bridge maintenance or construction during the breeding season for these species should be carefully considered.

MDNR also provided correspondence that highlighted the presence of several fisheries resources that could be impacted by the build alternatives (MDNR, 2024b). For more information on threatened, endangered, and special status species see the *Natural Environmental Technical Report*.

Figure 6-16: NOAA Section 7 Consultation Areas

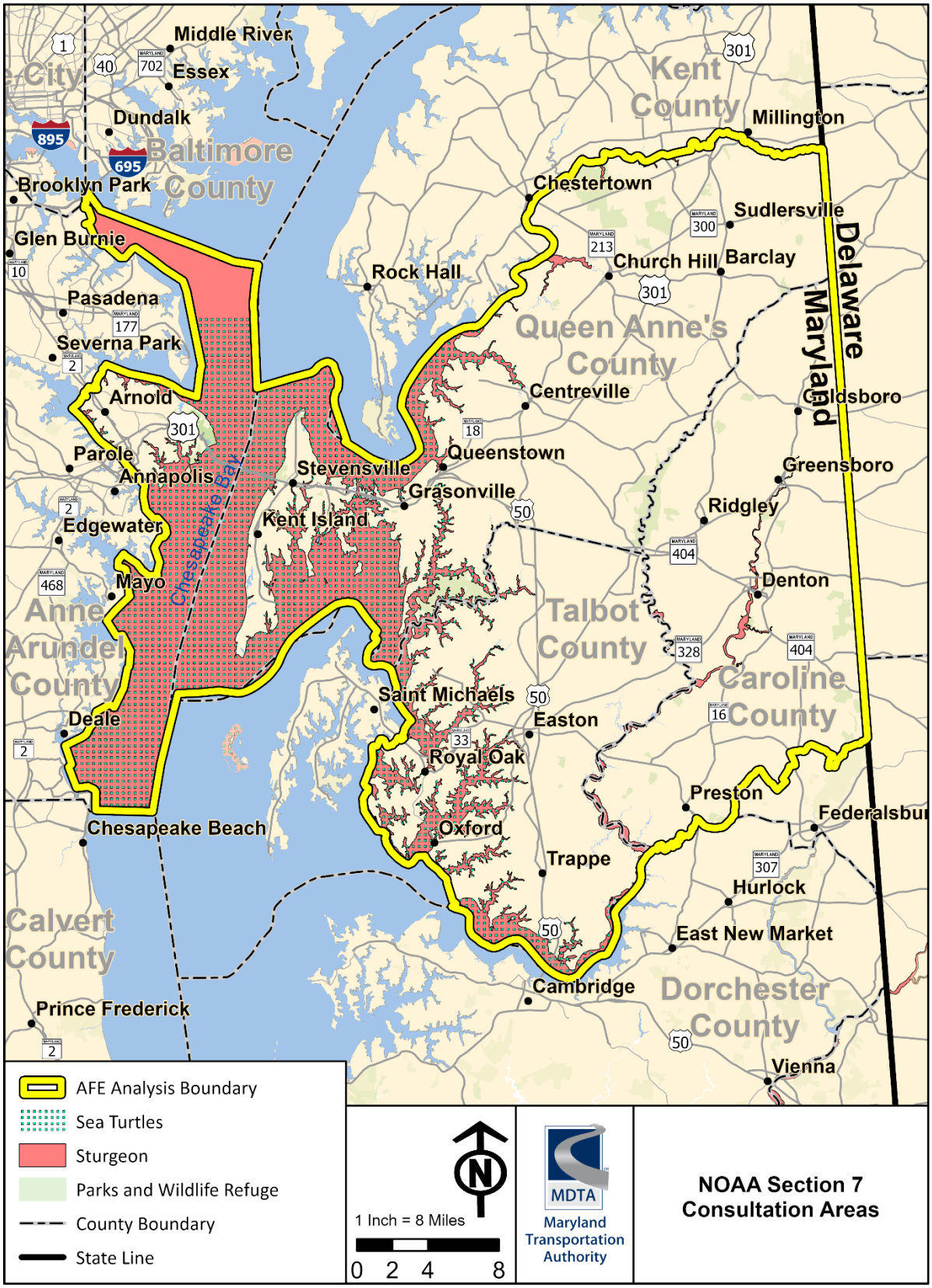


Table 6-40: State Rare, Threatened, and Endangered Species Potentially Occurring in the Analysis Area

Species	Status	Date listed	Source
Sora (*Porzana Carolina)*	Rare	N/A	MDNR WHS Letter
American peregrine falcon *(Falco peregrinus anatum)*	In Need of Conservation	N/A	MDNR Environmental Review Program (ERP) Letter
Black Rail (*Laterallus jamaicensis)*	Endangered	2020	MDNR WHS Letter
Glade fern *(Homalosorus pycnocarpos)*	State - Threatened	1984	MDNR WHS Letter
Least tern (*Sternula antillarum)*	State - Threatened	N/A	MDNR WHS Letter
Blackbanded sunfish *(Enneacanthus chaetodon)*	State - Endangered	2007	MDNR ERP Letter
Yellow perch *(Perca flavscens)*	In Need of Conservation	N/A	MDNR ERP Letter
American oyster *(Crassostrea virginica)*	In Need of Conservation	N/A	MDNR ERP Letter
Delmarva fox squirrel (*Sciurus niger cinereus*)	In Need of Conservation	N/A	MDNR WHS Letter

Source: MDNR Environmental Review Program, 2024

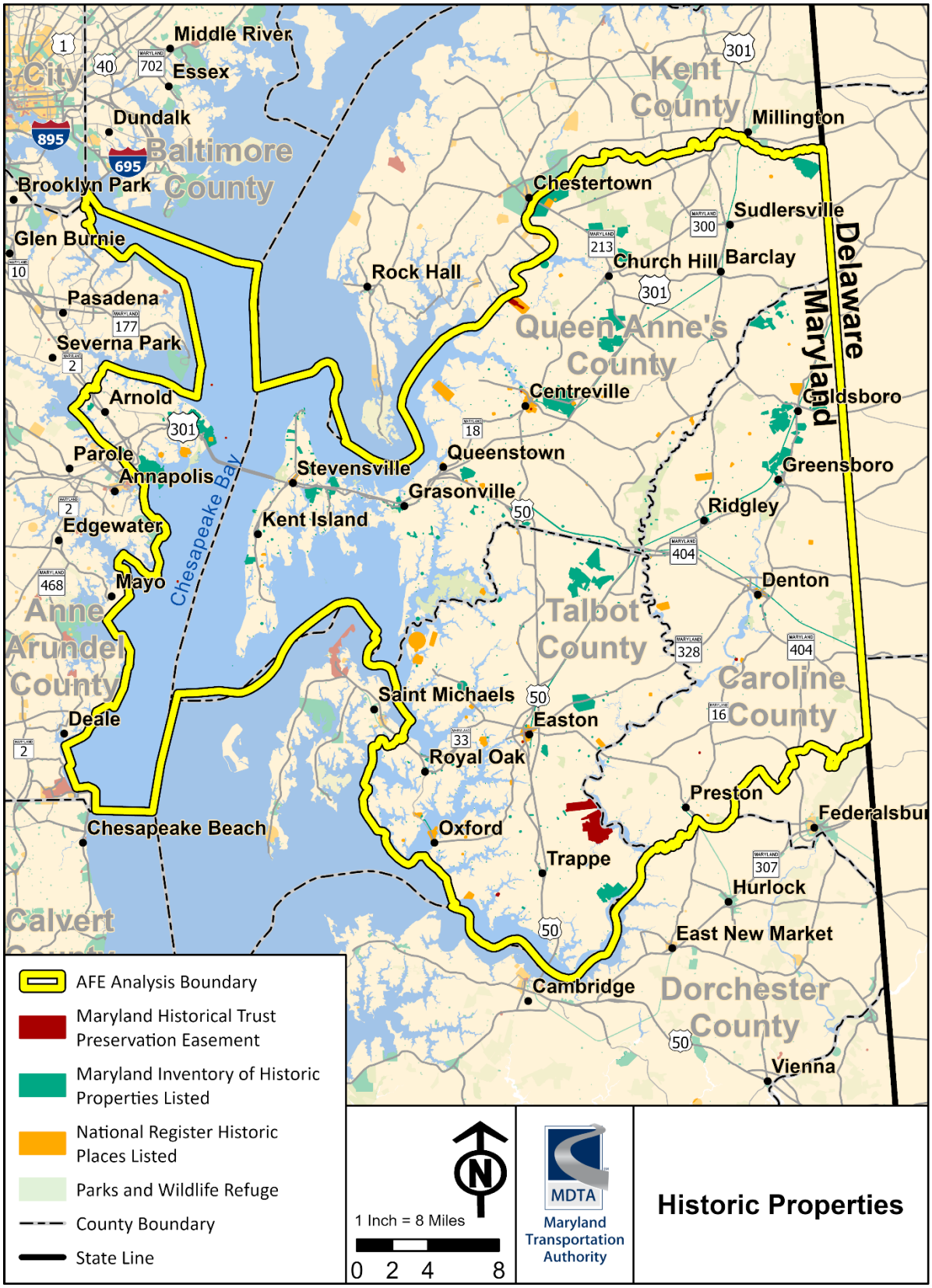
6.3 Historic Properties

The NHPA defines a historic property as any "*prehistoric or historic district, site, building, structure, or object included in, or eligible for inclusion in, the National Register of Historic Places (NRHP), including artifacts, records, and material remains related to such a property or resource*." FHWA and the MDTA are taking a phased approach to the identification and evaluation of historic properties for the Bay Crossing Study. For this analysis, historic properties are historic architectural and archaeological resources listed on the NRHP and the Maryland Inventory of Historic Properties (MIHP).

FHWA and the MDTA have initiated the Section 106 consultation process and will implement the phased identification of historic properties. This identification process will not be conducted for the entire Analysis Area, so this report relied on a combination of peer identified historic properties and available GIS data sources. The MDTA's historic properties team has identified 33 properties, as shown in **Figure 6-17**, listed on the NRHP database or properties with NRHP eligibility within their corridor study area.

Within the Analysis Area there are 93 historic properties listed in the NRHP, 1,811 properties listed in the MIHP, and 42 properties in MHT preservation easements (MDP, 2024c). The MHT preservation easements account for approximately 1,381 acres within the Analysis Area. The largest MHT preservation easement is Lloyd's Landing in southeast Talbot County (**Figure 6-17**). **Appendix C** contains a list of the NRHP and MIHP properties and MHT preservation easements in the Analysis Area. More information on historic properties and Tier 2 recommendations are included in the *Cultural Resources Technical Report* and the *Section 4(f) Report*.

Figure 6-17: Historic Properties



7 DIRECT IMPACTS OF EACH ALTERNATIVE

The objective of this step is to identify direct impacts which may have downstream effects that conflict with the laws, goals, and statutes discussed in **Section 4** and/or impact the resources identified in **Section 6**. Some examples of these impact-causing activities include alteration of drainage, channelization, noise, and vibration, cut and fill, barriers, excavation, erosion and sediment control, landscaping, and alteration of travel time/cost.

The estimated direct effects of actions associated with the ARDS are summarized in **Table 7-1**. The table includes a range of potential direct effects for community, historic and natural resource types where impacts could occur. Estimating the direct effects of actions associated with the ARDS enables the identification of resources that may be affected other than directly (i.e. downstream). Potential property impacts of the ARDS are shown in **Table 7-2**. The findings of the identification and evaluation processes utilized are presented in **Section 8**.

Table 7-1: Potential Direct Effects of the ARDS

Resource Type[1]	Resource	Unit	No-Build Alternative	Alternatives B and C[2]	Alternatives D Through G[2]
Community Resources	Residential Property Displacements	#	0	0	1
	Commercial Property Displacements	#	0	2	7
	Partial Acquisitions	#	0	46	304-207
	Total Property Impact	#	0	48	211 – 215
		Acres	0	20.5 – 20.8	82.0 – 86.4
	Community Facilities	#	0	8	26
		Acres	0	9.2 – 9.5	16.4 – 18.4
	Parks	#	0	4	9
		Acres	0	2.4 – 2.8	3.5 – 4.7
Historic Resources	Number of Historic Properties[3]	#	0	2 – 3	4 – 5
	Historic Property Area[3]	Acres	0	0.9 – 1.4	1.1 – 1.9
Natural Resources	SSPRA	#	0	7	8
		Acres	0	109.4 – 110.0	118.8 – 122.5
	FIDS Habitat	Acres	0	12.1	33.3 – 34.5
	Forest Areas	Acres	0	27.4	87.2 – 88.6
	Agricultural Lands (2010 LULC)	Acres	0	0	1.5
	Critical Areas	Acres	0	164.1 – 166.5	395.4 – 402.0
	Wetlands (Field Delineated)	Acres	0	5.6 – 5.9	11.2 – 12.1
	100-Year Floodplain Area	Acres	0	33.5 – 35.6	57.0 – 60.7
	Surface Waters – Nontidal	Acres	0	0.1	0.9
		Linear ft.	0	670 - 700	3490 - 3600
	Surface Waters – Tidal[4]	Acres	0	1.0 – 1.1	4.7 – 5.4
		Linear ft.	0	290	860 - 900

Resource Type[1]	Resource	Unit	No-Build Alternative	Alternatives B and C[2]	Alternatives D Through G[2]
	Submerged Aquatic Vegetation (2019-2023)	Acres	0	0 – 0.4	0.4 – 0.9
	Public Shellfishery Areas	Acres	0	5.6 – 6.1	8.8 – 9.8
	Oyster Sanctuaries	Acres	0	0.6	1.1 – 1.6
	Natural Oyster Bars	Acres	0	9.4 – 10.2	12.6 – 14.6
	MDNR Owned and Conservation Easements	Acres	0	1.7 – 2.1	1.7 – 2.3
	GI	Acres	0	0.4	21.2
	Local Protected Land	Acres	0	0.7	1.4 – 1.9
	MET Easements	Acres	0	0 – 2.1	4.7

1. This table includes key impacts, further impact details can be found in respective Technical Reports.
2. Build alternatives represented as a range derived from the different possible alignment alternatives.
3. Historic properties include two bridges, the Bay Bridge and the MD 18 Kent Narrows Bridge. These historic bridges are not included in impact area calculations. Count/acres includes only those properties determined to be adversely impacted.
4. Does not include Chesapeake Bay.

Table 7-2: Potential Property Impacts of the Build Alternatives

Property Impact Type	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Partial Acquisitions (# of properties)	46	46	204	204	207	207
Residential Displacements[1] (# of properties)	0	0	0	0	1	1
Business/Other Displacements[2] (# of properties)	2	2	7	7	7	7
Total Property Impact (# of properties)	48	48	211	211	215	215
Total Property Impact[3] (acres)	**20.5**	**20.8**	**82.0**	**82.3**	**86.2**	**86.4**

1. Residential property owners would receive relocation assistance in accordance with federal and state requirements, where eligible.
2. *Other Properties impacted is equal to the sum of impacted properties with non-residential zoning designations, including Commercial/Employment, Industrial, Mixed-Use, Park/Open Space, Planned Unit/Planned Community, and Transportation. These properties may include community facilities.*
3. Note*: Total right-of-way acreage requirements may differ from total land use conversion acreage due to differences in GIS base layer boundaries. Right-of-way acreage requirements are calculated by applying the LOD over precise property line boundaries, while land use conversion acreage is calculated by applying the LOD over generalized land use/zoning boundaries.*

The build alternatives would result in the conversion of existing land use to right-of-way for transportation use, including the alteration of transportation right-of-way from non-highway facilities (e.g., county right-of-way) outside of the SHA right-of-way. The impacts to land use differ under each of the build alternatives, with Alternatives B and C having the least impact (approximately 27 acres) and Alternative G having the greatest impact (approximately 88 acres). Alternatives D, E, F, and G (ranging from approximately 84 to 88 acres) would result in land use impacts more than three times larger than Alternatives B and C (approximately 27 acres each). Land use impacts for the ARDS are summarized in **Table 7-3**.

