State and District of Columbia Analyses

CHESAPEAKE BAY COMPREHENSIVE WATER RESOURCES AND RESTORATION PLAN

STATE CHAPTER

State of Delaware

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US Army Corps of Engineers®

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SECTION 1

1.1 Introduction

The goal of the *Chesapeake Bay Comprehensive Water Resources and Restoration Plan* (CBCP) is to provide a single, comprehensive and integrated restoration plan that would assist with implementation of the *2014 Chesapeake Bay Watershed Agreement* (2014 Bay Agreement). The CBCP provides a "roadmap" of implementation actions to protect, restore, and preserve the Chesapeake Bay and actions that adopt and align with what other organizations are doing without duplicating ongoing or planned actions. Additionally, the CBCP maximizes the use of existing information and identifies projects that can be implemented in each jurisdiction in the Chesapeake Bay Watershed.

The CBCP aligns with the vision established in the 2014 Bay Agreement:

"We envision an environmentally and economically sustainable [and resilient] Chesapeake Bay watershed with clean water, abundant life, conserved lands and access to the water, a vibrant cultural heritage, and a diversity of engaged citizens and stakeholders."

To identify implementation actions to protect, restore, and preserve the Chesapeake Bay, geospatial analyses were conducted at a 1) baywide, 2) jurisdiction or state, and 3) a watershed scale. The baywide analysis characterized problems, needs, and opportunities at a hydrologic unit code 10 (HUC 10) scale, hereafter referred to as subwatershed. CBCP analyses were based on a core set of questions formulated from the 2014 Bay Agreement goals and outcomes as well as stakeholder input. The baywide analysis resulted in a set of recommended implementation strategies that included locations (subwatersheds), potential management measures, a range of potential costs, benefits, potential project implementation agencies, and any sequencing or dependences that could affect implementation. The full results of the baywide analysis are described in the CBCP Main Report. The CBCP state analyses are the result of the baywide analysis "clipped" per jurisdiction in the Chesapeake Bay Watershed (New York, Pennsylvania, West Virginia, Virginia, Maryland, Delaware, and the District of Columbia). The results of State of Delaware Analysis are described in this section of the report. The portion of the Chesapeake Bay Watershed within Delaware is referred to as Delaware throughout this chapter.

The CBCP state-selected watershed analysis contains a more detailed investigation in each jurisdiction, with the goal of identifying more site-specific project-scale opportunities (with priorities defined by each jurisdiction) for implementation. The Nanticoke River Watershed was identified as the state-selected watershed by the State of Delaware for stream restoration, wetland creation, and agricultural best management practices (BMPs). A number of agencies have identified the Nanticoke River watershed as a priority including Ducks Unlimited, the National Fish and Wildlife Foundation (NFWF), The Nature Conservancy, and the U.S. Fish and Wildlife Service (USFWS). Additionally, the *Condition of Nontidal Wetlands in the Nanticoke River Watershed, Maryland and Delaware* report, dated September 2008 (available at http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Documents/Nanticoke%20Wetland%20Profile_final.pdf) and the *Nanticoke River Watershed Restoration Plan,* dated May 2009 (available at

http://www.dnrec.delaware.gov/Admin/DelawareWetlands/Documents/Nanticoke_Restoration_Plan_4May09.pdf) are strategic plans previously developed for assisting in the restoration of the Nanticoke River watershed.

The following are reference maps displaying the boundaries, name (Figure 1), and number (Figure 2) of each HUC 10 subwatershed in Delaware. Table 1 (all tables are provided following the report content) provides the number, name, size (acres), and other drainage states of each Delaware HUC 10 subwatershed. Hereafter, HUC 10 subwatersheds are referred to simply as subwatersheds.