Table 7-3: Land Use Converted to Transportation Right-of-Way (Acres)

Land Use	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E	Alternative F	Alternative G
Transportation *	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Very Low-Density Residential	0.0 acre	0.0 acre	0.0 acre	<0.1 acre	<0.1 acre	<0.1 acre	<0.1 acre
Low-Density Residential	0.0 acre	0.7 acre	0.7 acre	4.3 acres	4.3 acres	4.5 acres	4.5 acres
Medium-Density Residential	0.0 acre	<0.1 acre	<0.1 acre	0.5 acre	0.5 acre	0.5 acre	0.5 acre
High-Density Residential	0.0 acre	0.0 acre	0.0 acre	1.0 acre	1.0 acre	1.0 acre	1.0 acre
Commercial	0.0 acre	4.0 acres	4.3 acres	16.7 acres	17.1 acres	18.0 acres	18.4 acres
Industrial	0.0 acre	0.0 acre	0.0 acre	0.9 acre	0.9 acre	0.9 acre	0.9 acre
Institutional	0.0 acre	0.8 acre	0.8 acre	1.5 acres	1.5 acres	1.6 acres	1.6 acres
Extractive	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre	0.0 acre
Open Urban Land	0.0 acre	1.2 acres	1.2 acres	5.3 acres	5.3 acres	5.3 acres	5.3 acres
Water*	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other Land	0.0 acre	18.9 acres	18.9 acres	54.1 acres	54.2 acres	56.1 acres	55.9 acres
Total Change in Land Use	0.0 acre	**26.5 acres**	**26.9 acres**	**84.3 acres**	**84.8 acres**	**87.9 acres**	**88.1 acres**

Note: Numerical values presented are rounded to the nearest 0.1 acre.
** Impacts to Transportation and Water Land Use types are not applicable for this analysis. Land designated for Transportation use will remain Transportation under each of the build alternatives. Impacts to water resources are documented in the Natural Environment Technical Report.*

Except for the potential displacements listed in **Table 7-2**, the build alternatives would primarily convert strips of land from undeveloped areas or areas of landscaping and trees, and paved areas associated with commercial and other transportation developments along U.S. 50/301 to Transportation use. As demonstrated in **Table 7-3**Error! Reference source not found., for most l and use types, land use conversions are one acre or less. For all build alternatives, Other Land (between approximately 19 and 56 acres, depending on the alternative) and Commercial (between approximately 4 and 18 acres) uses would be the most common land use types converted to Transportation use. Impacts converting Residential land use types (Very Low-Density, Low-Density, Medium-Density, and High-Density Residential) to Transportation use is anticipated to be less than 5 acres.

8 DOWNSTREAM AND INDUCED GROWTH EFFECTS ANALYSIS

The objective of the analysis completed was to assess the downstream or induced growth effects to community, natural, and historic resources based on the direct effects identified above in **Table 7-1**. For the analysis, the ARDS were grouped into three categories based on their similarities in traffic volumes forecast and traffic operations within those categories. The three categories were: Alternative A (No-Build), Alternatives B and C, and Alternatives D, E, F, and G. The discussion and analysis below provide a summary of potential downstream (**Section 8.1**) and induced growth effects (**Section 8.2**) to socioeconomic resources (land use, community cohesion, businesses, travel reliability, property ownership, and recreational resources), natural resources (water resources, wildlife and habitat, and RTE species), and historic properties. The analysis identifies the downstream effect type, the impact-causing activities (direct effects), a description of the potential changes, and potential minimization and mitigation measures.

For induced growth effects, this AFE report analyzes those effects associated with Alternative A (No-Build), Alternatives B and C, and Alternatives D, E, F, and G to socioeconomics, natural resources, and historic resources using the methodology described in **Section 5.1.2**.

The following analysis relied on prior guidance to assess the severity of an impact based on context and intensity. Context may be geographic at multiple scales such as society as a whole, or an affected region, affected interests, or specific localities. Intensity is the severity of impact regarding multiple factors, including:

- Impacts both beneficial and adverse;
- Degree of public health and safety impacted;
- Unique characteristics of the geographic area;
- Degree of controversy surrounding that action and the effect;
- Potential to set precedent for future actions;
- Aggregate effects which may be significant, even though the action itself would not create significant impacts; and
- Whether there is a violation of federal, state, or local law or requirements meant to protect the environment.

Impacts with respect to each of the intensity criteria can be described in various levels of severity (**Table 8-1**). The significance or importance of impacts was determined by evaluating the proposed action against existing environmental standards, thresholds, guidelines, or objectives established by federal, state, and local agencies.

Table 8-1: General Effects Determination Matrix

Severity	Extent	Duration	Likelihood
Major	Large	Long	Probable
Moderate	Medium	Medium	Possible
Minor	Small	Short	Unlikely

For the purposes of this analysis, a large extent would be statewide, a medium would be regional, and a small extent would be local. For most resources, a long duration corresponds to over five years, a medium duration would be one to five (years, and a short duration would be less than one year. Likelihood helps distinguish direct effects from downstream effects. Direct effects are

often inevitable while downstream effects have varying degrees of likelihood with probable effects likely to happen, possible effects can happen and are not ruled out, while unlikely effects are not reasonably expected to occur. These potential effects were taken into consideration in the following discussions of aggregate effects of the ARDS to land use, socioeconomic and natural resources, and historic properties.

8.1 Downstream Effects

8.1.1 Socioeconomic Resources

8.1.1.1 Alternative A (No-Build)

Alternative A (No-Build) would result in increasingly poor traffic conditions at the existing Bay Bridge and approach roadways by 2045. Traffic analysis conducted for the Bay Crossing Study determined that under the Alternative A (No-Build), daily trips in both directions across the Bay Bridge are expected to increase between 2022 and 2045 by 26,200 vehicles per day (approximately 25 percent) on a typical SWED, and by 21,600 vehicles per day (approximately 31 percent) on a typical NSWD (**Table 5-1**). Currently, the Bay Bridge experiences three hours with Level of Service (LOS) E or F on NSWDs (all in the eastbound direction) and 19 hours on summer weekends (with 10 hours in the eastbound direction and 9 hours in the westbound direction). This is expected to worsen by 2045 to 7 hours on NSWDs (with 5 hours in the eastbound direction and 2 hours in the westbound direction) and 22 hours on summer weekends (with 12 hours in the eastbound direction and 10 hours in the westbound direction). Under the Alternative A (No-Build), continued travel unreliability, as described above, coupled with increases in population and vehicle traffic along U.S. 50/301 would have a negative impact on businesses, community facilities, residents, commuters, and through-traffic. Given the importance of the Bay Bridge in connecting the communities on the Eastern and Western Shores, including the Baltimore region overall, increasing congestion and travel unreliability impedes the delivery of and access to goods and services and results in lost economic productivity due to workers being delayed in traffic and increased fuel consumption from increased idling.

8.1.1.2 Alternatives B and C

Construction of either Alternatives B or C improvements would result in congestion relief, greater travel reliability, and mobility for the people who reside in communities within the Analysis Area, employers on both sides of the Chesapeake Bay, and those users that travel through the Analysis Area for weekend trips and would reduce maintenance and alleviate cost burdens for the routine and unexpected maintenance of the Bay Bridge. Further, greater connectivity over the Chesapeake Bay would provide new access to community facilities such as hospitals which are more prevalent on the Western Shore.

Both Alternatives B and C improvements would be primarily within existing right-of-way and over open water. The temporary and permanent right-of-way requirement of approximately 21 acres for both alternatives would be limited to narrow strips adjacent to U.S. 50/301 and new bridge approaches in the Analysis Area. These potential right-of-way acquisitions would not change overall land use in the Analysis Area; therefore, direct impacts to land use would be limited and minor, minimizing the potential for downstream effects apart from potential induced growth which is discussed in **Section 8.2.2.1**.

Generally, reduced congestion makes facilities more attractive for travelers. Local roadways that parallel the improved U.S. 50/301 may see traffic volume reductions, as drivers divert from existing surface streets to the improved corridor where they would find better travel conditions. This would result in a moderate downstream benefit to those communities along U.S. 50/301 with both the Alternatives B and C improvements.

No residential displacements would occur under Alternatives B or C. Therefore, Alternative B or C would not result in further splitting or isolation of the impacted community. Additionally, both Alternatives B and C would maintain the same number of lanes on U.S. 50/301, following the approach tie-ins, therefore they would generally not increase the separation distance between neighborhoods and services on either side of the Bay Bridge in the Analysis Area.

As the relationship between the Bay Bridge and surrounding neighborhoods has been established for decades, and local road connections would be maintained to preserve connectivity and access, independent of induced growth, the downstream impact to community cohesion would be minor due to the lack of additional fragmentation or isolation as a direct effect of Alternatives B and C improvements. In addition, U.S. 50/301 currently divides the communities in the area, thus the impact to cohesion would be minor due to the improvements when compared to the introduction of a new transportation facility on a new alignment. In fact, both Alternatives B and C improvements would benefit the connection between neighborhoods and services in the Analysis Area by reducing congestion and improving travel reliability and mobility along U.S. 50/301 and the adjacent local roadways.

Community cohesion impacts are generally minimized when there is sufficient replacement housing available and relocated residents and businesses can relocate and remain within or near their existing communities. Minimization of right-of-way impacts would occur during final design, as required. Potential minimization efforts include the use of retaining walls to minimize the LOD of the improvements, shifting away from the affected resources, and other modifications to the design. The MDTA has already minimized potential residential property impacts under both Alternatives B and C by limiting widening to the new bridge and bridge approaches. In addition, widening along the approach improvements would occur within the existing U.S. 50/301 median to the greatest extent practicable. Property acquisition activities would be performed in accordance with the Uniform Relocation Assistance and Real Properties Acquisition Act of 1970 (Uniform Act), as amended. Fair market value would be provided to all affected property owners as compensation for land acquisition.

Short-term construction effects (downstream effects) to businesses from temporary detours may occur that could cause some customer losses and make deliveries more difficult, but these effects would be temporary and minimized by proactive measures like early communication, clear detour signage, and collaboration with residents and businesses on adjusted schedules and alternative access choices. Moderate increases in job opportunities may be expected due to short-term construction hiring and long-term operation and maintenance of either Alternatives B or C improvements. Additionally, construction activities around the existing Bay Bridge may temporarily restrict or deter recreational and commercial boating and fishing activities, which may cause a short-term increase in demand for available boat ramps and fishing grounds elsewhere.

Temporary socioeconomic impacts (downstream effects) associated with road closures and detours during construction would be mitigated through the implementation of proactive

communication strategies. Affected communities and businesses would be informed well in advance of disruptions, and collaborative efforts would be undertaken to facilitate schedule adjustments and the identification of alternative access routes. These measures aim to minimize economic inconveniences and ensure a smooth transition throughout the construction period.

Longer-term (downstream) effects on businesses not just within the Analysis Area, but at a regional scale, may include potential benefits from reduced congestion and improved travel reliability and mobility for commuters, customers, and deliveries, possibly facilitating economic growth. Travel time savings would be provided to major employers in the region, expanding employment opportunities. Further, both Alternatives B and C improvements include increased navigational clearance within Chesapeake Bay which would allow larger vessels to reach the Port of Baltimore, which may also result in moderate benefits to productivity, long-term employment, and local, regional, and national economies.

Implementation of either Alternatives B or C would result in downstream reductions in travel time and improved reliability for all travelers crossing Chesapeake Bay via the improved bridged crossing compared to No-Build conditions (*Socioeconomics and Land Use Technical Report*). These benefits would be available to drivers of private vehicles, carpools, transit users, and commercial vehicles, and pedestrians and cyclists utilizing a potential SUP.

The potential pedestrian and bicycle SUP included with Alternatives B and C would fill in gaps in the existing and future bicycle network within the Analysis Area. This would have a moderate downstream benefit to local travelers and businesses by improving network connectivity beyond that of the existing local roadway network and would benefit regional recreation and related tourism.

8.1.1.3 Alternatives D, E, F, and G

Alternatives D, E, F, and G (Alternatives D through G) would each have similar types of downstream effects to socioeconomic resources, as described for Alternatives B and C, but their effects would be generally greater in benefit or detriment (depending on the resource under consideration) with the increase in lane count across Chesapeake Bay (eight to 10 lanes) and along U.S. 50/301 (six to eight lanes). The potential bridge and approach roadway improvements under Alternatives D through G, respectively, would be wider and modifications to U.S. 50/301, as described in **Section 3**, would occur farther from the new Bay Bridge than with either Alternatives B or C improvements, thus increasing the area where downstream effects are possible. While U.S. 50/301 would be widened from six to either eight or 10 lanes under Alternatives D through G, the roadway would generally follow the existing alignment except where necessary to connect to the new bridge spans. The additional width needed throughout the area of improvements would require a total of between approximately 82 and 86 acres of temporary and permanent right-of-way, 61 to 65 acres more than with either Alternatives B or C (**Table 7-1**). While the overall land use in the area adjacent to the improvements would not change, based on the increased right-of-way requirements under Alternatives D through G, respectively, additional lands would be converted to transportation use with each increase in lane count along U.S. 50/301 having a greater downstream effect to overall land use in the Analysis Area.

Construction of Alternatives D through G improvements would result in an overall improvement in congestion and reliability for travelers across the Chesapeake Bay and along U.S. 50/301 within the Analysis Area (*Alternatives Report*). Alteration of travel patterns and accessibility may, over

time, result in downstream changes to community composition, cohesion, and stability. Communities consist of residential areas that can become more or less attractive, depending on perceived benefits or detriments of living in proximity to a highway with added capacity. The additional travel lanes on the widened bridge and along U.S. 50/301 in the Analysis Area would require a slightly different alignment and more modifications to U.S. 50/301 than with either Alternatives B or C, resulting in Alternatives D through G improvements having a downstream effect of being potentially closer to sensitive noise receptors. The additional receptors may incur greater noise impacts with the increase in lane count along the roadway (six to eight lanes). The direct effects of construction and operational noise are addressed in the *Noise Analysis Technical Report*.

Similar to Alternatives B and C, the Alternatives D through G improvements would have beneficial downstream effects to the local communities due to reduced travel times, which would improve with the respective increase in lane count across Chesapeake Bay (eight to 10 lanes) and along U.S. 50/301 (six to eight lanes). The additional travel lanes would make the roadways more attractive for use by travelers, thereby likely having a downstream effect of reducing bridge-bound volume on the local roadways that parallel U.S. 50/301 in the Analysis Area having a safety and health benefit in the commercial and residential areas north and south of U.S. 50/301 where pedestrian and vehicle conflicts are more likely.

Like Alternatives B and C, no residential displacements would occur under Alternatives D and E. Therefore, Alternatives D and E would not result in further splitting or isolation of the impacted community. Alternatives F and G would each require a total of one residential displacement, located in Broadneck. The potentially displaced residents are located on the edge of neighborhoods and adjacent to U.S. 50/301, and no downstream effects such as splitting of neighborhoods or isolating communities would occur under with Alternatives F and G improvements. In addition, U.S. 50/301 currently divides the communities in the area, thus the impact to cohesion would be minor due to the improvements when compared to the introduction of a new transportation facility on a new alignment.

The additional travel lanes along U.S. 50/301 with Alternatives D through G would increase the physical separation distance between neighborhoods and services on either side of U.S. 50/301 within the Analysis Area, and the separation would increase respective to the increase in total lane count (six to eight lanes along the roadway). While the relationship between U.S. 50/301 and surrounding neighborhoods has been established for decades, and local road connections would be maintained to preserve connectivity and access, the effects to community cohesion would be moderate due to the increased separation distance between neighbors caused by the direct effects of the improvements, although no additional fragmentation or isolation would occur.

Minimization and mitigation measures to effects on socioeconomic resources with Alternatives D through G improvements, would be like those described for Alternatives B and C, such as widening to the inside median to the greatest extent practicable and complying with the Uniform Act for all property acquisitions.

Similar to Alternatives B and C, Alternatives D through G improvements would have short-term construction effects to businesses from temporary detours which may cause some customer losses and make deliveries more difficult. These effects would be greater with Alternatives D through G than with Alternatives B or C given the additional length of widening along U.S. 50/301.

However, similar to Alternatives B and C, these effects would be temporary and similarly minimized. The likely increases in job opportunities from construction hiring would be expected to extend for a longer duration with Alternatives D through G, with the longest duration anticipated for the widest alternatives (Alternative F and Alternative G). Alternatives D through G would also involve construction activities around the existing Bay Bridge that may temporarily restrict or deter recreational and commercial boating and fishing activities, which may cause a short-term increase in demand for available boat ramps and fishing grounds elsewhere.

Temporary socioeconomic effects associated with road closures and detours during construction of Alternatives D through G would be like those described for Alternatives B and C and similarly minimized, as required. However, as construction would extend for a longer period with the additional travel lanes and wider bridge, the effects of road closures and detours would be experienced for longer periods, when compared to Alternative B and Alternative C, as well with the respective increase in lane count (six to eight lanes along U.S. 50/301).

Longer-term downstream effects to businesses not just within the Analysis Area but at a regional scale may include potential benefits from reduced congestion and improved travel reliability for customers and deliveries, possibly increasing patronage facilitating economic growth. These effects are anticipated to be greater than realized with either Alternatives B or C improvements and are expected to improve with the respective increase in lane count for Alternatives D through G (i.e. eight to 10 lanes across Chesapeake Bay and six to eight lanes along U.S. 50/301). Similar to Alternatives B and C improvements, Alternatives D through G would each include increased navigational clearance within Chesapeake Bay allowing larger vessels to reach the Port of Baltimore, benefiting down and upstream productivity, long-term employment, and local, regional, and national economies.

Like with Alternatives B and C, noise walls may be constructed with Alternatives D through G improvements, where warranted, and where at least half the affected properties approve of their construction, as required.

Finally, similar to Alternatives B and C improvements, the potential pedestrian and bicycle SUP included with Alternatives D through G improvements would fill in gaps in the existing and future bicycle network. This would have moderate downstream benefits to local travelers and businesses by improving network connectivity opportunities beyond that of the local roadway network and would benefit regional recreation and related tourism.

8.1.2 Natural Resources

8.1.2.1 Alternative A (No-Build)

Alternative A (No-Build) would not result in Bay Crossing Study-related construction or changes to the natural environment. Therefore, no study-related downstream effects on natural resources in the Analysis Area would occur.

8.1.2.2 Alternatives B and C

Water Resources

Improvements associated with the build alternatives would cause direct habitat and water resource losses (see **Table 7-1**) and would result in downstream changes to natural systems in the Analysis Area. These changes may result in short- and long-term moderate adverse

degradation of water resources, such as increased downstream sedimentation from in-water and land disturbing activities and from increased impervious surface area. As dredging is required for construction, dredging and disposal activities would affect water quality by increasing suspended solids in the water, affecting benthic and pelagic species, including shellfish, anadromous fish, and the EFH, SAV habitat, fish spawning and nursery habitat, Section 7 Consultation Areas, and oyster resources in the corridor as detailed below (See **Figure 6-15** and **Figure 6-16**).

Some effects from impervious surface creation may be offset by drainage structures that would be developed in later phases of design and would be in conformance with current stormwater regulations to minimize downstream effects on water quality. Further as discussed below, strict adherence to required erosion and sediment controls would minimize the potential for increased downstream sedimentation and its effects on species and habitats.

Direct effects of Alternatives B and C to wetlands would result from excavation and filling activities and forested or scrub/shrub wetland clearing. Direct impacts from cut/fill would result in loss of all wetland functions within the immediate footprint of the impact and contribute to downstream habitat fragmentation effects described below.

Direct effects to streams under either Alternative B or C may result from hardening, piping, bridging, straitening, filling, relocating stream channels, or lengthening of culverts which may alter upstream and downstream hydrologic flow. These direct impacts to streams and floodplains may result in downstream changes in hydrologic flow dynamics through adjacent natural communities, which sometimes alters these dynamics at the ecosystem level. Maintaining the hydrodynamic flow through these systems is important because reduced flow reduces the ability to move sediment and material downstream, clogging streams, and reducing habitat functionality. Altered flow has downstream impacts on aquatic life movement, breeding and nursery, and feeding/prey success downstream of the direct effects area. This potential for downstream effects is minimized by proper design of culverts, pipes, and bridges. Under both Alternatives B and C, bridges and culverts would be designed in accordance with applicable state guidance and requirements. Adherence to required specifications would ensure adequate hydraulic openings are in place so that hydrologic flow patterns are not disrupted, and hydraulic connectivity is maintained for wetlands and waters located upstream and downstream from both Alternatives B and C improvements.

The direct impacts of either Alternatives B or C improvements to streams and wetlands may result in downstream effects to offsite streams and wetlands due to hydrologic alteration or isolation. Portions of wetlands or streams which extend outside of the LODs may be subject to downstream effects if their hydrology is altered due to direct impacts occurring within the LOD. These downstream effects can alter wetland and stream functions such as habitat, plant community, carbon cycling, and groundwater recharge/infiltration. Cut/fill areas in wetlands and streams would be reduced to the minimal design slope necessary to prevent any additional habitat fragmentation to wetlands and streams, as required. Other impact avoidance and minimization measures would be formalized in final design and any necessary additional wetland or waterbody mitigation determined during permitting.

Filling floodplains to construct either Alternatives B or C improvements may result in loss of floodplain functions within the impacted floodplains in the corridor. Floodplain impacts may alter the hydrology of the floodplain that may result in more severe flooding in terms of flood height, duration, and erosion. New crossings resulting from the build alternatives would be designed to

adequately pass design floods and accommodate the passage of aquatic organisms, as required. The design would aim to minimize the downstream effects to water quality from drainage of the new crossings. Design modifications to eliminate or minimize floodplain encroachments to the extent practicable are required by EO 11988: Floodplain Management.

Constructing additional bridged lanes over the Chesapeake Bay may shade tidal wetlands, SAV, shellfish habitat, and EFH, altering the water and sediment temperature and reducing photosynthesis that may have downstream impacts on plant communities and wildlife habitat in these areas, potentially impacting sensitive species and habitat. Restoration of vegetated buffers, replanting of woody vegetation and tree cover, and other mitigation measures, such as compensatory mitigation, may be implemented post-construction to offset any potential impacts to riparian areas, as required.

In accordance with Maryland Stormwater Management Programs, various control measures may be incorporated into the roadway and bridge design and maintenance plans to reduce impacts for wetland hydrology, water quantity, and water quality due to directly increased impervious surface area and drainage alterations, as required. Control measures may include implementing required stormwater BMPs and adhering to strict erosion and sediment control measures to minimize potential degradation of water quality due to increased impervious surface and drainage alteration. These measures would reduce or detain discharge volumes and remove many pollutants before discharging them into receiving impaired waters, such as the Chesapeake Bay and its tidal bays and rivers.

Construction activities may potentially lead to erosion, sedimentation, and accidental spills of hazardous materials from equipment. These activities could lead to decreased water quality, altered flow patterns, and habitat destruction. However, adhering to established spill prevention and erosion and sediment control protocols, as required, would mitigate these risks and minimize potential downstream impacts from either Alternatives B or C improvements on water resources.

Wildlife and Habitat

The most prevalent natural land cover types within the landward portions of the Alternatives B and C LODs are tree canopy and low vegetation. The areas classified as low vegetation almost entirely represent managed turf areas (lawns and roadway clear areas) in the corridor. In the areas which remain undeveloped, intact habitat occurs in the form of wetlands, streams, open water, benthic habitat, SAV habitat, riparian areas, and forested areas. Direct habitat losses from the improvements in these natural areas would impact the SSPRAs, FIDS habitat, TEA, and aquatic habitat present within the corridor. From these direct effects, there may be downstream effects under either Alternatives B or C that could change the natural processes in the Analysis Area and affect protected species and/or their habitats. In addition, impacts on aquatic habitat could affect commercial and recreational fishing or crabbing locations (see **Figure 6-13**). As described in **Section 8.1.1.2**, temporary restrictions on recreational and commercial fishing around the existing Bay Bridge during construction could lead to increased concentration of fishing and crabbing activities in the available fishing areas.

However, as the direct terrestrial impacts of either Alternatives B or C improvements to natural areas would primarily occur in wooded areas of wildlife habitat that are currently highly fragmented by the U.S. 50/301 corridor (see the Maryland HCN data in **Figure 6-13**), the potential effects of terrestrial habitat fragmentation to sensitive wildlife would be minor, excluding potential induced growth as discussed in **Section 8.2.2**. Excluding potential induced growth effects, impacts to

FIDS habitat would be limited to the edges of this habitat type along the U.S. 50/301 corridor, shifting the limits of edge habitat towards more interior habitat; no direct impact to interior habitat would occur. This shift of edge habitat is not expected to alter the wildlife assemblages in these areas but may shrink the available interior habitat, potentially reducing disturbance-sensitive species like FIDS. Outside of the land approach areas where new roadways would connect to U.S. 50/301, no new fragmentation of existing forests would occur under either Alternatives B or C as the remaining vegetation clearing would occur along U.S. 50/301 and would expand into previously fragmented sections. The effects of either Alternatives B or C improvements to terrestrial habitat continuity would be minor, excluding potential induced growth effects, as forest impacts would occur within these fragmented areas of linear habitat in the transportation rights-of-way and separated by existing roadways, or in edge habitat along the existing mainline roadway.

Similarly, landward of the Chesapeake Bay, aquatic habitat within each build alternative's LOD has been previously fragmented by existing bridges and culverts along the U.S. 50/301 corridor. Direct impacts occurring within the LOD may result in downstream hydrological alteration and wetland or stream fragmentation outside the LOD. Direct impacts from cut/fill would result in loss of all wetland and stream functions within the immediate footprint of the impact, and this upland wetland or stream fragmentation would have downstream impacts to aquatic habitat (ex. EFH, SAV, fish, shellfish, and protected species habitat [sturgeon and sea turtles]) from upstream wetland or stream fragmentation.

Potential impacts to terrestrial and aquatic wildlife habitat expected from either Alternatives B or C may be minimized through use of design measures such as countersinking culverts and reducing the roadway cut/fill footprint, as required. Countersinking culverts and constructing bridges minimizes aquatic habitat impacts by allowing the natural hydrologic processes to remain largely intact while also providing wildlife crossings. Restoration of vegetated buffers, replanting of woody vegetation and tree cover, and other mitigation measures may be implemented post-construction to offset any potential impacts to wildlife habitat areas, as required. Planting and re-seeding landscape plans would be prepared in later project development phases, as required. Re-establishing canopy over water and/or incorporating designs that minimize blocking sunlight to aquatic habitats may reduce impacts to water temperature and chemistry, where needed and required, and benefit aquatic species. Restoring and reestablishing terrestrial habitat would reduce effects to habitat functionality and connectivity, especially in identified Maryland HCN gaps in the corridor (**Figure 6-13**). Decisions on the development of potential impact-minimizing design measures such as these, together with details and specifications, would be made during final design, as required.

Alternatives B and C improvements each have the potential to introduce pollutants from vehicle exhaust, brake pads, fuel spills, and hydraulic spills to the right-of-way. Many of these pollutants carried in roadway runoff, including copper and nitrogen, may worsen the existing surface water impairments of the Analysis Area. The introduction of pollutants from roadway runoff can facilitate the degradation of nearby terrestrial and aquatic habitat through deposition of sediments or contamination from chemical pollutants (Smith and Kaster, 1983; Sun et al., 2019). This can result in downstream accelerated changes in the macrobenthic community structure and composition (Forrow, 1995), which in turn can affect the fish and amphibian populations that rely on them as a food source, as well as the birds and aquatic mammals that prey on fish and amphibians. Use of required BMPs, such as erosion and sediment control and pollution

prevention measures which are regularly inspected and maintained, would serve to minimize pollutants to minor levels from roadway runoff entering receiving waters near the area of improvements from either Alternatives B or C, protecting sensitive species and aquatic habitat.

In addition, temporary impacts to terrestrial and aquatic wildlife and habitat would be reduced through proper location and minimization of staging areas and construction access roads in valuable habitats, as required. To prevent the introduction and establishment of invasive species during construction, the contractor would adhere to SHA's *Environmental Guidelines for Construction Activities*, and other applicable regulations, as required. Adherence to these guidelines and regulations would help protect sensitive wildlife species habitat such as in the designated SSPRAs in the corridor.

Threatened, Endangered, and Special Status Species

Impacts to threatened, endangered, and special status species would be from the same impacting activities described for general wildlife species above, except that the life history characteristics of threatened, endangered, and special status species tend to render them less resilient when faced with habitat loss or alteration or competition from invasive species.

As identified in the *Natural Environmental Technical Report*, direct impacts to habitat for protected species are most likely to occur and are of most concern for the NLEB, tricolored bat, monarch butterfly, migratory birds, Atlantic and shortnose sturgeon, sea turtle species (loggerhead, Kemp's Ridley, green, and leatherback turtle), and bottlenose dolphin. Downstream effects to these species may occur through the loss of or degradation to suitable forage, roost, reproductive, and/or nesting habitat, as described for each species below.

The suitable foraging and summer roosting habitat for the NLEB and tricolored bat, and bird nesting habitat, is located along outside edges of the existing rights-of-way and within the existing intersection loops within the respective LODs of either Alternatives B and C. Additionally, there are multiple bridge crossings within the LODs of either Alternatives B and C, including the existing Bay Bridge that may provide daytime and nighttime roosting, including maternity sites for both bat species, and nesting for migratory birds. Forest clearing and bridge construction activities could have moderate, negative impacts on bat and bird species by decreasing their available breeding and nesting habitat and limiting their ability to find food.

Potential monarch butterfly habitat occurs within the respective LODs for either Alternatives B or C, which include the forest areas described for the NLEB and tricolored bat, and meadow areas and open fields within and adjacent to the existing right-of-way that may contain suitable flowering plants for foraging and breeding, such as milkweed (*Asclepias spp.*). The direct clearing or conversion of suitable forested or meadow areas would have downstream impacts on the monarch butterfly by reducing suitable foraging or reproductive habitat. In addition, land clearing activities have the potential downstream effect of introducing or contributing to the spread of invasive species which can outcompete native flowering plants and may also reduce or degrade suitable monarch butterfly habitat.

Areas of potential Atlantic sturgeon and shortnose sturgeon habitat are present throughout the Chesapeake Bay and its tributaries in the Analysis Area in both deep-water areas within the federally maintained navigation channel and shallow water areas containing suitable forage and habitat such as SAV areas. Alternatives B and C improvements would each impact sturgeon

migrating and foraging habitat directly through physical disturbance of sediments (pile driving and dredging) and entrainment of associated benthic resources, which may result in downstream impacts to sturgeon species by reducing the availability of prey. However, recolonization of the opportunistic benthic species should occur quickly, making downstream impacts to sturgeon prey and habitat minor and short-term in duration, outside of the direct effect areas. In addition, underwater noise impacts during construction from marine piling may cause the species to avoid certain areas of foraging habitat, however, these impacts would be temporary and due to the width of the Chesapeake Bay in the Analysis Area, most of the Chesapeake Bay would remain unaffected.

Areas of potential sea turtle habitat are present throughout the Chesapeake Bay, primarily in the shallow areas where suitable foraging species and SAV occur, and on shore where sandy beaches occur. Sea turtles would be directly affected through physical disturbance of benthic habitat (pile driving and dredging) and entrainment of associated forage resources and loss of habitat such as SAV and sandy beaches for nesting, which may result in downstream impacts to sea turtle species by reducing the availability of prey, foraging resources, and nesting sites. However, limited direct impacts to SAV and beaches are expected, making downstream impacts to sea turtle prey, habitat, and reproduction minor and short-term in duration.