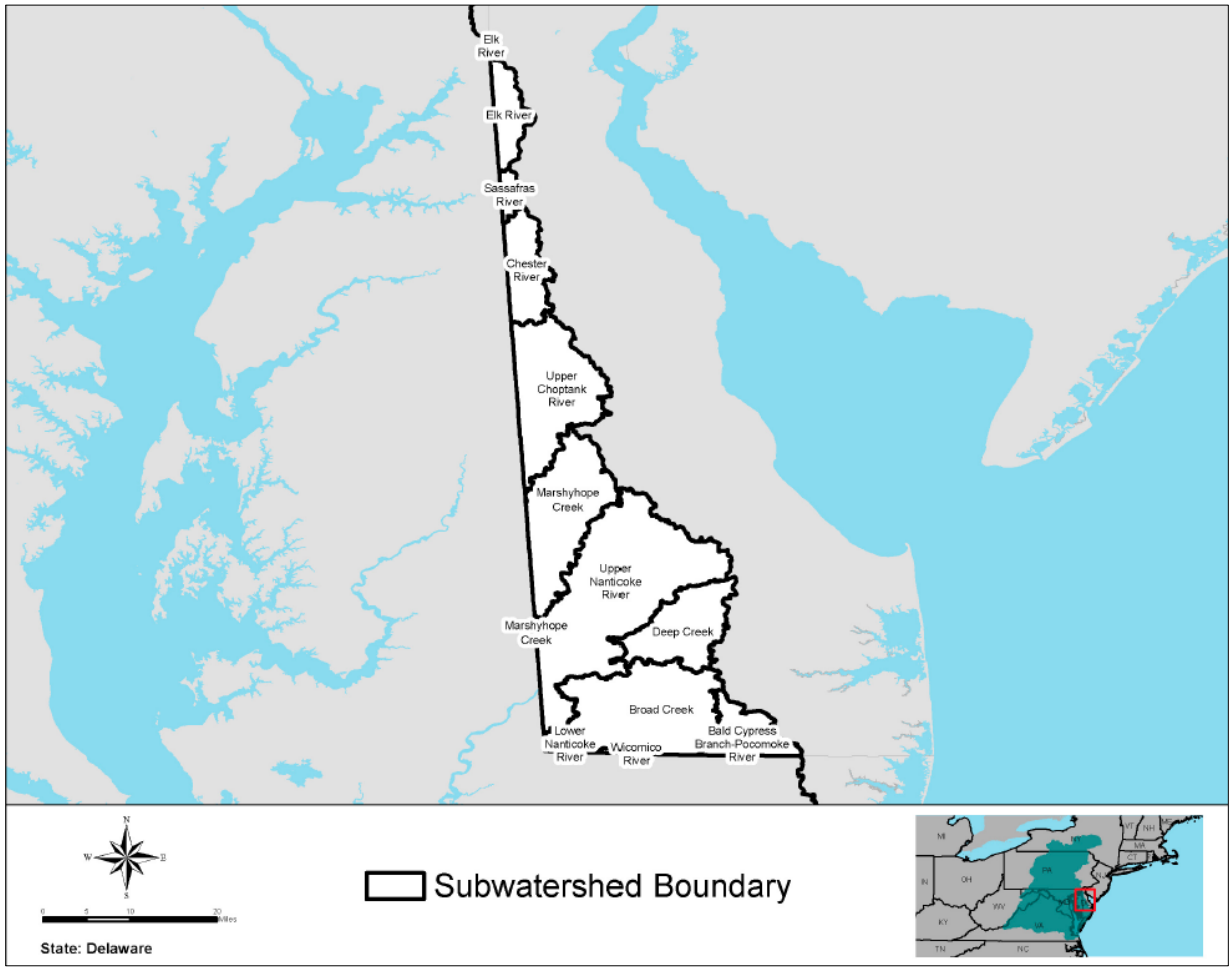

Figure 1. Hydrologic unit code (HUC) 10 subwatershed names for Delaware

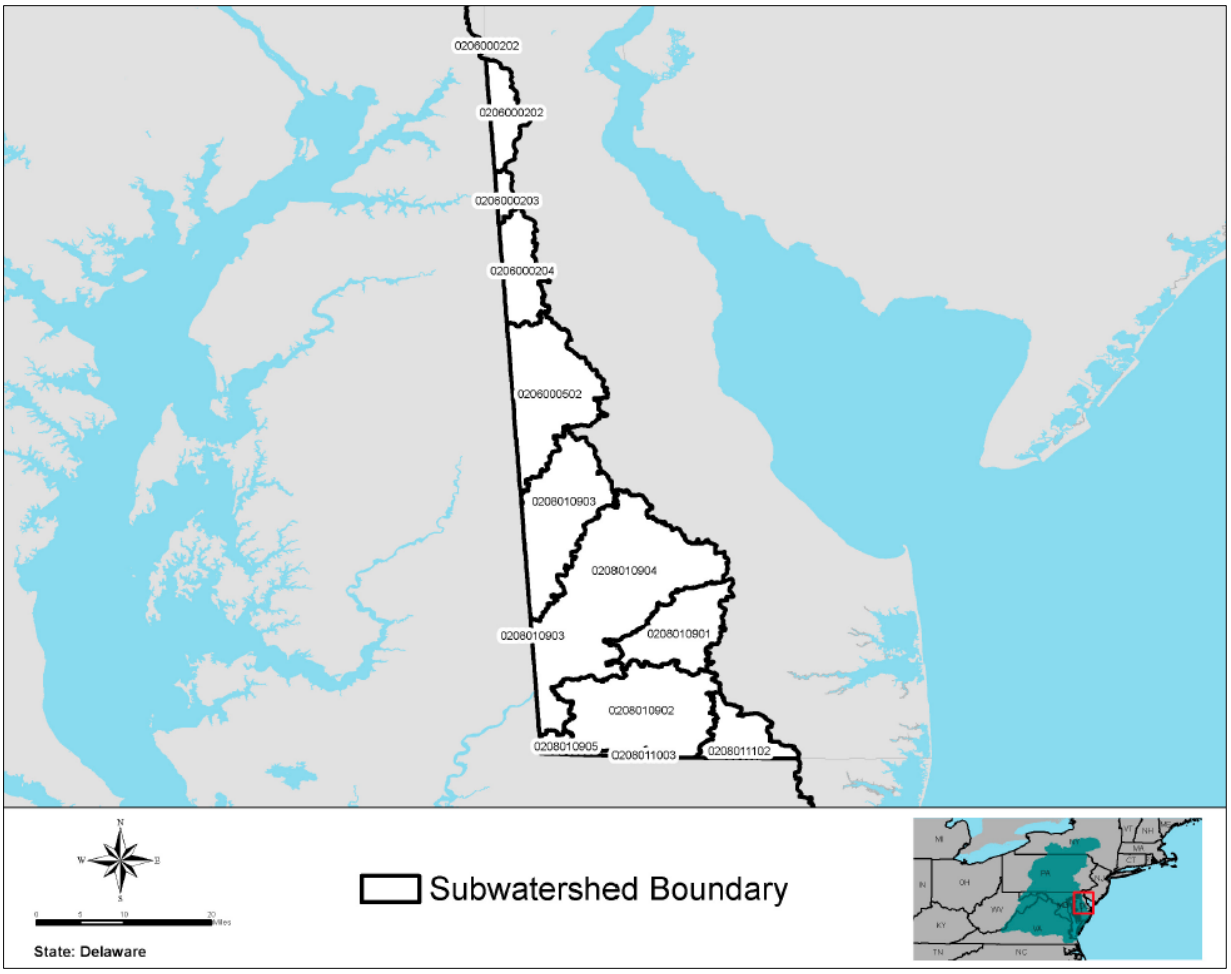

Figure 2. Hydrologic unit code (HUC) 10 subwatershed numbers for Delaware

Table 1. Summary of each hydrologic unit code (HUC) 10 subwatershed in Delaware

HUC 10 Number	Subwatershed Name	Acres	Drainage States
0206000204	Chester River	302,621	DE, MD
0206000202	Elk River	172,346	DE, MD, PA
0206000502	Upper Choptank River	165,569	DE, MD
0208010904	Upper Nanticoke River	150,145	DE
0208011003	Wicomico River	147,430	DE, MD
0208010903	Marshyhope Creek	140,636	DE, MD
0208011102	Bald Cypress Branch-Pocomoke River	138,122	DE, MD
0208010905	Lower Nanticoke River	118,238	DE, MD
0208010902	Broad Creek	79,228	DE
0206000203	Sassafras River	62,118	DE, MD
0208010901	Deep Creek	41,149	DE

1.2 Watershed Stressors

The Watershed Stressors Analysis evaluated the presence of stressors in each subwatershed based on six metrics listed below. See the Planning Analyses Appendix for more details on the data used.

- *Percent impervious cover* (Chesapeake Conservancy 2016)
- *Percent forest cover* (Chesapeake Conservancy 2016)
- *Percent of stream network with forested riparian buffers* (Environmental Protection Agency (EPA) 2010)
- *303(d) impaired waterways list* (EPA)
- *Benthic Index of Biotic Integrity (B-IBI)* (Chesapeake Bay Program (CBP))
- *Nitrogen and phosphorous yields* (as predicted by Spatially Referenced Regressions on Watershed (SPARROW) modeling)

Results of the Watershed Stressors Analysis for each subwatershed in Delaware are shown on Figure 3 and in Table 2. Subwatersheds that contain the least watershed stressors resulted in a high watershed stressor score, and subwatersheds that contain the most watershed stressors resulted in a low watershed stressor score. The healthiest watersheds are areas that, if not already protected, would be good candidates for protection. The areas that are less healthy indicate areas that may benefit from restoration actions aimed at increasing the overall health of the subwatersheds. In general, the pattern of watershed stressors typically follows that of development, with the greater the amount of development and industrial activities in an area, the more stressed the watershed.

Based on the CBCP analysis, all the subwatersheds in Delaware have a low watershed stressor score (0.39 or lower) and are considered to be in poor health. The Wicomico River Subwatershed (HUC 0208011003) contains the most watershed stressors (resulting in the lowest watershed stressor score) and the Deep Creek Subwatershed (HUC 0208010901) has the least watershed stressors (resulting in the highest watershed score).

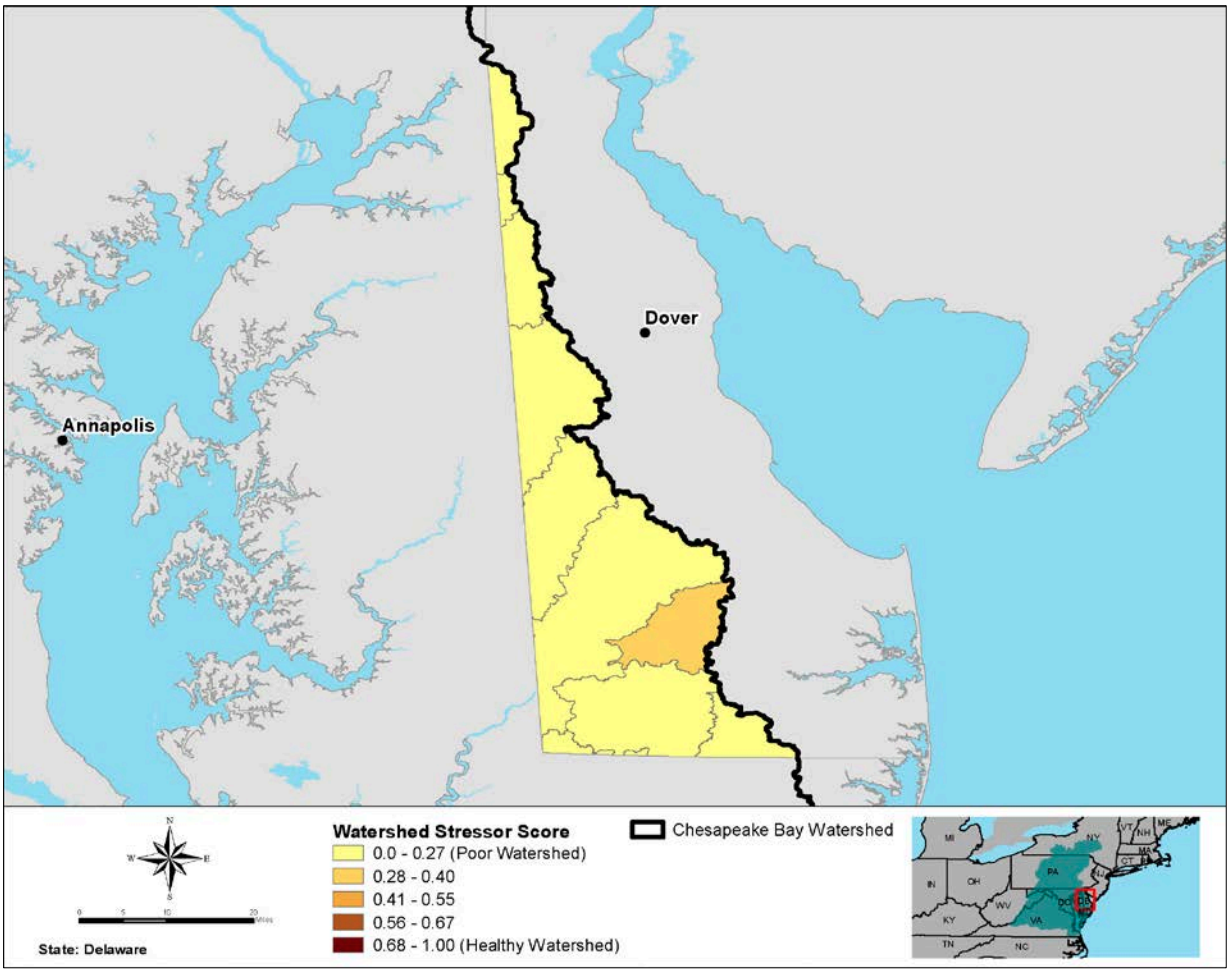

Figure 3. Watershed Stressors Analysis for Delaware

Table 2. Watershed Stressors Analysis for Delaware

Subwatershed Name	Watershed Stressor Score
Deep Creek	0.39
Elk River	0.28
Sassafras River	0.28
Upper Choptank River	0.28
Broad Creek	0.28
Upper Nanticoke River	0.28
Lower Nanticoke River	0.28
Chester River	0.22
Marshyhope Creek	0.22
Bald Cypress Branch-Pocomoke River	0.22
Wicomico River	0.17

SECTION 2

Restoration Efforts Contributing to Baywide Priorities

Opportunities for action were identified throughout the Chesapeake Bay Watershed by the baywide geospatial analyses. The *Opportunities Assessment* identifies subwatersheds with the greatest potential, need, or impairment, depending on the nature of the evaluation. The following sections discuss the *Opportunities Assessment* findings in Delaware and presents *Opportunity* maps that highlight subwatersheds holding the greatest potential to address the need investigated in each map. Shaded cells in the tables and darker-colored subwatersheds in the figures represent subwatersheds with the highest amount of *Opportunities*.

2.1 Vital Habitats Goal

"Restore, enhance and protect a network of land and water habitats to support fish and wildlife and to afford other public benefits, including water quality, recreation uses and scenic value across the watershed."

2.1.1 Outcome: Black Duck

"By 2025, restore, enhance and preserve wetland habitat to support a wintering population of 100,000 black ducks. Refine population targets through 2025 based on best available science."

The CBP black duck focus areas were overlaid on the CBCP wetland restoration and enhancement maps to identify the subwatersheds that provide wetland restoration and enhancement opportunities with the potential to benefit black duck populations during the nonbreeding, over-wintering season.

Results of this analysis identified subwatersheds in which to focus wetland restoration and enhancement to benefit black duck populations during the nonbreeding, over-wintering season lie within the tidally influenced wetland areas of the Chesapeake Bay Mainstem and near the mouths of bay tributaries as these areas are the most important over-wintering habitats utilized by the black duck.

Opportunities for Delaware are shown in Figures 11 and 12 (nontidal and tidal wetland restoration opportunities in important bird areas) and listed in Table 7. There are nontidal restoration opportunities throughout Delaware to benefit the black duck population. All of the subwatersheds in Delaware that are part of the Chesapeake Bay Watershed contain nontidal wetland restoration opportunities and were all identified for the presence of black duck. The Chester River Subwatershed (HUC 0206000204) provides 122,820 acres of nontidal wetland restoration opportunities to benefit the black duck population.

2.1.2 Outcome: Eastern Brook Trout

"Restore and sustain naturally reproducing brook trout in the Chesapeake Bay's headwater steams, with an eight percent increase in occupied habitat by 2025."

Geospatial data and analyses regarding brook trout have been provided by the CBP and Trout Unlimited, and are embedded in the Fish Passage, Riparian Forest Buffer, and Stream Restoration Analyses below.

2.1.3 Outcome: Fish Passage

"Continually increase habitat to support sustainable migratory fish populations in the Chesapeake Bay watershed's freshwater rivers and streams. By 2025, restore historical fish migration routes by opening 1,000 additional stream miles to fish passage. Restoration success will be indicated by the consistent presence of alewife, blueback herring, American shad, hickory shad, American eel and brook trout, to be monitored in accordance with available agency resources and collaboratively developed methods."

Fish passage within the Chesapeake Bay Watershed is limited by a significant number of blockages that range from large hydroelectric power-generating dams to historical mill dams to road culverts and utility pipes that have been exposed by erosion. The intent of the CBCP's Fish Passage Blockages Opportunities Assessment was to build upon the work of the CBP's Fish Passage Workgroup to identify where high prioritized blockages are co-located with *Opportunities* for stream restoration. The following data were used in the Fish Passage Blockages Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used).

- *High prioritized fish passage blockages* (CBP Fish Passage Workgroup)
- *Stream Restoration Analysis results* (CBCP)

Results of the Fish Passage Blockages Opportunities Assessment for Delaware are shown in Figure 4 and in Table 3. There are opportunities to improve fish passage throughout Delaware.

- 52 blockages were identified in the Chester River Subwatershed (HUC 0206000204) to benefit anadromous fish
- Opportunities to improve fish passage for anadromous fish were identified in the Elk River (HUC 0206000202), Wicomico River (HUC 0208011003), Upper Choptank River (HUC 0206000502), Marshyhope Creek (HUC 0208010903), and Lower Nanticoke River Subwatersheds (HUC 0208010905)
- Opportunities to improve fish passage for resident fish were identified in the Broad Creek (HUC 0209010902) and Upper Nanticoke River (HUC 0208010904) Subwatersheds

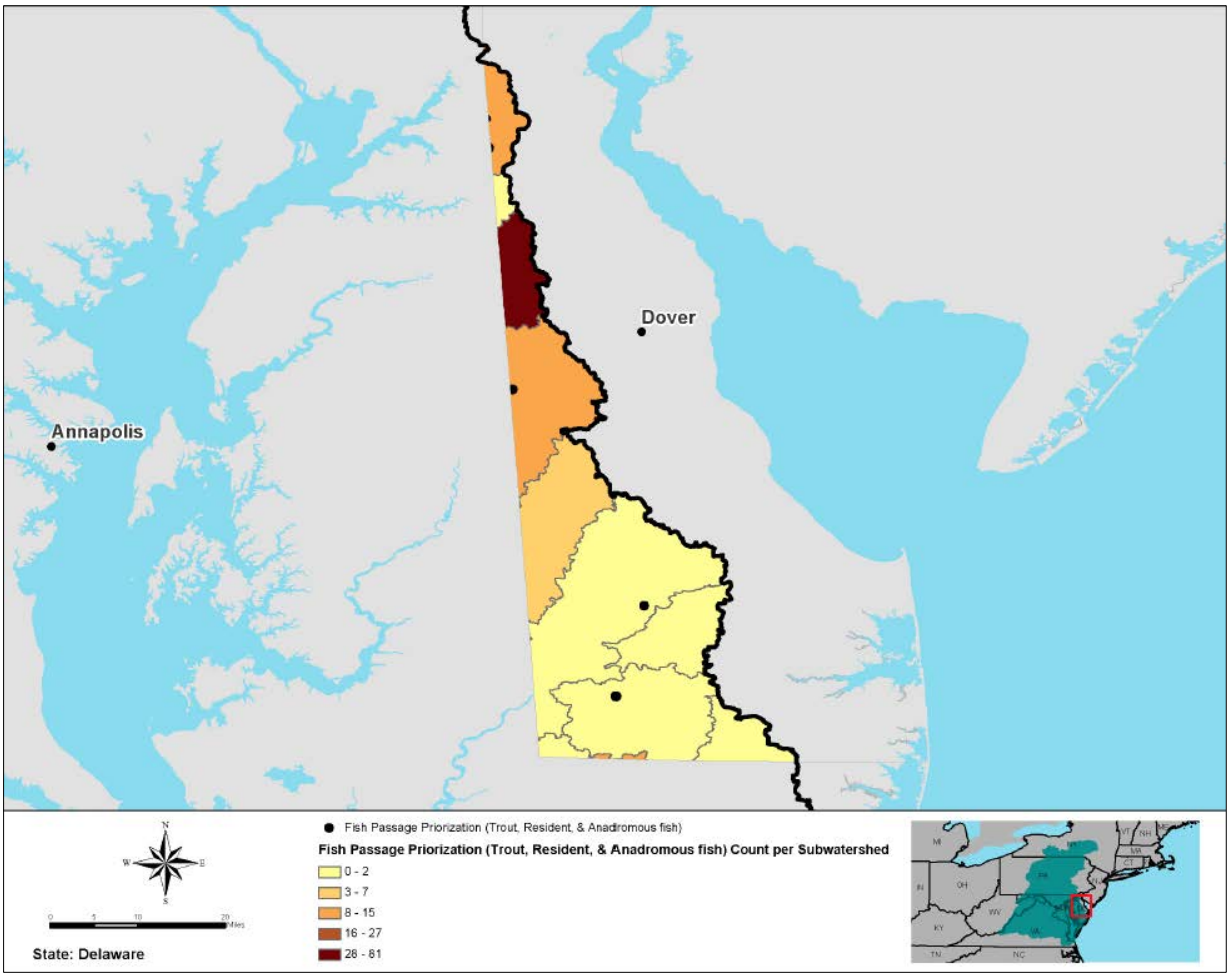

Figure 4. Prioritized fish passage blockages in Delaware

Table 3. Prioritized fish passage blockages in Delaware

Subwatershed Name	Number of Opportunities to Improve Fish Passage for Anadromous Fish	Number of Opportunities to Improve Fish Passage for Resident Fish
Chester River	52	
Elk River	14	
Wicomico River	9	
Upper Choptank River	9	
Marshyhope Creek	3	
Lower Nanticoke River	2	
Broad Creek		1
Upper Nanticoke River		1

2.1.4 Outcome: Riparian Forest Buffers

"*Continually increase the capacity of forest buffers to provide water quality and habitat benefits throughout the Chesapeake Bay watershed. Restore 900 miles of riparian forest buffers per year and conserve existing buffers until at least 70 percent of riparian areas in the watershed are forested.*"

The purpose of the Riparian Forest Buffer Opportunities Assessment was to identify subwatersheds to focus riparian buffer restoration. Riparian buffer restoration can provide numerous benefits while targeting various impairments. This analysis identified subwatersheds where riparian buffer restoration opportunities exist to:

- Address watershed stressors (high-yielding nitrogen and phosphorous subwatersheds)
- Improve brook trout habitat
- Support improving stream habitat for resident fish and migratory species

The following data layers were used in the Riparian Forest Buffer Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *Area of existing riparian buffers* (acres) (forested and non-forested) (CBP from Chesapeake Conservancy 2016)
- *Nitrogen and phosphorous yields* (as predicted by Spatially Referenced Regressions on Watershed (SPARROW) modeling)
- *Brook Trout Watersheds* (U.S. Geological Survey (USGS) National Hydrography Dataset plus catchments identified as potentially supporting brook trout based on the Eastern Brook Trout Joint Venture Salmonid Catchment Assessment and Habitat Patch Layers)
- *National Fish Habitat Assessment* (National Fish Habitat Partnership (NFHAP))
- *Eastern Brook Trout Conservation Portfolio, Range-wide Habitat Integrity and Future Security Assessment, and Focal Area Risk and Opportunity Analysis* (Trout Unlimited, Fessenmeyer et al. 2017)

Results of the Riparian Forest Buffer Opportunities Assessment for Delaware are shown in Figure 5 and in Table 4. In general, there are broad riparian forest buffer *Opportunities* in Delaware. Most of the subwatersheds in Delaware have extensive acreages of forest buffers, with one subwatershed having approximately 90 percent forest coverage within a 30-meter stream buffer. Additionally, many subwatersheds in Delaware with high riparian buffer acreages are areas where streams contain resident fish populations. Subwatersheds for utilizing forest buffer restoration to reduce nitrogen and phosphorus loads are located throughout Delaware.