Potential habitat for the bottlenose dolphin may occur within the Chesapeake Bay and may be impacted directly by bridge construction through habitat alteration, noise pollution, increased human activity, disruption of natural substrate by dredging and pile driving, and strikes with construction vessels. These direct impacts may result in downstream effects such as reduced prey abundance, habitat degradation, and displacement from or avoidance of breeding habitats.

Downstream effects to aquatic habitat for threatened and endangered species may occur through increased runoff volumes that increase sedimentation and reduced water quality resulting from pollutants in the runoff, placement of permanent and temporary piles, barge spuds, work trestles, and bridge piers, impacting aquatic life movement, breeding, and nursery success, and hindering finding prey. Further, activities that may affect the location or abundance of prey (aquatic macroinvertebrates), such as hardening of channels (culverting), can affect the distribution of sensitive species such as anadromous fish. This potential should be minimized through consultation with regulatory agencies, and the required design of crossings in accordance with Maryland standards.

Avoidance, minimization, and mitigation plans for impacts to protected species and their habitat from Alternatives B or C would be developed, as required, during final design and as part of the consultation/permitting process. Potential downstream impacts to threatened, endangered, and special status species may be minimized through required contractor awareness training and design measures, such as countersinking culverts, constructing stormwater management facilities, reducing construction footprint, avoiding key habitat, implementing stormwater and erosion and sediment control measures, and utilizing BMPs which are regularly inspected and maintained. In addition, temporary impacts may further be reduced through proper location and minimization of staging areas, construction access roads, and modifying construction techniques in valuable habitats.

Additional coordination with MDNR, MDE, USFWS, and/or NOAA would occur, as required, and prior to the permit decisions for either Alternatives B or C, as any mitigation measures, conditions, or restrictions determined necessary by the resource agencies would be included as conditions of any future permits issued. Mitigation measures may include, if required, presence/absence surveys; contractor training in recognizing and avoiding threatened, endangered, and special status species and their habitats; timing restrictions on in-stream construction or tree clearing; and/or restoration of habitats.

Ecosystem Services

The people of Maryland benefit from the natural environment in many ways. Forests clean the air, wetlands clean the water, and the Chesapeake Bay provides food sources like fish and crabs. These benefits that people gain from the environment can be collectively referred to as "*ecosystem services*". Seven different ecosystem services provided by forests and wetlands have been quantified and mapped for Maryland. These services include carbon sequestration, nitrogen removal, stormwater mitigation and flood prevention, wildlife habitat and biodiversity, air pollutant removal, groundwater recharge, and surface water protection.

Accompanying the direct loss of habitat for each build alternative as listed in **Table 7-1**, there would likely be losses in some of the ecosystem services provided by specific resources listed in the table and these would be considered downstream effects as they would be separated in time from the direct impacts. Therefore, the value of these lost services was considered in this report, and the following analysis, which was developed by MDNR. The following discusses the economic value of ecosystem services in the project vicinity and the annual loss of these services per build alternative in US dollars following when the direct impacts occur. The MDTA has incorporated the analysis and results developed by MDNR into this report. Note that this analysis is based on the LOD area for each build alternative rather than the larger Analysis Area. All resource data layers and supporting information utilized in the analysis are available for viewing with the MDNR GreenPrint web viewer, and the layers are available for download from the Maryland iMap. MDNR's report, *Accounting for Maryland's Ecosystem Services* (MDNR, 2018), provides technical details on how MDNR assesses the value of ecosystem services in Maryland.

The monetary values presented in this report represent "*non-market value*", meaning benefits to society that are not directly being paid for, or typically considered, with the transportation improvement's construction costs. These values were determined by looking at a number of different ways that people benefit from ecosystem services, such as costs avoided through the existence of the resource (e.g., water treatment that would be necessary if the forest or wetland were not already doing it), cost of regulation (e.g., cost being paid to ensure the benefit will continue to exist), or the price in an analogous market (e.g., price paid to put land in conservation in order to protect biodiversity) (Campbell, et al., 2019).

The goal of this analysis was to estimate the annual economic value of ecosystem services (expressed as US dollars per year) that would likely be lost due to loss of forest and wetlands during the life of the project. For each build alternative, two data layers were used: 1) a set of polygons that represented the area of forest or wetland directly impacted, and 2) a 30-meter resolution raster layer representing a "Total Ecosystem Service Economic Value (US dollars per year)", which provided the combined annual economic values for all seven ecosystem services listed above associated with the forest and wetland areas currently present in each 30-meter pixel. Due to some overlap of forest and wetland polygon impact areas, the forest and wetland

polygon layers were combined to create a single project impact area layer for each build alternative, and the acres of total impact area for each new set of combined project polygons was calculated. For each build alternative layer, the zonal statistics tool was then used to calculate the sum of the Total Annual Ecosystem Service Economic Value (US dollars per year) per individual polygon area. This data was used to calculate the sum economic value for all pixels overlapping the impact area polygons, the total area in acres of the overlapping pixels, and the per acre annual ecosystem service economic value (US dollars per year).

It is important to note that the pixel area considered by the zonal statistics tool was much larger than the actual impact areas across all six build alternatives, due to instances where the impact polygons only overlapped partially with full 30-meter pixels. To ensure that the total estimated economic value of the impact polygons was not overestimated, the per acre annual ecosystem service economic value (US dollars per year) was multiplied by the impact area polygon acres to determine the final "Total Estimated Economic Value of the Impact Polygons (US dollars per year)."

Table 8-2 shows the input values and the estimated total annual economic value of ecosystem services lost for each build alternative. Alternatives B and C have the smallest impact areas, approximately 31 acres each, with associated estimates of approximately $41,800 in loss of annual ecosystem service value of forests and wetlands.

Table 8-2: Estimated Ecosystem Service Value Loss Per Year in US Dollars

Build Alternative	Build Alternative Impact Area (Acres)	Pixel Area (Acres)	Per Acre Value of Pixel Area ($/year)	Total Estimated Ecosystem Service Value for Build Alternative Impact Area ($/year)
Alternative B	31.6	328.7	$1,323	$41,807
Alternative C	31.3	326.5	$1,337	$41,842
Alternative D	96	988.1	$1,193	$114,535
Alternative E	95.6	985.9	$1,197	$114,467
Alternative F	97.8	1,006.8	$1,191	$116,475
Alternative G	97.3	1,003.0	$1,196	$116,362

Notes: Acreage values are rounded to the nearest 0.1 acre and dollar values are rounded to the nearest dollar.

8.1.2.3 Alternatives D, E, F, and G

Water Resources

The potential effect types from Alternatives D through G improvements to water resources would be like those identified for Alternatives B and C. However, Alternatives D through G would result in increased amounts (acreage or linear footage) of direct impacts to water resources (wetlands, streams, open water, floodplains, riparian areas, hydrodynamics, and water quality) with each increase in total lane count on the new Bay Bridge and along U.S. 50/301 (**Table 7-1**). As the direct impacts would increase with each larger set of build alternatives (Alternatives B and C vs. Alternatives D and E vs. Alternatives F and G), so would the potential for downstream effects to water resources. These downstream effects may affect benthic and pelagic species, including shellfish, anadromous fish, and the EFH, SAV habitat, fish spawning and nursery habitat, Section

7 Consultation Areas, and oyster resources adjacent to the LOD for each build alternative (See **Figure 6-15** and **Figure 6-16**).

The same potential impact avoidance and minimization measures for water resources discussed in **Section 8.1.2.2** for Alternatives B and C, would apply to Alternatives D through G. The use of these measures would be formalized in final design, and any required mitigation would be determined during the permitting stage for the selected alternative.

Wildlife and Habitat

Similar to Alternatives B and C, the most prevalent natural land cover types within the LODs of Alternatives D through G are tree canopy and low vegetation. Similar to Alternatives B and C, areas which remain undeveloped within the LODs of Alternatives D through G provide habitat in the form of wetlands, streams, open water, benthic habitat, SAV habitat, riparian areas, and forested areas. These types of habitats also occur within the Alternatives D through G LODs to the east and west of the terminal extents of Alternatives B and C along U.S. 50/301. The potential direct habitat losses, and potential for wildlife impacts, to SSPRAs, FIDS habitat, TEA, and aquatic habitat present increases respectively with each increase in lane count for the build alternatives across Chesapeake Bay and along U.S. 50/301 (Alternatives B and C vs. Alternatives D and E vs. Alternatives F and G). Therefore, based on direct effects, there would be potential for increased effects which could change the natural processes in the Analysis Area, and affect protected species and/or their habitats, with increase in size of the build alternative's LOD.

Alternatives D through G improvements would require between approximately 87 to 89 acres of tree clearing, 60 to 62 acres more than under either Alternatives B or C. The increase in tree area impacts with Alternatives D through G would occur within and to the outside of the rights-of-way along the mainline of U.S. 50/301 and within the existing intersections at feeder roads. These areas are currently fragmented edge habitat and the shifting of edge habitat further from roadways would not alter the wildlife assemblages in remaining undisturbed areas.

The direct fragmentation effects on wetlands or streams caused by Alternatives D through G may cause downstream hydrology alteration of aquatic habitat that extends further than with either Alternative B or C. These impacts may contribute to increased levels of wetland or stream fragmentation. Therefore, with each increase in total lane count, Alternatives B and C vs. Alternatives D and E vs. Alternatives F and G, there is a greater potential for downstream impacts to aquatic habitat (ex. EFH, SAV, fish habitat, shellfish habitat, and protected species habitat [sturgeon and sea turtles]) from upstream wetland or stream fragmentation.

Similar to Alternatives B and C, Alternatives D through G improvements have the potential to introduce pollutants from vehicle exhaust, brake pads, fuel spills, and hydraulic spills to the right-of-way, which may worsen the existing water quality impairments in the Analysis Area. The potential for adverse effects increases incrementally with increasing lane count, and these effects can accelerate changes in the macrobenthic community structure and composition which can have increasing negative effects on fish, amphibian, bird, and mammal populations with increases in LOD acreage. However, similar to Alternatives B and C, the use of required BMPs, such as erosion and sediment control and pollution prevention measures which are regularly inspected and maintained, would serve to minimize pollutants to minor levels from roadway runoff entering receiving waters near the area of Alternatives D through G improvements, protecting sensitive species and aquatic habitat.

Threatened, Endangered, and Special Status Species

Similar to Alternative B and C improvements, direct impacts to habitat for protected species from Alternatives D through G improvements are most likely to occur and are of most concern for the NLEB, tricolored bat, monarch butterfly, migratory birds, Atlantic and shortnose sturgeon, sea turtle species, and bottlenose dolphin. Alternatives D through G would also directly impact known habitat for the Delmarva fox squirrel, a state species deemed In Need of Conservation, located north of U.S. 50/301, from Winchester Creek to Little Queenstown Creek in Queen Anne's County. The potential downstream effects to these species may result from the direct loss of or degradation to suitable forage, roost, reproductive, and/or nesting habitat, as described for Alternatives B and C (ex. land clearing, dredging, pile driving, vessel strikes, sediment and nutrient laden runoff, and/or beach impacting activities). However, based on each alternative's respective direct effects (**Table 7-1**), there would be potential for increased downstream effects to protected species and/or their habitats, with each increase in size of the build alternative's LOD.

Similar to Alternatives B and C, avoidance, minimization, and mitigation plans for impacts to protected species and their habitat would be developed, as required, during final design and as part of the consultation/permitting process. The same potential avoidance, minimization, and mitigation measures described in **Section 8.1.2.2** are available for the four larger build alternatives.

Additional coordination with MDNR, MDE, USFWS, and/or NOAA would occur, as required, and prior to the permit decisions for either Alternatives D, E, F or G, as any mitigation measures, conditions, or restrictions determined necessary by the resource agencies would be included as conditions of any future permits issued for the selected alternative.

Ecosystem Services

Similar to Alternatives B and C, Alternatives D through G would result in losses to the seven different ecosystem services provided by forests and wetlands, which include carbon sequestration, nitrogen removal, stormwater mitigation and flood prevention, wildlife habitat and biodiversity, air pollutant removal, groundwater recharge, and surface water protection.

As shown in **Table 8-2**, Alternatives D, E, F, and G have higher impact area totals than Alternatives B or C, ranging from approximately 95 to 98 acres each. Alternatives D through G are estimated to result in annual economic losses to forest and wetland ecosystem services of approximately $114,000 to $116,000. While the total impact area of forest and wetlands for Alternatives D, E, F, and G is triple that of Alternatives B and C, the estimated loss in economic value from the loss of ecosystem services for Alternatives D, E, F, and G is approximately 2.75 times higher than that of either Alternative B or C.

8.1.3 Historic Properties

8.1.3.1 Alternative A (No-Build)

Alternative A (No-Build) would have no direct physical impact on archaeological or architectural resources as no construction would occur; therefore, no study-related effects on historic properties in the Analysis Area would occur.

8.1.3.2 Alternatives B and C

Historic architectural properties in the Historic Properties APE are identified in the *Cultural Resources Technical Report Volumes 1-3*. Direct effects considered in the Section 106 consultation include visual, audible, and atmospheric elements that may diminish the integrity of architectural historic properties. These direct effects to historic properties would be limited to the area of roadway improvements and would not expand further in time or distance reducing the possibility of downstream effects (potential induced growth and aggregate effects are discussed in later sections of this report). Three architectural historic properties (Skidmore, Sandy Point State Park, and the existing Bay Bridge) would be adversely affected by Alternative B, and two would be impacted by Alternative C (Skidmore and the existing Bay Bridge). Downstream effects to historic properties would be in the form of increased visitation and tourism, made possible by improvements of the build alternatives.

8.1.3.3 Alternatives D, E, F, and G

Similar to potential Alternative B and C improvements, effects to historic architectural properties from Alternatives D through G have been considered under Section 106 of the NHPA through consultation between the MDTA and MHT. Five architectural historic properties (Skidmore, Sandy Point State Park, Dutch Mill Farm Restaurant, Sharpe-Ridout-Boone Mill, and the existing Bay Bridge), would be adversely affected by Alternatives D and F, and four properties would be impacted by Alternatives E and G (Skidmore, Dutch Mill Farm Restaurant, Sharpe-Ridout-Boone Mill, and the existing Bay Bridge). Similar to Alternatives B and C, downstream effects to historic properties from Alternatives D through G would be due to increased visitation and tourism.

8.2 Induced Growth Effects

As described in **Section 5.1.2** of this technical report, an analysis was performed to examine potential induced growth effects caused by improved access to areas farther removed in distance from the build alternatives. These improvements may result in induced growth effects on natural lands and vacant properties as well as conversion of existing developed areas to more intensive land uses. The induced growth analysis evaluated the likelihood of additional future land development that may occur as a result of the ARDS[1].

An IGSA was established for the No-Build, Alternatives B and C, and Alternatives D through G, as described in **Section 5.1.2.** The IGSAs for the ARDS are shown on **Figure 5-2**. The analysis identified those lands vulnerable to development within the IGSAs and evaluated the potential socioeconomic, natural resource, and historic property effects which may result from induced growth.

Table 8-3 presents the existing acreages of developed, agricultural, and natural LULC within the IGSAs, as described in **Section 5.3.2**. The completed analysis shows substantial acreage (more than 240,000 acres) within the Alternative A (No-Build) IGSA, approximately 126,500 additional acres within the Alternatives B and C IGSA, and an additional, approximately 61,000 acres within the Alternatives D through G IGSA. **Figure 5-2** shows that Stevensville, most of Kent Island, Grasonsville, Queenstown, Centreville, Church Hill, and Ridgely are within a 60-minute drive time of Alternative A. Denton, Easton, Barclay, Sudlersville, Barclay, and Greensboro are within the

[1] This paragraph was updated for clarity in May 2026.

60-minute travel time of Alternatives B and C, and Goldsboro is within the 60-minute travel time of Alternatives D through G.

Table 8-3: Land Cover Impacts Resulting from Potential Induced Growth

ARDS	IGSA (Acres)	Developed Lands (Acres)	Agricultural Lands[1] (Acres)	Natural Lands[2] (Acres)
Alternative A No-Build	240,938	27,934	119,087	66,349
Alternatives B and C	367,432 (+126,494)	44,821	194,438	118,769
Alternatives D Through G	428,410 (+60,978)	50,488	221,813	138,536

Source: Land cover data obtained from CBP and Chesapeake Conservancy, 2023.
[1] Includes Cropland, Pasture/Hay land cover classes.
[2] Includes Tree canopy (Other), Forest, Natural Succession, Harvested Forest and Wetlands (Riverine Non-Forested & Terrene Non-Forested land cover classes.
Table omits acreage of water and tidal wetlands.

Maryland uses PFAs to direct future growth to existing towns, cities, and locally designated growth areas based on the PFA criteria, and to preserve the rural character, forests, and farms within the state while still allowing development to occur. The PFA law exempts existing transportation facilities such as the Bay Bridge from being considered a "Growth Related Project" as defined in § 5-7B-01 of the Annotated Code of Maryland and specifically listed in Transportation Article § 4–101(h). **Table 8-4** presents the acres of PFAs and municipalities within 60-minute drive times of the Annapolis City Center for the ARDS groups. All counties and municipalities within the IGSAs have prepared master and local plans to direct growth and protect natural resources (**Appendix B:** Master Plans and Roadway Recommendations). The PFAs and incorporated municipalities are shown in **Figure 5-3**.

Table 8-4: Land in the PFAs within the IGSAs

Alternative A (No-Build) (Acres)	Alternatives B and C (Acres)	Alternatives D through G (Acres)
24,770	47,561	51,008

Source: MDP, 2019

New growth associated with the build alternative ARDS would occur beyond what would be expected under the No-Build Alternative, but the extent of such growth cannot be determined with certainty and would be influenced by future economic conditions and opportunities for future development. However, as discussed in **Section 6.1**, the current CMPs in the ARDS are focused on directing development to designated areas while preserving agricultural and natural lands. Therefore, areas designated for growth (such as PFAs or existing developed areas) would likely be prioritized for new development.

The Bay Bridge is a main route for travelers from Maryland, Washington, D.C. and Virginia traveling to destinations on the Atlantic coast in Maryland and Delaware. Greater access to these beach resort areas could increase demand for tourism, spurring new economic growth and land use development. The extent and location of such potential induced growth in tourist areas cannot be determined with certainty; such growth could have both beneficial and adverse effects and may result from improvements considered with each build alternative. Therefore, the induced

growth effects considered in this technical report focus on induced development within the IGSAs, independent of tourism related effects, and based on drive time to employment opportunities on the Western Shore as shown in **Figure 5-2**.

8.2.1 Socioeconomic Resources

8.2.1.1 Alternative A (No-Build)

Alternative A (No-Build) would not result in Bay Crossing Study-related induced growth effects to socioeconomic resources in its respective IGSA. Growth and development would proceed as identified in locality future land use plans, as well as projects currently underway or planned projects for which construction funding has been identified. Land near U.S. 50/301 may become less desirable and could lead to reduced demand for growth due to continued and worsening traffic congestion and diminishing travel reliability.

8.2.1.2 Alternatives B and C

These build alternatives would not change access to U.S. 50/301. Any changes in capacity resulting from Alternatives B or C improvements are restricted to the new Bay Bridge itself and approach roadways, extending up to approximately 5.5 miles west of the bridge and 8 miles east of the bridge. No major changes in intersection configuration or roadway geometric alignments are proposed, only lane modifications along the existing U.S. 50/301 roadway. The catalyst for induced growth on the Eastern Shore would be the benefits provided by the increased bridge/highway capacity, and reduced travel times from the Eastern Shore to the Western Shore, resulting from the ARDS. More areas on the Eastern Shore could be reached within a 60-minute drive time of the Annapolis City Center, and drive times to areas closer to the Bay Bridge would be reduced further with anticipated improvements in congestion. Less congested access to available developable/marketable land (suitable for septic and not protected from development) on the Eastern Shore, combined with the desire to live in a less urbanized area by some, may result in induced growth within the No-Build Alternative IGSA and the Alternatives B and C IGSA with implementation of either the Alternatives B or C improvements.

Induced growth could occur under Alternatives B and C because these alternatives would increase capacity and reduce congestion, making it more attractive for users and increasing access to surrounding land. It would also improve regional accessibility for customers as well as the delivery of goods and services that facilitates growth. As previously discussed, induced growth would most likely occur in areas within a 60-minute drive time of the Annapolis City Center. The IGSAs for Alternatives B and C are presented in **Figure 5-2**.

The traffic analysis determined that all build alternatives would increase daily trips during the NSWD in both directions across the Bay (*Traffic Analysis Technical Report*). Alternatives B and C would increase the number of trips by approximately 1.6 percent, and Alternatives D through G would increase number of trips by approximately three percent respectively, compared to the No-Build. Increases in the number of trips between the No-Build and build alternatives are shown in **Table 8-5**.

Table 8-5: Daily Trips Across Chesapeake Bay (vehicles per day)

	Day Type	Existing (2022)	Alternative A: No-Build (2045)	Alternatives B and C: 6-8-6 (2045)	Alternatives D and E: 8-8-8 (2045)	Alternatives F and G: 8-10-8 (2045)
Daily Trips	Typical NSWD	69,588	91,150	92,600	93,450	93,850
	Typical SWED	104,284	130,500	143,150	148,600	148,650
Percentage Change from No-Build	Typical NSWD	N/A	0.0	1.6	2.5	3.0
	Typical SWED	N/A	0.0	9.7	13.9	13.9

Source: Socioeconomics and Land Use Technical Report

Under either Alternatives B or C, besides the potential for additional or intensified growth in PFAs, the induced growth could occur to undeveloped/natural lands, presented in **Table 5-3**. Approximately 111,910 acres (33 percent) of undeveloped land is not under protective easements nor is it subject to targeted development from counties or municipalities and is therefore vulnerable to induced growth effects.

Improvements considered with Alternatives B and C could lead to induced growth within these undeveloped areas within the IGSA based on a variety of factors such as local land use policies and guidance. The IGSA for both alternatives includes areas in and outside of designated growth areas in Queen Anne's County, Talbot County, and Caroline County. Designated growth areas in these counties are targeted around the various municipalities in the IGSA including Easton, Queenstown, Centreville, Queen Anne, Hillsboro, Ridgely, Church Hill, Barclay, and portions of Sudlersville, Denton, and Greensboro. These municipality boundaries, as well as the U.S. 50/301 corridor travelling from Stevensville to the U.S. 50/301 split in Queenstown, are heavily covered by PFAs. These are areas where growth would be anticipated to occur regardless of this project, and while additional or intensified growth may occur, these areas were not considered for induced growth effects. Intensification within PFAs may require additional water and sewer infrastructure to support growth. Some PFAs, including within Queen Anne's County, have limited water and sewer capacity which would be a barrier to major growth. The 111,910 acres of undeveloped land outside of these designated growth areas within the IGSA are the lands seen as being the most vulnerable. As seen in **Table 5-3**, the majority of those undeveloped lands are agricultural lands in the form of cropland and pasture. These lands exist just beyond the municipal boundaries and PFAs within the IGSA, so induced growth pressure from Alternatives B or C could cause counties and municipalities to alter land use plans and allow for development in these otherwise undeveloped areas, particularly near those PFAs that have limited water and sewer capacity. **Section 6.1.4** discusses the CMPs for the counties and municipalities that encompass the IGSA, many of which have a goal to preserve and conserve these agricultural lands. That goal, in combination with other local and state policies such as the Septics Law, could minimize any potential induced growth to these areas as a result of Alternatives B or C.

Potential induced growth effects associated with Alternatives B or C could have both beneficial and adverse effects. For example, induced residential growth could lead to an increase in commercial, institutional, and infrastructure facilities (i.e., transportation, water, and sewer services) established to service newly developed areas and residents. This could be beneficial to local employment and the local economy. In addition, conversion of natural and agricultural

lands to residential and commercial uses could provide additional tax revenue for the respective counties as the tax base for these types of uses typically exceeds that of natural and agricultural lands. It could also affect community cohesion by changing the rural character of neighborhoods and rural areas to more developed uses. Aside from the more densely developed areas along U.S. 50/301 on Kent Island to approximately the U.S. 50/301 split, the existing communities in the IGSA for Alternatives B and C are largely rural in character, with expanses of open space afforded by agricultural and natural resource lands interspersed with farmsteads and small communities. Development pressures from the additional capacity created under Alternatives B or C could alter the rural setting, impacting community cohesion.

Impacts to community facilities could also be beneficial or adverse, such as displacing or burdening community facilities in the short-term from population growth, but in the long term potentially leading to more community facilities to serve a larger population. Population growth could lead to increased demand for school facilities, a need for greater water and sewer capacity to support planned growth or strain on other services provided by local governments such as emergency services including fire and police. In addition, constructing an SUP may increase demand for parking or rest amenities along existing park and trail facilities.

8.2.1.3 Alternatives D, E, F, and G

Traffic operations data from the *Traffic Analysis Technical Report* show Alternatives D through G would each provide free-flow travel conditions within the limits of the ARDS and greater induced growth effects than Alternatives B and C would be expected. The free-flow conditions would reduce travel time and costs for commuters and for businesses providing goods and services within the IGSA. As previously discussed in **Section 5.3.1**, induced growth would most likely occur in areas within a 60-minute drive time to the Annapolis City Center. The IGSA for Alternatives D through G are presented in **Figure 5-2** and it includes the areas contained within the No-Build Alternative IGSA and Alternatives B and C IGSA.

Similar to Alternatives B and C, other than the potential for additional or intensified growth in PFAs, the potential for induced growth is limited to undeveloped/natural lands available for development in the IGSA for Alternatives D through G, presented in **Table 5-3**. **Table 5-2** shows the developed lands, designated growth areas, and protected lands that were considered not vulnerable to development from induced growth, totaling 261,259 acres (approximately 67 percent) of the IGSA. The remaining 127,922 acres (approximately 33 percent) of undeveloped land is not under protective easements or subject to targeted development from local government or municipalities. Improvements proposed under either Alternatives D through G would most likely lead to more induced growth within these undeveloped areas within the IGSA based on a variety of factors such as local land use policies and guidance. Compared to the IGSA for Alternatives B and C, there was an increase of approximately 16,013 acres (approximately 14 percent) in undeveloped/vulnerable land within the IGSA for Alternatives D through G. These vulnerable lands are outside of designated growth areas in Queen Anne's County, Talbot County, and Caroline County. Designated growth areas in these counties are targeted around the various municipalities in the IGSA, all of which are the same as Alternatives B and C except the addition of Goldsboro and the entirety of Sudlersville, Greensboro, and Denton are covered.

These municipality boundaries, as well as the U.S. 50/301 corridor travelling from Stevensville to the U.S. 50/301 split in Queenstown, are heavily covered by PFAs. These are areas where growth would be anticipated to occur regardless of the Bay Crossing Study, and while additional or intensified growth may occur, these areas were not considered for induced growth effects. Similar

to Alternatives B and C, intensification within PFAs may require additional water and sewer infrastructure to support growth. Some PFAs, including within Queen Anne's County, have limited water and sewer capacity which would be a barrier to major growth. The 127,922 acres of undeveloped land outside of these designated growth areas within the IGSA are the lands seen as being the most vulnerable to induced growth. As seen in **Table 5-3**, most of those undeveloped lands are agricultural lands in the form of cropland and pasture. Like Alternatives B and C, these lands exist just beyond the municipal boundaries and PFAs within the IGSA, so induced growth pressure from Alternatives D through G could cause the counties and municipalities to alter land use plans and allow for development in these otherwise undeveloped areas, particularly near those PFAs that have limited water and sewer capacity. Areas of vulnerable cropland just beyond PFA or municipal boundaries are similar between Alternatives B and C and Alternatives D through G. **Section 6.1.4** discusses the CMPs for the counties and municipalities that encompass the IGSA, many of which have a goal to preserve and conserve these agricultural lands. That goal, in combination with other local and state policies such as the Septics Law, could minimize any potential induced growth to these areas as a result of Alternatives D through G.

8.2.2 Natural Resources

8.2.2.1 Alternative A (No-Build)

Alternative A (No-Build) would not result in Bay Crossing Study-related construction or changes to the natural environment. **Table 8-6** shows potential natural resource types specifically vulnerable to induced growth effects within the IGSAs, including those currently vulnerable within the Alternative A (No-Build) IGSA. However, no study-related induced growth effects on natural resources in the Alternative A (No-Build) IGSA would occur.

Table 8-6: Natural Resources within Lands Currently Vulnerable to Growth Effects

Resource Type	Alternative A No-Build (Acres)	Alternatives B and C (Acres)	Alternatives D through G (Acres)
NWI Wetlands (2024), 8 types combined	10,067	15,613	18,290
Wetlands of State Concern	4	29	56
Rivers and Streams (MDE, 2019) (Linear Miles)	216	335	375
Tier II Stream Segments	4.4	7.4	7.6
Tier II Catchments	19,486	32,148	32,442
100-Year Floodplain	1,597	2,913	3,517
Undeveloped Land within CBCA by Designation:	11,187	15,533	19,166
• Intensely Developed Area	2.5	3.3	6.0
• Resource Conservation Area	10,675	14,832	925
• Limited Development Area	509	698	18,235
Potential FIDS Habitat	17,736	26,662	31,756
HCN (all hubs and corridors)	14,847	22,170	26,830
Sensitive Species Project Review Area	5,649	9,631	11,958
TEAs	0	575	1,857

Source: MD iMap

8.2.2.2 Alternatives B and C

Water Resources

Induced growth associated with Alternatives B and C could have an adverse effect on water resources and water quality. An impact to water quality can influence human use of the resource and ecosystem functions. Federal, state, and local regulations addressing stormwater runoff and protecting water quality could reduce potential adverse impacts.

Induced growth associated with Alternatives B or C could affect wetlands, streams, floodplain areas, and related effects to groundwater recharge. Induced growth could result in filling wetlands and streams, encroachment into the floodplain, and reduced groundwater infiltration/recharge from impervious surface cover changes and increased consumption from induced growth-related construction. Increased groundwater withdraw within the confined aquifers in the IGSA for Alternatives B and C may deplete groundwater below sustainable levels causing well failure and drive the need to install deeper wells to reach the next available aquifer. Increased groundwater withdraw may also lead to brackish-water intrusion, contamination migration, land subsidence, and alteration of wetland ecology. As the majority of the water supply within the IGSA for Alternatives B and C is served by groundwater aquifers, induced growth-related development within this area would increase the demand on groundwater resources. The extent of additional groundwater withdraw due to induced growth-related development is uncertain and cannot be determined; however, consumption would be managed through MDE's Water Appropriations Permit which permits groundwater withdraws to ensure sustainability of this resource (MDE, 2021c).

Table 8-6 shows acreages of estimated wetlands, floodplains, and linear miles of streams within undeveloped/ vulnerable lands in the IGSA for Alternatives B and C. Wetlands are the most abundant water resources within vulnerable lands in this IGSA totaling approximately 15,610 acres. Seven miles of Tier II streams and 32,150 acres of Tier II stream catchments are also vulnerable to induced growth under these build alternatives. As addressed in **Section 6.2.1.3**, impacts to these Tier II resources can negatively affect water quality. Any induced growth that could have impacts to these regulated resources would be subject to review, approval, and/or permits from local, state, or federal agencies (including USACE, MDE, and MDNR) before any impacts could occur, making development in these areas less desirable.