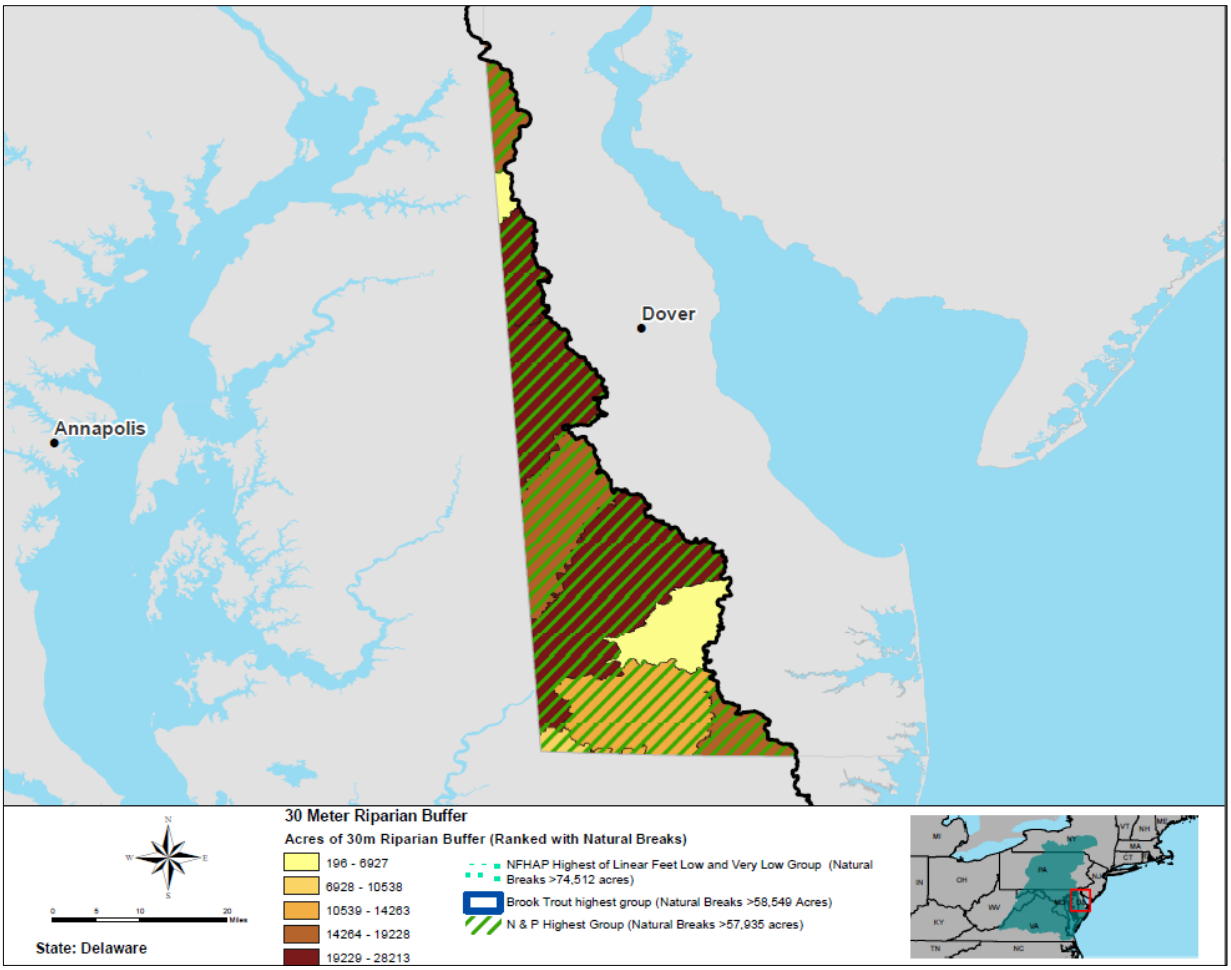

Figure 5. Riparian Forest Buffer Opportunities Assessment for Delaware

Table 4. Riparian Forest Buffer Opportunities Assessment for Delaware

Subwatershed Name	30 Meter Riparian Buffer (Acres)	Resident Fish (Acres)	Brook Trout (Acres)	Nitrogen and Phosphorous (Acres)	Percent Forested Buffer
Chester River	26784	7182	0	229419	89.7%
Upper Choptank River	21137	2083	0	118205	84.4%
Upper Nanticoke River	20248	5522	0	128164	83%
Bald Cypress Branch-Pocomoke River	18914	5921	0	89445	80.1%
Marshyhope Creek	18638	1520	0	106676	79.7%
Elk River	16266	4893	0	136271	69.3%
Wicomico River	13196	18396	0	86044	55.4%
Broad Creek	11257	2834	0	63211	46.7%
Lower Nanticoke River	8806	18852	0	61217	36.2%

2.1.5 Outcome: Stream Health

"Continually improve stream health and function throughout the Chesapeake Bay watershed. Improve the health and function of ten percent of stream miles above the 2008 baseline."

The purpose of this analysis was to identify subwatersheds to focus stream restoration efforts to benefit resident fish, brook trout, and anadromous fish. The following data was used in the Stream Restoration Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *Watershed Stressor Analysis* (CBCP)
- *National Fish Habitat Assessment* (NFHAP)
- *Brook Trout Watersheds* (USGS)
- *Extent of anadromous fish habitat* (CBP)
- *Conservation Strategies for Brook Trout* (Trout Unlimited)

Results of the Stream Restoration Opportunities Assessment for Delaware are shown in Figure 6 and in Table 5. There are many opportunities for stream restoration to benefit fish throughout Delaware. Stream restoration *Opportunities* to benefit anadromous fish and resident fish are located in highly stressed subwatersheds including the Elk River (HUC 0206000202), Chester River (HUC 0206000204), Upper Choptank River (HUC 0206000502), Marshyhope Creek (HUC 0208010903), and the Lower Nanticoke River (HUC 0208010905). Stream restoration *Opportunities* to benefit resident fish are located in highly stressed subwatersheds including the Upper Nanticoke River (HUC 0208010904), Broad Creek (HUC 0208010902), and Bald Cypress Branch-Pocomoke River (HUC 020801102). It is recommended that stressors are addressed prior to or in conjunction with stream restoration efforts in these subwatersheds to develop habitat benefits.