Wildlife and Habitat

Impacts of induced growth associated with Alternatives B or C on terrestrial and aquatic wildlife, and wildlife habitat, can include wildlife loss; habitat loss, fragmentation, and degradation; disruption of resting, feeding, movement, breeding, and nursery sites; changes in wildlife population density and species richness; alterations of hydrology and species interaction; and imperilment of protected species. Induced growth from Alternatives B or C could have adverse effects on terrestrial resources within the respective IGSA. Approximately 32,560 acres of forest land and tree canopy, which provides wildlife habitat, could be susceptible to induced growth effects from Alternatives B and C improvements.

The percent of impervious land cover within a given watershed is correlated to adverse effects to aquatic habitat when it rises above a certain threshold, where negative impacts on aquatic habitat begin to appear at 5 percent impervious cover for freshwater systems and 10 percent impervious cover for anadromous fish spawning habitat. Therefore, increased impervious land cover associated with growth within the IGSA for Alternatives B and C may also impact aquatic wildlife and habitat if the percentage of impervious cover reaches or exceeds these thresholds.

Wildlife habitat within these vulnerable lands includes potential FIDS habitat, TEAs, and SSPRAs as shown in **Table 8-6**. Some of these resources that border designated growth areas such as municipalities, PFAs, or existing major roadway corridors would likely be more susceptible to induced growth as a result of Alternatives B and C improvements. Approximately 22,170 acres of HCN lands, which provide both terrestrial and aquatic habitat, are vulnerable to induced growth effects within the respective IGSA (see **Table 8-6**).

Any federal or state-sponsored development or development on federal or state land could be regulated to minimize potential impacts to wildlife and wildlife habitat, including for protected species. Potential impacts to federally protected species on private property are also regulated as previously described in **Section 6.2.2** and **Section 6.2.3**. Proposed modifications to wetlands would be federally and state regulated as well, reducing potential adverse impacts of induced growth to wildlife and wildlife habitat, including protected species, as described in **Section 6.2.2**.

Threatened, Endangered, and Special Status Species

Induced growth effects from Alternatives B and C improvements, through the loss of forest hubs and corridors would be greater to species with specific habitat requirements such as threatened, endangered, and special status species. The historical loss of RTE habitat statewide has necessitated a state or federal listing of the species to protect the remaining habitats. As shown in **Table 8-6** approximately 26,662 acres of potential FIDS habitat and 9,631 acres of SSPRAs within the IGSAs of Alternatives B and C could be impacted by induced growth effects. Coordination with MDNR would be required to assess the impacts of projects and activities resulting from induced growth on SSPRAs. This coordination would identify the species associated with each affected SSPRA and determine the necessary avoidance and minimization measures. **Table 8-6** shows that approximately 575 acres of TEAs within the IGSAs of Alternatives B and C could be impacted by induced growth effects. These areas are most important for the protection of threatened, endangered, and special status species in the IGSA for Alternatives B and C.

The NLEB and tricolored bat are listed or proposed species within the Analysis Area, with no designated critical habitat (USFWS, 2025i). As shown in **Table 5-3**, approximately 32,560 acres of forest land and tree canopy that is potential foraging and summer roosting habitat within Alternatives B and C could be impacted by induced growth effects to the bat species.

Monarch butterfly habitat includes fields, roadside areas, open areas, wet areas, and urban gardens with flowering plants. Adult monarchs feed on the nectar of many flowers, but they breed only where milkweeds are found (*Natural Environmental Technical Report*). The habitat of the monarch butterfly is not exclusive to the induced growth areas. While a recent IPaC resource list determined the Eastern Shore does not overlap the critical habitat of the monarch butterfly (USFWS, 2025i), loss of habitat due to induced growth effects could occur. Development of vulnerable lands could increase the use of herbicides in newly developed areas, which would further reduce monarch butterfly habitat. An estimate of meadow habitat within the IGSAs is not available using LULC mapping.

Habitat of Atlantic sturgeon and shortnose sturgeon, sea turtle, and bottlenose dolphin, i.e., shallow and open water) is not included within the IGSAs, however increases in the percentage of impervious land cover in the watershed(s) within the IGSA above the thresholds described above could negatively impact aquatic habitat.

Coordination with MDNR, MDE, USFWS, and/or NOAA NMFS would occur, as required, and prior to the permit decisions for induced growth-related projects. Any mitigation measures, conditions, or restrictions determined necessary by the resource agencies would be included as conditions of any future permits issued for such activities.

8.2.2.3 Alternatives D, E, F, and G

Water Resources

Induced growth associated with Alternatives D through G could have an adverse effect on water resources and water quality discussed in the existing conditions **Section 6.2.2**. An impact to water quality can influence human use of the resource and ecosystem functions. Federal, state, and local regulations addressing stormwater runoff and protecting water quality could reduce potential adverse impacts.

Induced growth development associated with Alternatives D through G in the IGSA could have a greater effect to wetlands, streams, floodplain areas, and related groundwater effects, including from increased groundwater consumption, compared to the No-Build and Alternatives B and C. **Table 8-6** shows acreages of estimated wetlands, floodplains, and linear miles of streams within undeveloped/ vulnerable lands throughout the IGSA for Alternatives D through G. Wetlands are the most abundant water resources within vulnerable lands in the IGSA totaling approximately 18,290 acres for Alternatives D through G. There are approximately 7.6 miles of Tier II streams and 32,442 acres of Tier II stream catchments that are also vulnerable to induced growth under these ARDS. As addressed in **Section 6.2.1.3**, impacts to these Tier II resources can negatively affect water quality. Any induced growth that could have impacts to these regulated wetlands, waterways, floodplains, or groundwater as a result of these Alternatives could be subject to review, approval, and/ or permits from local, state, or federal agencies (USACE, MDNR, and MDE) before any impacts could occur.

Wildlife and Habitat

Impacts of induced growth from Alternatives D through G to terrestrial and aquatic wildlife and wildlife habitat can include wildlife loss; habitat loss, fragmentation and degradation; disruption of resting, feeding, movement, breeding, and nursery sites; changes in wildlife population density and species richness; alterations of hydrology and species interaction; and imperil protected species. Induced growth from Alternatives D through G could have adverse effects on terrestrial resources within the IGSA. Approximately 38,669 acres within undeveloped/ vulnerable land in the Alternatives D through G IGSA is comprised of forested land or tree canopy. This is approximately 19 percent more vulnerable forest/ canopy lands when compared to Alternatives B and C. Lands under protective easements were excluded from the induced growth analysis for this study and were not seen as lands vulnerable for development, so any natural resources referenced in this induced growth analysis are not under protective easements and are seen as lands vulnerable to induced growth as a result of Alternatives D through G.

Like Alternatives B and C, increases in impervious land cover associated with induced growth within the IGSA for Alternatives D through G may have adverse effects to aquatic wildlife and habitat if the percentage of impervious land cover reaches or exceeds the respective 5 percent and 10 percent thresholds for freshwater and anadromous fish habitat.

Wildlife habitat within these forest lands includes the FIDS area, TEAs, and SSPRAs shown in **Table 8-6**. Some of these resources that border designated growth areas such as municipalities, PFAs, or existing major roadway corridors could be more susceptible to induced growth as a

result of Alternatives D through G. Potential FIDS habitat is the most substantial of these resources areas within the IGSA, totaling 31,760 acres for Alternatives D through G. FIDS habitats are large, contiguous forest areas that these species require for breeding, foraging and overall species survival. Induced growth to these habitats would have greater implications for the species that reside within them. Approximately 26,830 acres (4,660 acres more than Alternatives B and C) of the HCN, which provides both terrestrial and aquatic habitat is within lands vulnerable to induced growth (see **Table 6-35** in **Section 6.2.2.2**).

Threatened, Endangered, and Special Status Species

Induced growth effects from Alternatives D through G improvements, through the loss of forest hubs and corridors would be greater to species with specific habitat requirements such as threatened, endangered, and special status species. The historic loss of RTE habitat statewide has necessitated a state or federal listing of the species to protect its continued existence. As shown in **Table 8-6**, approximately 31,756 acres of potential FIDS habitat and 11,958 acres of SSPRAs within the IGSAs of Alternatives D through G could be impacted by induced growth effects. Coordination with MDNR would be required to assess the impacts of projects and activities resulting from induced growth on SSPRAs. This coordination would identify the species associated with each affected SSPRA and determine the necessary avoidance and minimization measures. **Table 8-6** shows that approximately 1,857 acres of TEAs within the IGSAs of Alternatives D through G could be impacted by induced growth effects. These areas are most important for the protection of threatened, endangered, and special status species in the IGSA for Alternatives D through G.

The NLEB and tricolored bat are listed or proposed species within the Analysis Area, with no designated critical habitat (USFWS, 2025i). As shown in **Table 5-3**, approximately 38,669 acres of forest land and tree canopy that is potential foraging and summer roosting habitat within Alternatives D through G could be impacted by induced growth effects to the bat species.

The Delmarva fox squirrel is a state species designated In Need of Conservation, with known habitat located north of U.S. 50/301, from Winchester Creek to Little Queenstown Creek in Queen Anne's County. Induced growth effects to this species may result from the loss of or degradation to suitable forage, roost, reproductive, and/or nesting habitat as a result of subsequent improvements.

Monarch butterfly habitat includes fields, roadside areas, open areas, wet areas, and urban gardens with flowering plants. Adult monarchs feed on the nectar of many flowers, but they breed only where milkweeds are found (*Natural Environmental Technical Report*). The habitat of the monarch butterfly is not exclusive to the induced growth areas. While a recent IPaC resource list determined the Eastern Shore does not overlap the critical habitat of the monarch butterfly (USFWS, 2025i), loss of habitat due to induced growth effects could occur. Development of vulnerable lands could increase the use of herbicides in newly developed areas, which would further reduce monarch butterfly habitat. An estimate of meadow habitat within the IGSAs is not available using LULC mapping.

Habitat for sturgeon, sea turtles, and bottlenose dolphins, (i.e., shallow and open water) is not included within the IGSAs, however increases in the percentage of impervious land cover in the watershed(s) within the IGSA above the thresholds described above could negatively impact aquatic habitat.

Similar to Alternatives B and C, coordination with MDNR, MDE, USFWS, and/or NOAA NMFS would occur, as required, and prior to the permit decisions for induced growth-related projects. Any mitigation measures, conditions, or restrictions determined necessary by the resource agencies would be included as conditions of any future permits issued for such activities.

8.2.3 Historic Properties

8.2.3.1 Alternative A (No-Build)

Alternative A (No-Build) would not result in Bay Crossing Study-related impacts on archaeological or architectural resources. Therefore, no study-related induced growth effects on historic properties in the IGSA would occur. However, historic properties are currently vulnerable to induced growth effects from past and other present actions within the Alternative A (No-Build) IGSA. **Table 8-7** shows the historic properties that could be vulnerable to induced growth within the IGSAs.

Table 8-7: Historic Properties within Lands Currently Vulnerable to Induced Growth

Historic Property Type	Alternative A No-Build (Acres)	Alternatives B and C (Acres)	Alternatives D through G (Acres)
Maryland Historical Trust Easements	0	0	0
MIHP	741	1,947	2,276
National Register of Historic Places	102	287	458

8.2.3.2 Alternatives B and C

New construction or rehabilitation associated with induced growth has the potential to adversely affect archaeological and architectural historic properties. This could occur by:

- Demolition, excavation, or vibration effects;
- Changing the design, materials, or workmanship; and/or
- Altering the setting, feeling, and association of historic properties.

Development projects funded, permitted, or on lands controlled by federal and state agencies must consider effects on historic properties by complying with Section 106 of the NHPA and consulting with the MHT, which serves as the State Historic Preservation Office (SHPO) in Maryland. As seen in **Table 8-7,** the IGSA for Alternatives B and C comprises 27 NRHP properties (287 acres) within lands vulnerable to induced growth. Development from induced growth on these properties is possible following any potential review process. Compliance with Section 106 may require modification or mitigation in development plans.

8.2.3.3 Alternatives D, E, F, and G

New construction or rehabilitation associated with induced growth has the potential to adversely affect archaeological and architectural historic properties in the same ways as Alternatives B and C. However, as seen in **Table 8-7**, the IGSA for Alternatives D through G includes an additional four NRHP properties (31 total) for a total of 458 acres of land vulnerable to induced growth. Development from induced growth on these properties is possible following any potential review process. Compliance with Section 106 may require modification or mitigation in development plans.

9 AGGREGATE EFFECTS ANALYSIS

9.1 Geographic Area and Resources

The geographic limits for the AFE analysis are the same as the Analysis Area as described in **Section 5.3**. The resources affected by the ARDS would be the same as those resources identified in **Section 6** and evaluated for potential downstream and induced growth effects in **Section 8**.

9.2 Past, Present, and Foreseeable Actions

9.2.1 Past Actions

Section 6 describes many of the past actions that have broadly contributed to the baseline conditions of the Analysis Area that were used for this analysis. Many of the evaluated resources in the Analysis Area have been heavily affected by these past actions, including extensive development in the metropolitan areas, with population and employment growth, development (especially on the Western Shore where there are several developed areas), and conversion of natural lands to more intensive and agricultural uses. These actions have resulted in a loss of wildlife habitat and species, impacts to wetlands and streams, increased levels of air and water pollution, and negative effects to historic properties.

Since 1970, development in the form of infill, with increasing density of development, occurred in the Analysis Area west of Chesapeake Bay as shown in the aerial imagery included in **Appendix D**. On the eastern side of the Bay many residential and commercial developments, and associated transportation improvements, were built following the opening of the second span in 1973 including those along the waterways and coves of the Wye River and Greenwood Creek and the constructed Bennett Point Road and Prospect Bay Road in Queen Anne's County. Medium density residential and commercial development also occurred, with accompanying transportation improvements, on Kent Island along the Chesapeake Bay, and the waterways and coves of Shipping Creek, Cox Creek, Warehouse Creek, Crab Alley Bay, Prospect Bay, and the Chester River. Further east of the Bay, infill and development were centered around the existing Towns of Church Hill, Centreville, Goldsboro, and Greensboro, with significant development occurring in and between Ridgley and Denton, and around Easton.

Along with the roadways constructed to, and within, the new and expanded residential and commercial developments included above, additional transportation related actions included the construction of the Bay Bridge Airport and Gooden Airpark, and runway, taxiway, terminal, office, and hanger construction at the Easton Airport.

Non-transportation actions included construction or development of country clubs and golf courses (Cove Creek Club, Blue Heron Club, Queenstown Harbor, Prospect Bay Country Club, and Hog Neck Golf Course), and sand and gravel mining activities along Merrick Corner Road and Bridgetown Road in Queen Anne's County and Oakland Road in Caroline County.

9.2.2 Present and Foreseeable Actions

The Analysis Area, particularly on the Western Shore, has many projects planned or under construction that would potentially impact the same resources affected by the ARDS. While this study is narrowly focused, the number of planned projects is too many to list. Therefore, this

study reviewed major projects, including those present and future projects budgeted for $10 million or more on the Western Shore and $5 million or more on the Eastern Shore. It is assumed that projects budgeted for these amounts would be those with the greatest impacts on resources that may also be affected by the ARDS.

"*Foreseeable Future Actions*" are those actions that are fiscally constrained in the region's transportation plans. LRTPs identify the capital improvement projects for the region's highway, transit, and active transportation systems that transportation agencies expect to be able to fund over the next 20-plus years. Due to scarce financial resources, projects that do not have identified funding may not be constructed and are therefore not foreseeable. **Table 9-1** and **Table 9-2** list the major present and foreseeable future projects within the Analysis Area and notes the status of each project. A full list of projects within the Analysis Area is located in **Appendix E**. These projects could all contribute to foreseeable effects related to socioeconomic and natural resources and historic properties in the Analysis Area.