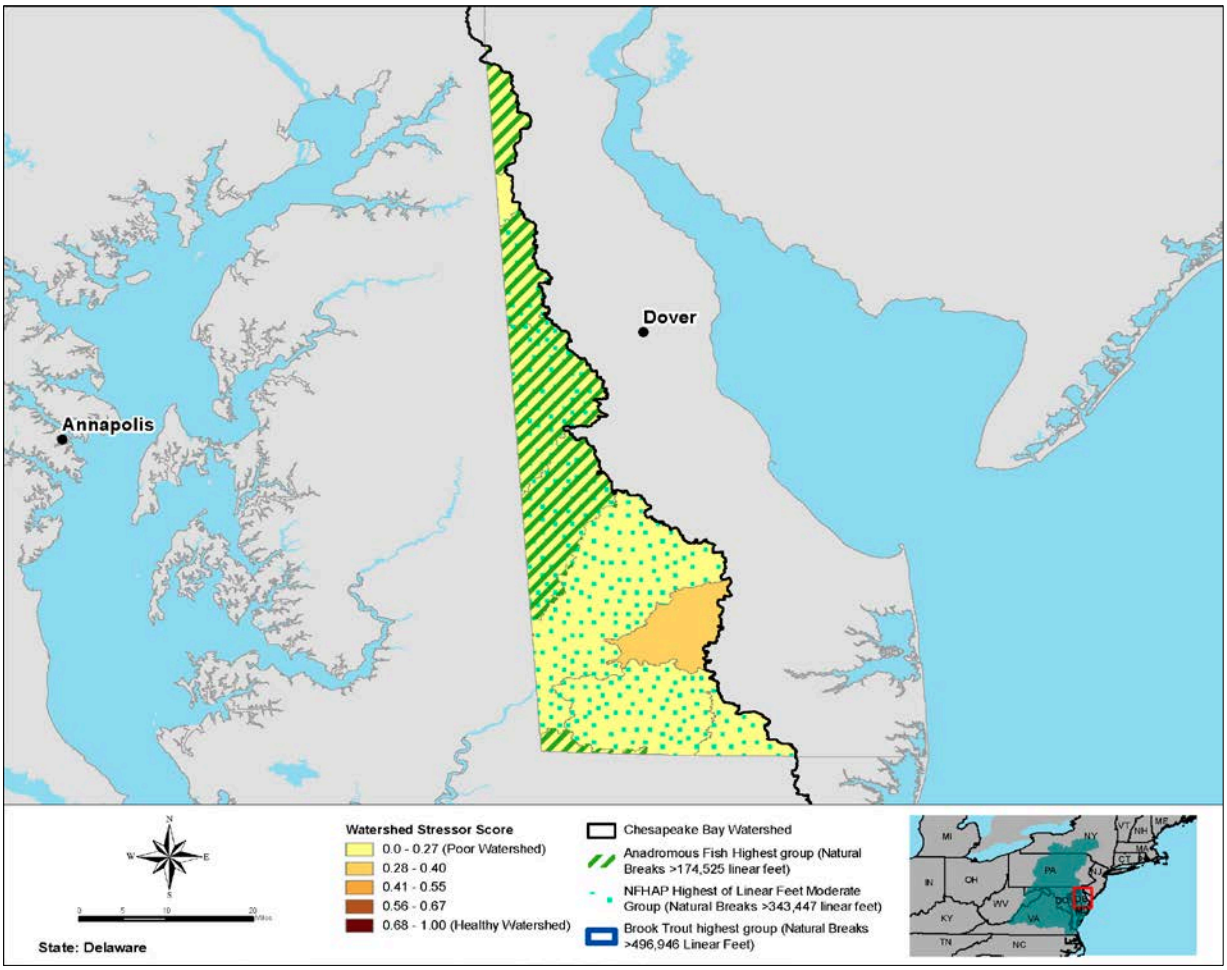

Figure 6. Stream Restoration Opportunities Assessment for Delaware

Conservation strategies for brook trout were incorporated into the Stream Restoration Opportunities Assessment to propose actions to benefit brook trout. No stream restoration *Opportunities* were identified in Delaware to benefit brook trout based on Trout Unlimited conservation strategies.

Table 5. Stream Restoration Opportunities Assessment for Delaware

Subwatershed Name	Watershed Stressor Score	Brook Trout (Linear Feet)	National Fish Habitat Assessment (Linear Feet)
Lower Nanticoke River	0.28	0	316033
Upper Nanticoke River	0.28	0	584753
Broad Creek	0.28	0	365643
Upper Choptank River	0.28	0	742006
Elk River	0.28	0	125252
Bald Cypress Branch-Pocomoke River	0.22	0	658245
Marshyhope Creek	0.22	0	635685
Chester River	0.22	0	504976
Wicomico River	0.17	0	328386

2.1.6 Outcome: Wetlands

"Continually increase the capacity of wetlands to provide water quality and habitat benefits throughout the Chesapeake Bay watershed. Create or reestablish 85,000 acres of tidal and nontidal wetlands and enhance the function of an additional 150,000 acres of degraded wetlands by 2025. These activities may occur in any land use (including urban), but should primarily occur in agricultural or natural landscapes."

2.1.6.1 Identify Wetland Enhancement Opportunities

The Wetlands Enhancement Opportunities Assessment (nontidal and tidal) for Delaware identified areas where wetlands exist and may provide enhancement opportunities to increase their ecological value. The following data was used in the Wetlands Enhancement Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *High Resolution Land Cover Data* (collected in 2016 by the Chesapeake Bay Conservancy and provided by NFWF)
- *Hydric Soils Dataset* (CBP)

Results of the Wetlands Enhancement Opportunities Assessment for Delaware are shown in Figures 7 (nontidal) and 8 (tidal) and in Table 6. Numerous areas with the potential for nontidal wetland enhancement were identified in Delaware, with the highest amount of existing nontidal wetlands (45,444 acres) located in the Bald Cypress Branch-Pocomoke River Subwatershed (HUC 020801102). The Lower Nanticoke River (HUC 0208010905) and the Wicomico River (HUC 0208011003) Subwatersheds have the highest acreage of tidal wetlands.

The existing datasets do not evaluate the function and value of the existing wetlands; therefore, additional field analyses would be necessary to determine the existing wetland areas in need of enhancements and to identify the specific type of enhancement necessary.