Table 9-1: Major Present and Foreseeable Future Non-Transportation Projects within the Analysis Area

Project	Location	Description	Status*
Bay Bridge Protection Project	Chesapeake Bay	Installation of up to 16 dolphins to provide protection to the existing main span piers of the Eastbound and Westbound Bay Bridges.	Planning
Western Shore			
Broadneck Peninsula Trail	Anne Arundel[2] County	Multi-use paved trail	Phased construction
Four new major subdivision projects	Anne Arundel County	Major subdivisions (greater than five lots)	Two in the Final Plan phase, two in the Sketch phase
Four minor subdivision projects	Anne Arundel County	Minor Subdivision (five or fewer lots)	All are in the Final Plans phase
11 site development plans	Anne Arundel County	Site development plan	All are active and in the Site Plan Phase
Eastern Shore			
South Kent Island Wastewater Sub-district	Kent Island, Queen Anne's County	Provide sanitary service over a 10-year period to 1,518 existing homes, 8 non-residential, and 632 infill lots.	Phase 1: 2015 – 2022 Phase 2: 2019 – 2023 Phase 3: 2020 – 2025 Phase 4: 2021 – 2027
Arcadia Assisted Living/ Arcadia of Stevensville	Main Street, Stevensville, MD	16-unit development	Not constructed

[2] Anne Arundel County, 2025a-c.

Project	Location	Description	Status*
Jemal's Kent Island	Piney Narrows Road, Kent Island, MD	396-unit apartment complex	Not constructed
Living Water/Land Bridge, LLC	Romancoke Road Stevensville, MD	10-unit development	Not constructed
Kent Island Crossing	Piney Creek Road, Chester, MD	84-unit development	Not constructed
Chesapeake Square	Main Street, Chester, MD	42-unit apartment complex	Not constructed
Calm Seas	Piney Creek Road, Chester, MD	19 residential lots and one open space lot	Planning review process ongoing
Nesbit Road Townhomes	Nesbit Road, Grasonville, MD	42 townhomes	Planning review process ongoing
Hopelands	Centreville, MD	Major subdivision – Create 1 lot	Planning review process ongoing
Aspire at Ewing Farm, K Hovnanian Homes of Maryland, LLC	Grasonville, MD	292-lot subdivision and a water and sewer amendment	Planning review process ongoing
Bay Bridge Marina	Stevensville, MD	28 duplex lots and 5 commercials lots	Planning review process ongoing
Parcel 24 Holding LLC	Stevensville, MD	12-unit apartment building	Planning review process ongoing
Armored Storage Kent Island	Piney Creek Road, Chester, MD	Construct a 3-story indoor storage facility	Planning review process ongoing
Old School Properties, LLC	Stevensville, MD	Construct a standalone 6,250 sf and 7,500 sf flex industrial buildings	Planning review process ongoing
Cedar Lane Solar, LLC	605 Cedar Lane, Church Hill, MD	Major site plan – Construct a 1.744 MW solar array on a 15-ac lease area within a 165.028 parcel	Planning review process ongoing
Chesapeake Bay Beach Club, LLC	Stevensville, MD	Construct a new hotel (32 rooms)	Staff TA Committee (STAC) date 10/2/24 Planning review process ongoing
David A. Bramble, Inc	Centreville, MD	Conditional use for a 31.1-acre expansion of an existing major extraction operation	Planning review process ongoing

Project	Location	Description	Status*
Sustainable Land Use, LLC	Ingleside, MD	109.41-acre major extraction operation	Planning review process ongoing
Merrick Farm, LLC	Barclay, MD	225.78-acre expansion of an existing major extraction operation	STAC date 6/5/24 Planning review process ongoing
Bridgetown Development Company	Henderson, MD	21.11-acre expansion of an existing major extraction operation	Planning review process ongoing

**Status of projects as of April 15, 2025*

Table 9-2: Major Present and Foreseeable Future Transportation Projects within the Analysis Area

Project	Source	Location	Description	Status
Western Shore				
U.S. 50; MD 70 to MD 2	BMC	Anne Arundel County	U.S. 50, from MD 70 to MD 2 (north), including the Severn River/Pearl Harbor Memorial Bridge.	Partially funded
U.S. 50, from MD 97 to MD 2 (north)	Maximize 2045 LRTP and Resilience 2050 LRTP	Anne Arundel County	Capacity improvements including the Severn River/Pearl Harbor Memorial Bridge MD 175, Annapolis Road.	Planning
U.S. 50, from I-97 to MD 2	Maximize 2045 LRTP and Resilience 2050 LRTP	Anne Arundel County	Widen from 6 to 8 lanes.	Planning
Eastern Shore				
MD 18 Kent Narrows to Bay Bridge	Maximize 2045 LRTP	Queen Anne's County	MD 18 and MD 835 on the east side of Kent Narrows and MD 18 – Widen from 2 to 4 lanes, including right-of-way acquisition, utility relocation, pedestrian improvements, intersection reconstruction.	Planning
MD 8 / U.S. 50/301 Interchange and Service Roads	Maximize 2045 LRTP	Queen Anne's County	Widening from 2 to 4 lanes on MD 8, reconstructing existing overpass, Improve Bike/ped safety.	Planning
U.S. 50, construct interchange at MD 213	MDOT SHA-Consolidated Transportation Program	Queen Anne's	Construct interchange	Project on hold
U.S. 50/301 (Blue Star Memorial Hwy) Kent Island Traffic Management	MDOT SHA - Project portal	Queen Anne's	Pilot ramp management project along westbound U.S. 50/301 from Castel Marina Road to MD 8.	Ongoing

Project	Source	Location	Description	Status
U.S. 301 Bridge over Chester River	MDOT SHA – Project portal	Queen Anne's County	Bridge replacement	Construction

9.3 Aggregate Effects

The aggregate effects to land use, socioeconomic and natural resources, and historic properties in the Analysis Area consist of the direct, downstream, and induced growth effects of the ARDS in the context of the impacts of other past, present, and foreseeable actions. Past, present, and foreseeable actions have already affected or have the potential to impact these resources and properties, as do the ARDS. Past trends and forecasts impacting the human and natural environmental resources evaluated in the AFE are discussed in detail in **Section 6,** and included in **Section 9.2.1**, while major, present, and foreseeable actions are listed in **Table 9-1** and **Table 9-2**.

9.3.1 Socioeconomic Resources and Land Use

The aggregate effects to socioeconomic resources and land use due to past, present, and reasonably foreseeable future actions are closely related and are described together in the following sections.

Since 1970 numerous past actions have contributed to the land use changes and development discussed in **Section 6.1** and visible in the imagery contained in **Appendix D**. These actions have been both beneficial and adverse to socioeconomic resources, adverse to land use, and it is expected that foreseeable future actions could be beneficial and adverse as well. Past and present transportation actions have or would improve the mobility of people. Past and present growth and development have or would increase the standards of living for communities that benefit community cohesion and provide greater access to community facilities and recreational resources. Such growth and development have benefited local economies by improving access to markets and customers resulting from past and current transportation improvements, including the existing Bay Bridge. However, some past and present developments on the Eastern Shore have or would continue to result in large-scale community changes where the transition is made from predominantly agrarian/farming communities to major residential and commercial developments (ex. Kent Island).

Conversion of farmland to developed uses can impact local agricultural economies, such as on the Eastern Shore of Maryland, affecting private property land values and the tax base of the localities. Often farmland has lower property taxes than residential and commercial developments, therefore when farmland is converted to residential and commercial uses, the property's market value rises dramatically. The increase in property values of neighboring properties incentivizes the continued selling of farmland to developed uses. With the increase in property value (land plus improvements) also comes a corresponding increase in property taxes for the newly developed residential and commercial lands. This surge in tax revenue from the converted land contributes to a larger overall tax base for the locality which can fund services and infrastructure that could support current and future population growth.

An example of infrastructure fueling growth occurred on Kent Island. Development of the island from predominately farming to intensive uses was made possible by the construction of the existing Bay Bridge, its capacity expansion in 1973, and the increased mobility of people throughout the area. It was also likely tied to and driven by the availability of sewer systems such as which were constructed between 1979 and 1982 as part of the Kent Narrows/Grasonville/Stevensville Wastewater Service Area. The service area from this project extended along U.S. 50/301 from Hess Road in Grasonville to MD 8 on Kent Island (Queen Anne's County, 2025). This growth and development, as evident in the percentage population change in Queen Anne's County (**Table 6-9**) between 1970 and 1990 following completion of the sewer system, likely facilitated the existing land uses, population dynamics, and income levels on Kent Island realized today.

Away from the existing Bay Bridge, roadway infrastructure associated with the existing conditions and U.S. 50/301 on either side of the Bay has had positive socioeconomic impacts by providing accessibility and economic opportunity, but also by negatively impacting community cohesion in the vicinity of the infrastructure. The existing transportation facilities have reduced access to and between areas directly adjacent to the highways.

9.3.1.1 Alternative A (No-Build)

Alternative A (No-Build) would not provide a new Bay Crossing between the Western and Eastern Shores of the Chesapeake Bay in Maryland and no improvements to the capacity over the Bay would occur. Alternative A (No-Build) would result in increasingly poor traffic conditions and LOS at the existing Bay Bridge and approach roadways by 2045, and it is probable for it to extend to non-summer workdays, having a moderate, adverse aggregate effect on socioeconomic resources.

Alternative A (No-Build) would not improve the crossing of the Chesapeake Bay at the existing Bay Bridge and therefore would not result in any incremental contribution of effects on community cohesion, community facilities, nor land use in the Analysis Area. However, Alternative A (No-Build) would have a probable moderate negative effect on local economies due to worsening LOS along Analysis Area roadways and would not meet the study's need items of addressing existing and predicted travel time and mobility issues.

Other present or foreseeable future projects are occurring or may occur as listed in **Table 9-1** and **Table 9-2**, some of which may result in induced growth within the Analysis Area independent of the Bay Crossing Study. This independent growth, which is predicted to occur even with selection of Alternative A (No-Build), is exemplified in the population and employment changes predicted in the Analysis Area localities listed in **Table 6-10** and **Table 6-15**, respectively. Under Alternative A (No-Build), independent future growth would be expected to occur within PFAs and municipalities where growth is to be directed and where sufficient public utility (water and sewer) or septic services exists or are planned.

9.3.1.2 Build Alternatives

Alternatives B and C

Alternatives B and C would replace the existing Bay Bridge spans with two new bridge spans, would remove the existing Bay Bridge, and would consist of six lanes along U.S. 50/301 on the Western Shore, eight lanes on the new bridge, and six lanes along U.S. 50/301 on the Eastern Shore. The approach roadways would remain on the existing roadway alignment, except where

necessary to connect to the new bridge spans. These improvements would positively support growth by reducing congestion and accommodating travel demand more efficiently, providing improved LOS compared to No-Build conditions.

As U.S. 50/301 would not be widened with new travel lanes beyond the approaches with either alternative, the improvements would not result in new fragmentation or isolation of communities within the Analysis Area, as resulted from other past actions.

Present and future transportation projects would continue to increase access to community facilities and recreational resources, locally within the Analysis Area, and regionally, while potentially displacing others (See **Table 7-1**). Following the approach tie-ins to existing U.S. 50/301 on each side of the Chesapeake Bay, the improvements would result in limited direct conversions of existing land use to transportation, lessening each alternative's contribution to negative land use effects and reducing potential incremental effects to community facilities and recreation resources.

Present and future independent transportation and non-transportation projects may potentially result in additional residential and commercial displacements within the Analysis Area. Although unlikely due to the existing bisection of the communities on either side of the Chesapeake Bay, Alternative B and C would each have minor incremental adverse contributions to effects on community cohesion resulting from direct, limited displacements.

As shown in the 2023 imagery in **Appendix D**, much of the land is developed where direct improvements are proposed along U.S. 50/301 in Anne Arundel County and Queen Anne's County. Further, as shown in **Figure 5-3**, nearly the entire area is designated as a PFA along U.S. 50/301 within Queen Anne's County where direct impacts would occur. As such, induced growth within PFAs would likely have a minor incremental effect on land use and local planning in these existing more-intensely developed areas.

Additional induced growth occurring outside of PFAs, as discussed in **Section 8.2.2**, would have a probable, moderate incremental effect on land use and local planning where undeveloped and less developed lands are converted to developed uses. These conversions would require additional infrastructure and services to eliminate strain for transportation, utilities, and public services (including but not limited to schools, libraries, fire stations, sheriff and police departments, and emergency response). The incremental contribution of either Alternatives B or C to land use change, beneficial or adverse, in the Analysis Area would be probable in likelihood and moderate in severity.

Growth in established communities can provide opportunities for increased cohesion with new social and recreational opportunities. Therefore, induced growth in these areas from Alternatives B and C, such as within PFAs, would have a minor, positive aggregate effect on community cohesion. Growth in rural and agricultural areas would result in a loss of farms, estates, forests, and streams, which can embody the essential values that are treasured in rural areas. Therefore, induced growth in these types of areas from Alternatives B and C, would have a probable, moderate aggregate effect on community cohesion in rural areas on the Eastern Shore.

Based on the limited direct and downstream effects of Alternatives B and C improvements to community and recreational facilities, the incremental adverse contribution of either alternative to aggregate effects on these resources would be unlikely and minor in severity. If induced growth

occurs because of Alternatives B and C improvements, it is unlikely to result in displacement of community facilities and recreational resources due to land use protections. Past, present, and reasonably foreseeable transportation and other actions would continue to have both positive and negative aggregate effects on community and recreational facilities locally, and regarding transportation access, the improvements would provide regional benefits to these resources.

Alternatives B and C improvements would result in probable, moderate improvements to transportation reliability and mobility, providing greater capacity for efficient movement of people, goods, and services across the Chesapeake Bay and in adjacent communities that would benefit productivity, long-term employment, and local economies. Minor, short-term, and localized construction effects to businesses from temporary detours and potential lost parking are possible which may cause some customer losses and make deliveries more difficult, but these effects would be temporary and minimized by advanced notice of closures and directional signing. Temporary job increases associated with the construction of Alternatives B and C improvements would occur that would provide a probable moderate benefit to the local economies on both sides of the Chesapeake Bay in the Analysis Area. Alternatives B and C improvements would also provide a probable moderate benefit to the regional and national economies within and beyond the Analysis Area as the increased navigational clearance provided by the larger Bay crossing would permit larger vessels capable of carrying additional cargo to reach the Port of Baltimore.

As discussed in **Section 6**, farming on the Eastern Shore is essential to the local economies and Maryland statewide agricultural economy. Conversion of farmland to developed uses would result in a further decrease in farmland acreage on the Eastern Shore which was noted above as occurring between 2017 and 2022. Loss of farmland would reduce farm-to-market opportunities including potential benefits of grower collectives and agricultural co-ops if memberships are reduced due to farmland to developed use conversions when farmers choose to sell their lands.

Conversion of farmland to developed uses (residential, commercial, and industrial) would require the initial and continued support from existing and new industries/businesses in the region for utilities, construction, manufacturing, transportation and warehousing, finance, real estate, professional and business services, education, health care, and government enterprises. In addition to the jobs created, it is anticipated that the goods and services provided by these new industries would exceed the value of the lost agricultural production to the local and state economies when farmers choose to sell their land in areas suitable for growth and where land values have increased. The effects may be increased on smaller farm operations where higher land values and taxes could have disproportionate effects when the operations do not have the financial resources to continue farming in respect to increased costs. However, it is anticipated that Alternatives B and C would have probable, moderate, incremental and positive aggregate effects on local economies because the benefits would be moderate, and adverse direct and downstream effects of these alternatives to economies would be unlikely and minor in severity if they were to occur.

Alternatives D, E, F, and G

Alternatives D and E would replace the existing Bay Bridge spans with two new bridge spans, remove the existing Bay Bridge, and would consist of eight lanes along U.S. 50/301 on the Western Shore, eight lanes on the new bridge, and eight lanes along U.S. 50/301 on the Eastern Shore. Therefore, both alternatives would increase the number of lanes along U.S. 50/301 by two lanes as compared to Alternatives B and C.

Alternatives F and G would replace the existing Bay Bridge spans with two new bridge spans and would consist of eight lanes along U.S. 50/301 on the Western Shore, 10 lanes on a new bridge, and eight lanes along U.S. 50/301 on the Eastern Shore. Therefore, both alternatives would increase the number of lanes along the bridge and along U.S. 50/301 by two lanes as compared to Alternatives B and C. The alternatives would increase the number of lanes across the bridge by two lanes as compared to Alternatives D and E.

Between the two larger sets of alternatives (Alternatives D and E versus Alternatives F and G), Alternatives F and G have the greatest potential for positive and negative effects to socioeconomic resources. As Alternatives F and G would likely cause the greatest potential direct and downstream effects, they also have the highest potential to have adverse aggregate effects on land use, community cohesion, community facilities and recreation resources, and agrarian production.

With the added travel lanes compared to the other four build alternatives, Alternative F and G also have the highest potential to positively address the needs of improving travel times and mobility across the Chesapeake Bay at the Bay Bridge. As they are the largest in scale compared to the other build alternatives, they would conceivably support the local construction material and hospitality industries (lodging, food, and beverage services) in the Analysis Area for a longer period of time contributing a greater amount to the local economies. Finally, with the greatest potential for induced growth (See **Section 8.2**), Alternatives F and G would require the greatest amount of initial and continued support from existing and new industries/businesses in the region for utilities, construction, manufacturing, transportation and warehousing, finance, real estate, professional and business services, education, health care, and government enterprises. Therefore, these alternatives would have the largest probable, moderate, incremental, and positive aggregate effects on local economies, because the benefits would be moderate, and adverse direct and downstream effects of these alternatives to economies would be unlikely and moderate in severity if they were to occur. The navigational clearance would be the same for the four build alternatives and therefore would provide a probable moderate benefit to the regional and national economies.

9.3.2 Natural Resources

Past and present actions, and foreseeable future growth and development actions in the Analysis Area have been, and primarily would be, adverse to natural resources. Past intensification of land use particularly on the Western Shore has resulted in reduced water quality with many waters impaired for human and wildlife use (including Chesapeake Bay); loss of wetlands, streams, and floodplains; substantial wildlife population loss from overexploitation and loss of habitat; fragmented habitat; and degraded habitat quality. This has led to some species becoming threatened and endangered with extinction. On the Eastern Shore, agricultural production, rural development, and suburban development have resulted in degraded terrestrial and aquatic habitat due to forest clearing, filling, and draining of wetlands, piping and rerouting of streams, construction of impediments to fish passage, and reduction in water quality due to sediment, microbe (from grazing or feeding operations), and nutrient laden runoff.

The habitat alteration and development which has occurred reduced natural cover, increased impervious surface area, prevented natural infiltration, and increased stormwater runoff. Therefore, the contributing actions, and their consequences, have had a negative effect on natural resources and wildlife in the Analysis Area. Federal, state, and local regulations enacted over

the last 50 years have slowed this loss of wildlife and wildlife habitat, improved wildlife habitat, and water quality in some locations, and recovered some protected species. These regulations require consideration of avoidance and minimization of adverse impacts on natural resources.

Current environmental regulations, natural resource planning, conservation, and restoration efforts have protected and reduced impacts on natural resources more than what would otherwise have continued to occur prior to the 1970s. Future growth and development in the Analysis Area should be subject to the land use policies of each jurisdiction that aim to concentrate while preserving natural lands.

9.3.2.1 Alternative A (No-Build)

Alternative A (No-Build) would not provide a new Bay Crossing connecting the Western and Eastern shores of the Chesapeake Bay in Maryland. Other present or foreseeable future projects are occurring or may occur (**Table 9-1** and **Table 9-2**), and some of these may result in effects on natural resources within the Analysis Area. However, no incremental foreseeable effects to the natural environment would occur as a result of Alternative A (No-Build).

9.3.2.2 Build Alternatives

Alternatives B and C

As previously discussed, past growth and development have diminished natural resources within the Analysis Area encompassing the Alternatives B and C improvements. However, current federal, state, and local regulations and non-governmental conservation efforts minimize the effects of such development.

Past roadways, surrounding residential and commercial developments on the Western Shore, on Kent Island and along adjacent waterways, bounding U.S. 50/301, and within the towns on the Eastern Shore, along with agricultural production on the Eastern Shore, have contributed to fragmentation of terrestrial resources and terrestrial wildlife habitat within the Analysis Area (see **Appendix D**). Both Alternatives B and C improvements would cause some additional direct, terrestrial resource and habitat losses (**Table 7-1**).

Alternative B and Alternative C would have probable, minor positive incremental impacts to water resources and aquatic habitat and wildlife from improved stormwater treatment compared to existing conditions. However, considering the dredging required within the Chesapeake Bay for construction of the new Bay Bridge, these alternatives would have a probable, moderate incremental impact to water resources and aquatic habitat and wildlife, such as benthic habitat, SAV, EFH, public shellfishery areas, and oyster sanctuaries. Independent of potential induced growth effects, with mitigation, the incremental contribution of Alternatives B and C to adverse effects on wetlands and waters would be probable and moderate, with probable, incremental, and moderate adverse effects to floodplains. Considering the potential induced growth effects of future independent projects with Alternatives B and C improvements, and the aggregate impacts of past and present projects, with anticipated required mitigation, the incremental contribution of Alternatives B and C to adverse effects on wetlands and waters would be probable and moderate, with probable, incremental, and moderate adverse effects to floodplains.

The aggregate impacts to floodplains, wildlife habitat, and threatened, endangered, and special status species from present and reasonably foreseeable projects are difficult to quantify, as there are no comprehensive regulatory mechanisms that track aggregated impacts to these resources,

and the actual impacts from future independent projects cannot be known. Based on current and projected growth in the Analysis Area, it is reasonable to assume that current trends of impacts to floodplains, wildlife habitat, and threatened, endangered, and special status species would continue into the reasonably foreseeable future. State and federal regulations would continue to require that the reasonably foreseeable future actions listed (**Table 9-1** and **Table 9-2**) avoid and minimize effects on these resources.

Alternatives B and C are not expected to substantially contribute to the further impairment of any impaired waterbodies. Independent of induced growth effects of Alternatives B and C and other future independent projects, the alternatives would have probable, moderate adverse and probable, positive incremental effects to impaired water quality in the Analysis Area. Considering the potential induced growth effects of future independent projects with Alternatives B and C improvements, with anticipated required adherence to stringent stormwater management regulations with present and future projects, the incremental contribution of Alternatives B and C to adverse effects on water quality are probable, moderate, and adverse.

Terrestrial threatened and endangered species, and special status species habitat, in the LODs of the alternatives includes habitat for the NLEB, tricolored bat, monarch butterfly, and migratory birds. Due to the current barriers presented by U.S. 50/301, including noise and artificial lighting, the aggregate effect on NLEB, tricolored bats, and migratory birds from the actual improvements would be possible and moderate in severity. Considering the potential induced growth effects of future independent projects with Alternatives B and C improvements, with anticipated required adherence to threatened, endangered, and special status species regulations with these present and future projects, the incremental contribution of Alternatives B and C to adverse effects on terrestrial protected species are probable, moderate, and adverse.

Alternatives D, E, F, and G

Incrementally, with the additional lanes for each set of larger alternatives, there would be increased direct effects to natural resources (See **Table 7-1**), greater potential for downstream effects (See **Section 8.1**), including induced growth (See **Section 8.2**), and therefore a greater potential for aggregate effects as compared to Alternatives B and C. As Alternatives F and G include the greatest amount of potential direct and downstream effects (including induced growth), they also have the highest potential to contribute to adverse aggregate effects to these resources (terrestrial resources, water resources, wildlife and habitat, and threatened, endangered, and special status species).

Independent of potential induced growth effects from Alternatives D through G and other future independent projects, with mitigation, the incremental contribution of Alternatives D and E and Alternatives F and G to adverse effects on wetlands and waters would be probable and moderate, with probable, incremental, and moderate adverse effects to floodplains. Considering the potential induced growth effects of future independent projects with Alternatives D and E and Alternatives F and G improvements, and analysis of the previous development which occurred in the Analysis Area prior to widening of the Bay Bridge in the early 1970s (see imagery in **Appendix D**), with anticipated required mitigation, the incremental contribution of both Alternatives D and E and Alternatives F and G to adverse effects on wetlands and waters would be probable and major, with probable, incremental, and major adverse effects to floodplains.

Independent of induced growth, the larger sets of ARDS would have probable, moderate adverse and probable, positive incremental effects to impaired water quality in the Analysis Area. Considering the potential induced growth effects of future independent projects with Alternatives D and E and Alternatives F and G improvements, with anticipated required adherence to stringent stormwater management regulations with present and future projects, the incremental contribution of Alternatives D and E and Alternatives F and G to adverse effects on water quality would be greater than that realized with either Alternative B or Alternative C and the effects would be probable, moderate, and adverse.

The same as Alternative B and Alternative C, terrestrial threatened and endangered species, and special status species habitat, in the LODs of Alternatives D and E and Alternatives F and G includes habitat for the NLEB, tricolored bat, monarch butterfly, and migratory birds. Additionally, the LODs of Alternatives D, E, F, and G include habitat for Delmarva fox squirrel. Following the tie-ins of the bridge approaches to U.S. 50/301, direct forest clearing for the improvements would occur within previously fragmented areas of linear habitat in the rights-of-way, and in low-quality edge habitat along the feeder roads at the existing intersections of U.S. 50/301 extending to the U.S. 50 and U.S. 301 split in Queen Anne's County. While some forested areas are designated as FIDS habitat, clearing would be limited to the edges of FIDS habitat and interior habitat would not be directly impacted. These areas represent low-quality foraging and roost habitat value because they occur in an existing road corridor. Therefore, potential effects of tree removal would be to habitat only, not direct impacts to NLEB, tricolored bat, monarch butterfly, migratory birds, or Delmarva fox squirrel. Due to the current barriers presented by U.S. 50/301, including noise and artificial lighting, and due to the larger extent of forest clearing potentially occurring with Alternatives D and E and Alternatives F and G improvements when compared to either Alternative B or Alternative C (see **Table 7-1**), the aggregate effect on NLEB, tricolored bats, monarch butterfly, migratory birds, and Delmarva fox squirrel from the actual improvements would be possible and moderate in severity. Considering the potential induced growth effects of future independent projects with Alternatives D and E and Alternatives F and G improvements, including anticipated required adherence to threatened, endangered, and special status species regulations with these present and future projects, the incremental contribution of Alternatives D and E and Alternatives F and G to adverse effects on terrestrial protected species are probable, major, and adverse.

9.3.3 Historic Properties

With human occupation of the Maryland Chesapeake Bay region extending thousands of years into the past and ongoing today, archaeological and architectural historic properties have been continuously altered by succeeding developments over time in the Analysis Area. Transportation improvements and other actions potentially adversely affect archaeological and architectural historic properties by destruction or altering the integrity of their historically significant characteristics. Federal and state laws requiring agencies to consider effects on historic properties have slowed their loss. Section 4(f) of the Department of Transportation (DOT) Act of 1966 affords protection on historic properties by requiring DOT agencies to avoid adversely affecting archaeological and architectural historic properties important for preservation in place and only authorizing adverse effects if there is no prudent and feasible alternative.

Transportation improvements can also increase visitation to historic properties open to the public, sustaining historic property tourism and providing incentives for preservation. Other incentives for historic preservation are offered by federal, state, and local governments in the form of grants and tax breaks.

9.3.3.1 Alternative A (No-Build)

Alternative A (No-Build) would not provide a new Bay crossing between the Western and Eastern Shores of the Chesapeake Bay in Maryland and the existing Bay Bridge would not be improved or removed. Therefore, no incremental effects attributable to the Bay Crossing Study would occur to historic properties.

9.3.3.2 Build Alternatives

Past actions that have impacted on historic properties include the numerous infrastructure, agricultural, and land development activities that have occurred in the Analysis Area. The Analysis Area has experienced substantial growth of population, housing, and employment since 1970 (see **Section 6.1.7**). This has resulted in destruction or degradation of many resources, including demolition by new construction or changes in land use context surrounding historic properties. Present and future actions, including transportation projects and land development activities, would likely continue to impact historic properties in similar ways. For transportation projects with federal funding (such as included in **Table 9-2**), existing protective regulations and consultation requirements associated with Section 106 and Section 4(f) resources would minimize and mitigate for such effects. Potential present and future impacts on historic properties from non-transportation projects (such as included in **Table 9-1**) would also be subject to applicable federal, state, and local planning ordinances that protect many of these resources.

Alternatives B and C

Direct effects on archaeological and historic architectural properties have been considered under Section 106 of the NHPA for Alternatives B and C. Three architectural historic properties (Skidmore, Sandy Point State Park, and the existing Bay Bridge) would be adversely affected Alternative B, and two properties impacted by Alternative C (Skidmore and the existing Bay Bridge). No known archaeological historic properties would be adversely affected by either Alternatives B or C improvements. Portions of the APE of the selected alternative with a high potential for archaeological remains that have not been previously intensively inventoried would be surveyed in later phases of the study.

Future actions, such as redevelopment projects conducted by local governments, and various transportation and other present and reasonably foreseeable projects may have adverse effects on historic properties. These actions may encroach upon or necessitate the removal or relocation of historic properties, which would cause adverse effects to the historic setting and nature of the properties. Due to the complete removal of the existing historic Bay Bridge, the incremental contribution of Alternatives B and C to aggregate effects on historic properties, including from induced growth, would be probable in likelihood and major in severity.

Alternatives D, E, F, and G

Like for Alternatives B and C, direct effects to archaeological and historic architectural properties have been considered under Section 106 of the NHPA for Alternatives D and E and Alternatives F and G. Five architectural historic properties (Skidmore, Sandy Point State Park, Dutch Mill

Farm Restaurant, Sharpe-Ridout-Boone Mill, and the existing Bay Bridge), would be adversely affected by Alternatives D and F, and four properties impacted by Alternatives E and G (Skidmore, Dutch Mill Farm Restaurant, Sharpe-Ridout-Boone Mill, and the existing Bay Bridge). One known archaeological historic property (Sharpe-Ridout-Boone Mill) would be adversely affected by all four build alternatives. Due to the complete removal of the existing Bay Bridge and other historic property adverse effects, the incremental contribution of all four build alternatives to aggregate effects on historic properties, including from induced growth, would be probable in likelihood and major in severity.

9.3.4 Summary of Aggregate Effects

Table 9-4 summarizes the alternative's potential contribution to aggregate effects on the resources evaluated. Incremental impacts of the alternatives contributing to aggregate effects to socioeconomic resources, natural resources, and historic properties would range from possible to probable in likelihood and be minor to major in severity depending on the resource evaluated and ARDS considered.

Past and present actions have shaped the current state of land use and socioeconomic resources, natural resources, and historic properties within the Analysis Area, as well as regionally. These actions have been both beneficial and adverse to socioeconomic resources, and adverse to land use, natural resources, and historic properties. Although the build alternatives would have probable minor to moderate impacts on socioeconomic resources, coupled with past, present, and future actions, the overall aggregate effects of all actions should be beneficial to socioeconomic resources. The incremental effects of the build alternatives to natural resources in the Analysis Area would be primarily adverse and moderate to major in severity (depending on the build alternative size and potential for induced growth). The incremental effects of the build alternatives to historic properties would be probable, and major in severity due to the removal of the existing Bay Bridge. Adherence to current and future regulatory requirements and planning practices should minimize the aggregate effects of each of the build alternatives and the effects of other present and future projects on natural resources and historic properties in the Analysis Area.

Table 9-3: Summary of Alternative Incremental Contribution to Aggregate Effects

Resource	No-Build Alternative	Alternatives B and C[1]	Alternatives D through G[1]
Socioeconomic Resources	Moderate / Adverse	Minor to Moderate / Beneficial and Adverse	Moderate / Beneficial and Adverse
Natural Resources	None	Moderate / Predominantly Adverse	Moderate to Major / Predominantly Adverse
Historic Properties	None	Major / Adverse[2]	Major / Adverse[2]

1. Includes potential effects from induced growth.

2. Due to the removal of the historic Bay Bridge.

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