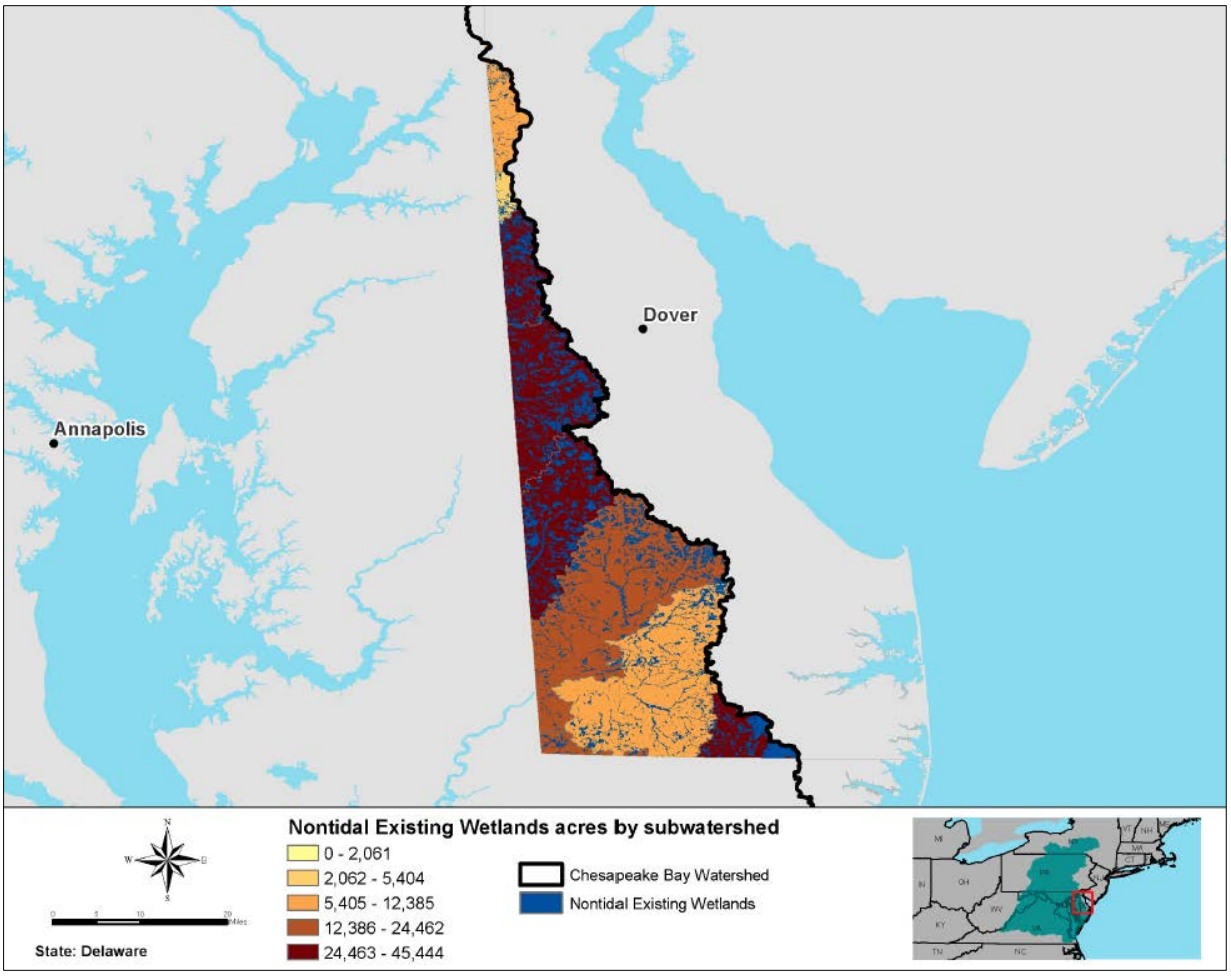

Figure 7. Existing nontidal wetlands in Delaware

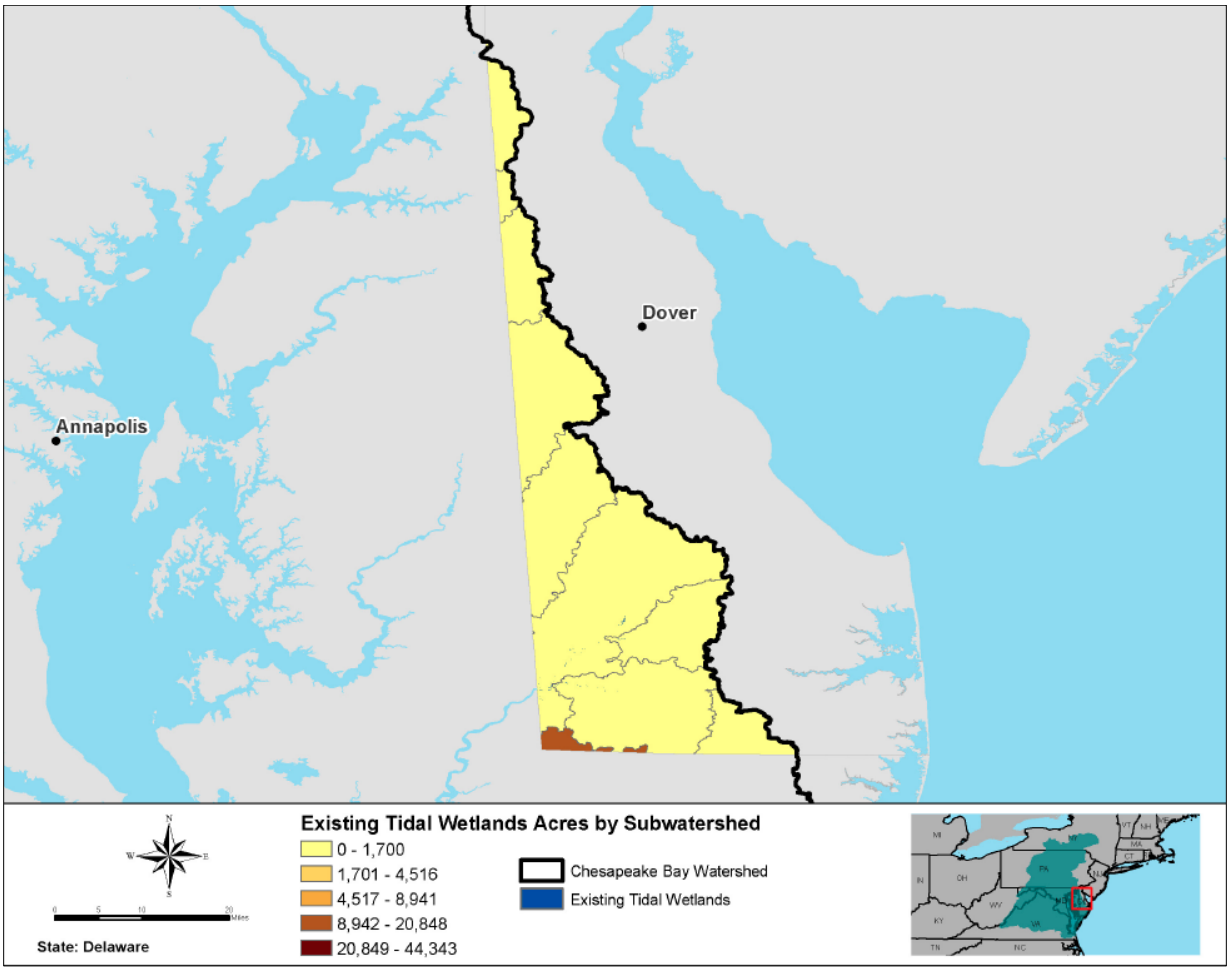

Figure 8. Existing tidal wetlands in Delaware

2.1.6.2 Identify Wetland Restoration Opportunities

The Wetlands Restoration Opportunities Assessment identified opportunities for wetland restoration in Delaware. The following data was used in the Wetlands Restoration Opportunities Assessment (see the Planning Analyses Appendix for more details on each layer):

- *Wetlands Enhancement Opportunities Assessment Results* (CBCP)
- *Digital Elevation Model* (USGS)

Results of the Wetland Restoration Opportunities Assessment (nontidal and tidal) are shown on Figures 9 (nontidal) and 10 (tidal) and in Table 6. The Wetlands Restoration Opportunities Assessment for Delaware identified numerous *Opportunities* for nontidal wetland restoration. The Chester River Subwatershed (HUC 0206000204) had the most potential, based on available acreage (122,820 acres), for nontidal wetland restoration, though there are nontidal wetland restoration *Opportunities* available throughout Delaware. Minimal opportunities exist throughout Delaware for tidal wetland restoration; the Wicomico River Subwatershed (HUC 0208011003) provides the highest opportunity for tidal wetland restoration in Delaware (60 acres).

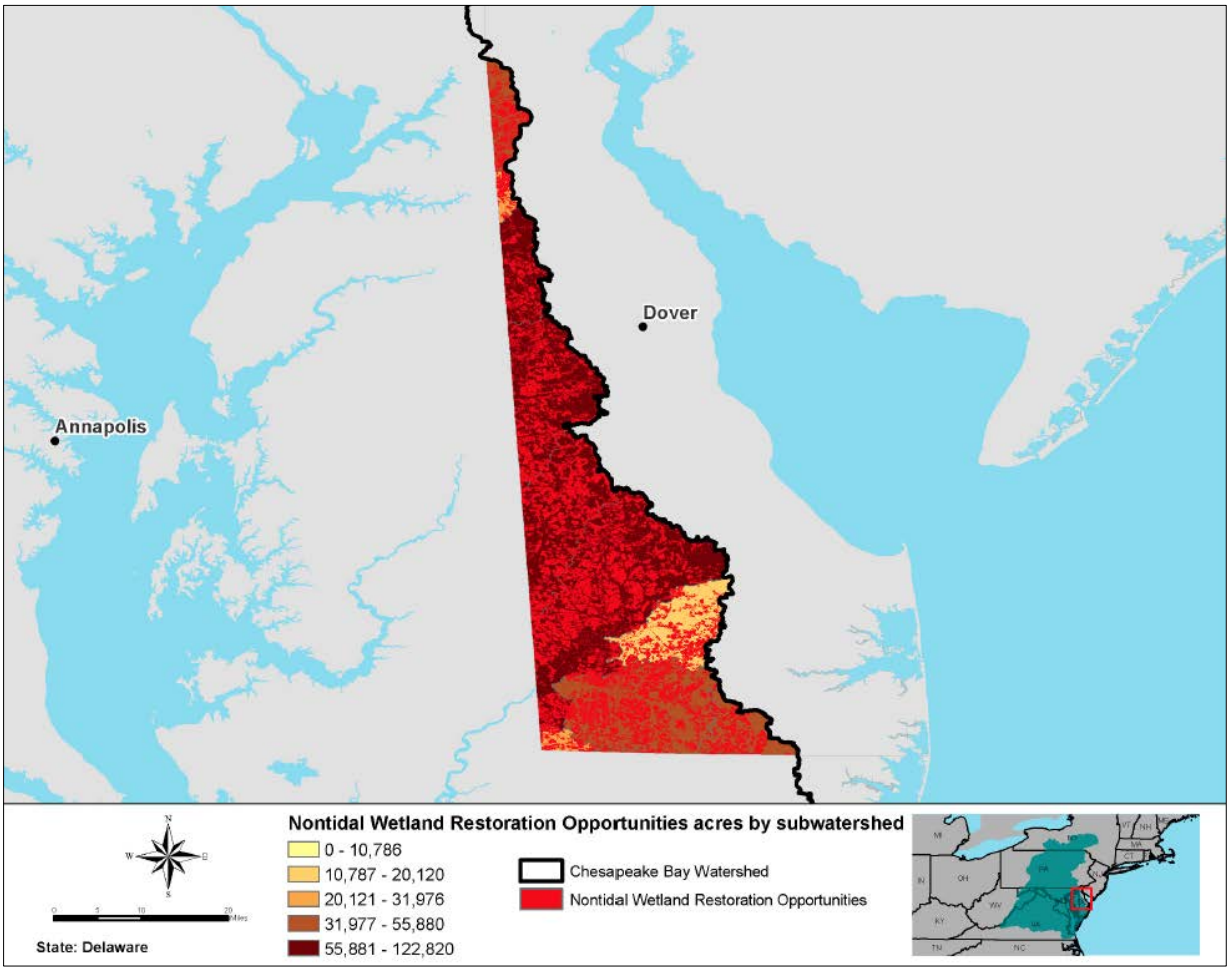

Figure 9. Nontidal wetland restoration opportunities in Delaware

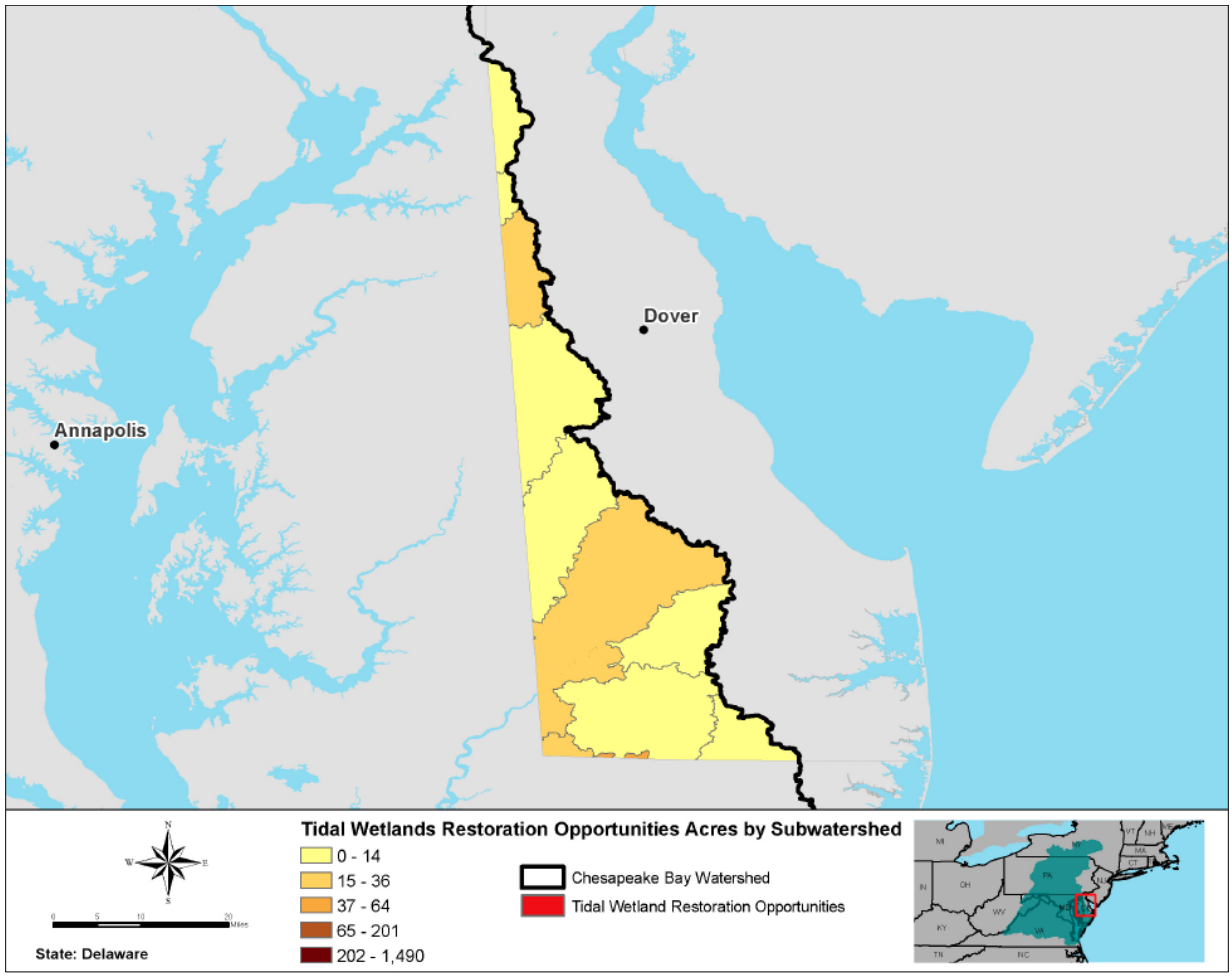

Figure 10. Tidal wetland restoration opportunities in Delaware

Table 6. Wetland Enhancement and Restoration Opportunities in Delaware

Subwatershed Name	Existing Nontidal Wetlands (Acres)	Existing Tidal Wetlands (Acres)	Nontidal Wetland Restoration Opportunities (Acres)	Tidal Wetland Restoration Opportunities (Acres)
Chester River	34,854	1,606	122,820	22
Upper Choptank River	32,260	291	72,163	2
Upper Nanticoke River	22,455	209	66,217	16
Marshyhope Creek	28,708	229	62,209	3
Elk River	5,511	551	53,691	5
Bald Cypress Branch-Pocomoke River	45,444	5	47,333	3
Broad Creek	8,382	43	35,316	1
Wicomico River	22,634	10,246	33,384	60
Sassafras River	3,072	209	27,903	3
Lower Nanticoke River	16,175	12,421	24,319	26
Deep Creek	7,333	16	14,425	0

2.1.6.3 Identify Wetland Restoration Opportunities to Benefit Avian Wildlife

The purpose of this analysis was to identify the wetland restoration *Opportunities* that have the potential to benefit avian wildlife by determining where *Opportunities* overlap with Audubon Important Bird Areas. The following data was used in this analysis (see the Planning Analyses Appendix for more details on the data used):

- *Wetlands Restoration Opportunities Assessment Results* (CBCP)
- *Nesting locations for wading birds and waterbirds* (Center for Conservation Biology)
- *Black Duck Focus Areas* (CBP)
- *Audubon Important Bird Areas*

Results of this analysis are shown in Figures 9 (nontidal) and 10 (tidal) and in Table 7. In Delaware, nontidal wetland restoration opportunities that overlap black duck habitat, Audubon important bird areas, and nesting locations for wading and water birds corresponds to subwatersheds in the middle of the state (Chester River (HUC 0206000204) and Marshyhope Creek (HUC 0208010903) Subwatersheds). In the southern portion of the state, the Upper Nanticoke River (HUC 0208010904) and the Bald Cypress Branch-Pocomoke River (HUC 0208011102) Subwatersheds were identified as Audubon important bird areas and areas identified as black duck habitat and are co-located with acreages of nontidal wetland restoration opportunities. There are minimal tidal wetland restoration opportunities that have the potential to benefit avian wildlife.

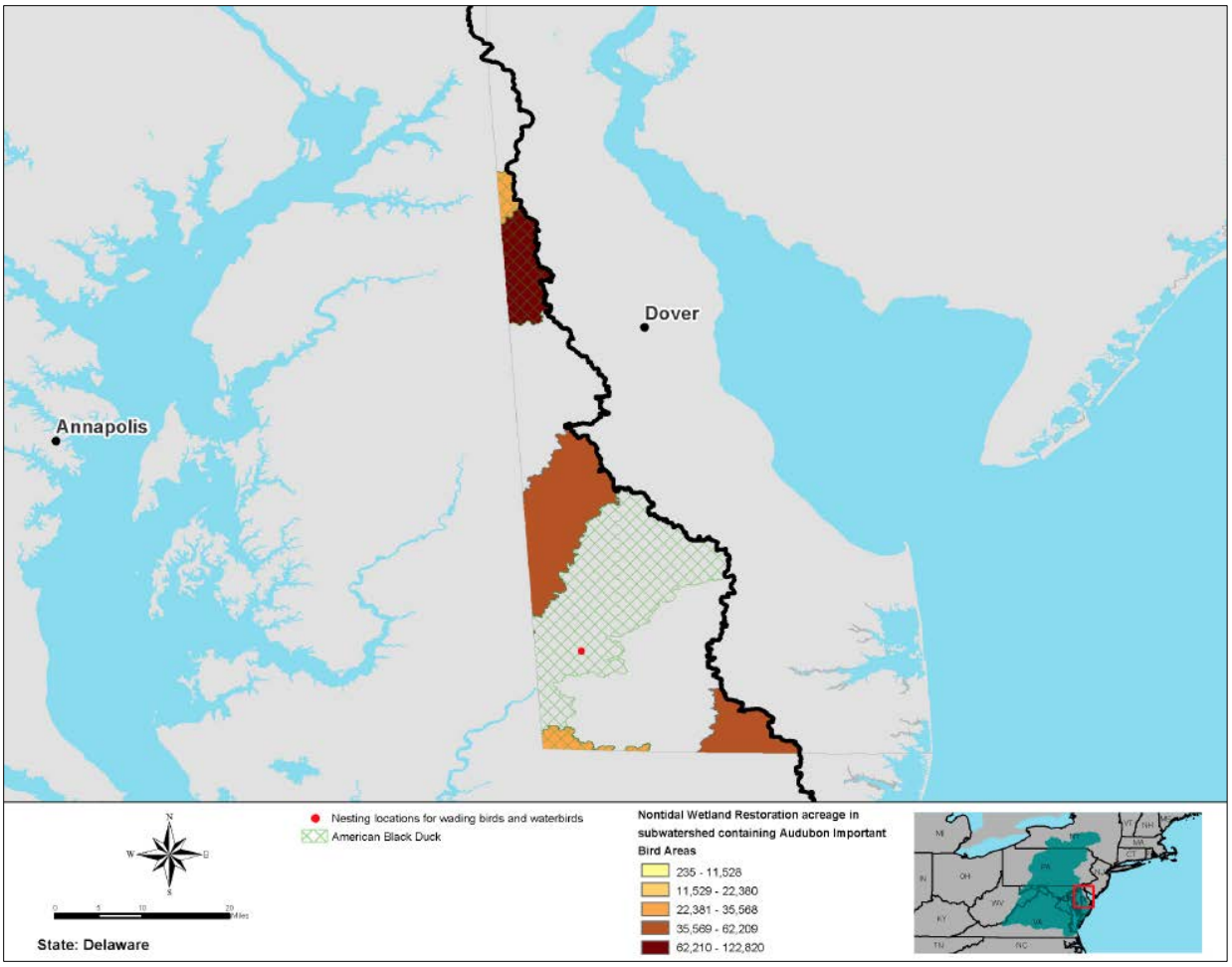

Figure 11. Nontidal wetland restoration opportunities with avian benefits in Delaware

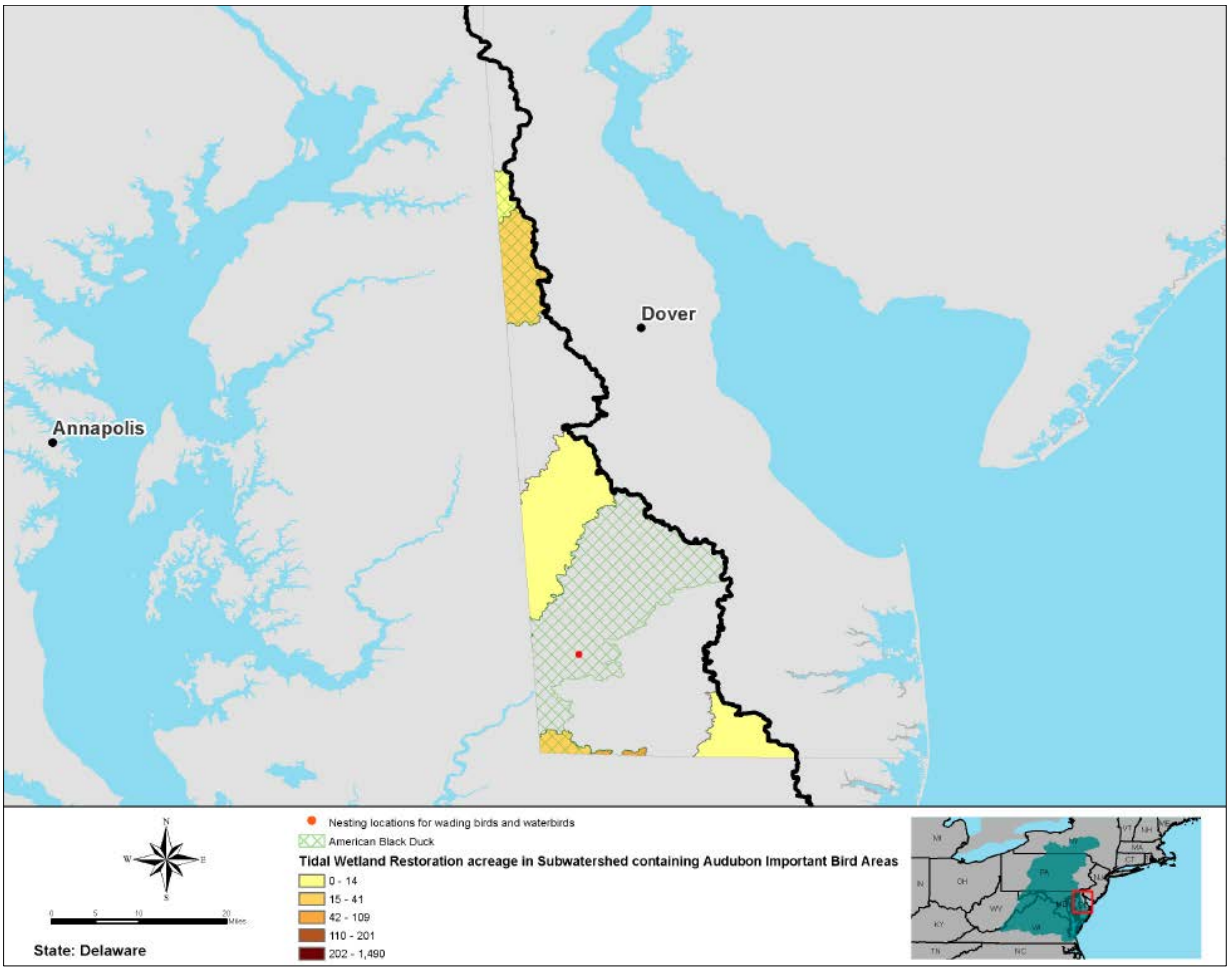

Figure 12. Tidal wetland restoration opportunities with avian benefits in Delaware

Table 7. Wetland restoration opportunities with avian benefits in Delaware

Subwatershed Name	Presence of Black Duck	Presence of Audubon Important Bird Areas	Presence of Nesting for Wading and Waterbirds	Nontidal Wetland Restoration Opportunities (Acres)	Tidal Wetland Restoration Opportunities (Acres)
Chester River	yes	yes	yes	122,820	22
Upper Choptank River	yes	no	yes	72,163	2
Upper Nanticoke River	yes	no	yes	66,232	16
Marshyhope Creek	yes	yes	yes	62,209	3
Elk River	yes	no	yes	53,696	5
Bald Cypress Branch-Pocomoke River	yes	yes	yes	47,333	3
Broad Creek	yes	no	no	35,315	1
Sassafras River	yes	yes	yes	27,903	3
Lower Nanticoke River	yes	yes	yes	24,319	26
Wicomico River	yes	no	yes	18,691	8
Deep Creek	yes	no	no	14,425	0

2.1.6.4 Identify Wetland Restoration Opportunities that are Important Habitats for Imperiled Species (Rare, Threatened, and Endangered)

The purpose of this analysis was to identify wetland restoration *Opportunities* that are important habitats for rare, threatened and endangered (RTE) species. The following data was used in this analysis (see the Planning Analyses Appendix for more details on the data used):

- *Wetlands Restoration Opportunities Assessment Results* (CBCP)
- *Nature's Network Imperiled Species Dataset* (identifies important, moderately important, and less important habitat for imperiled species)

Results of this analysis for Delaware are shown in Figures 11 (nontidal) and 12 (tidal). In Delaware, there are significant nontidal wetland restoration *Opportunities* that could potentially benefit imperiled species. Most of these *Opportunities* are located in subwatersheds in the middle of the state (Chester River (HUC 0206000204), Upper Choptank River (HUC 0206000502), and Marshyhope Creek (HUC 0208010903) subwatersheds) and in the Bald Cypress Branch-Pocomoke River (HUC 0208011102) subwatershed in the southern part of the state. These areas are identified as core habitat for imperiled species and co-located with acreages of nontidal wetland restoration *Opportunities*. There are also tidal wetland restoration opportunities that could potentially benefit imperiled species in the Lower Nanticoke (HUC 0208010905) and Wicomico River (HUC 0208011003) Subwatersheds located in the southern portion of the state.

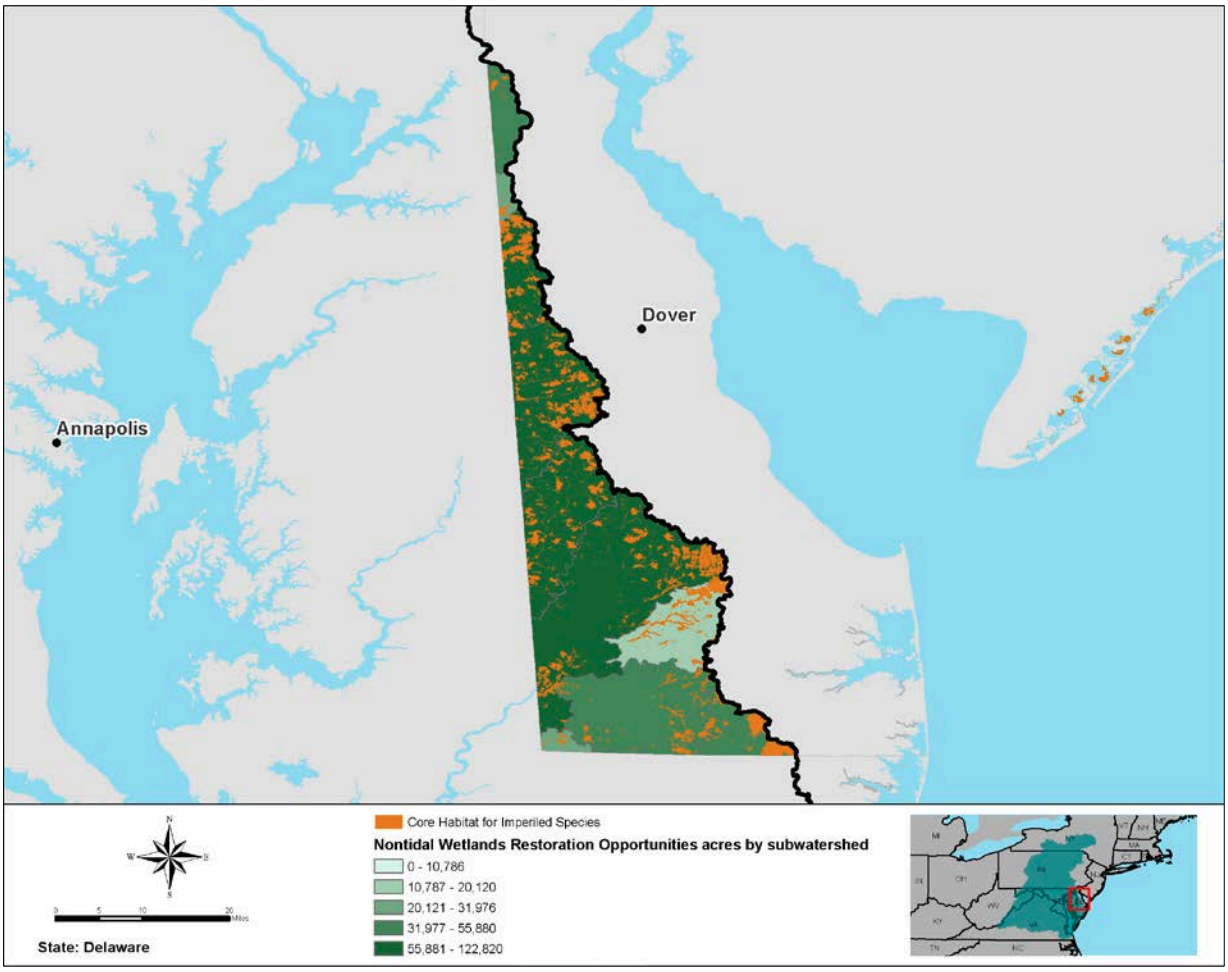

Figure 13. Core habitat for imperiled species in relation to existing nontidal wetland restoration *Opportunities* in Delaware

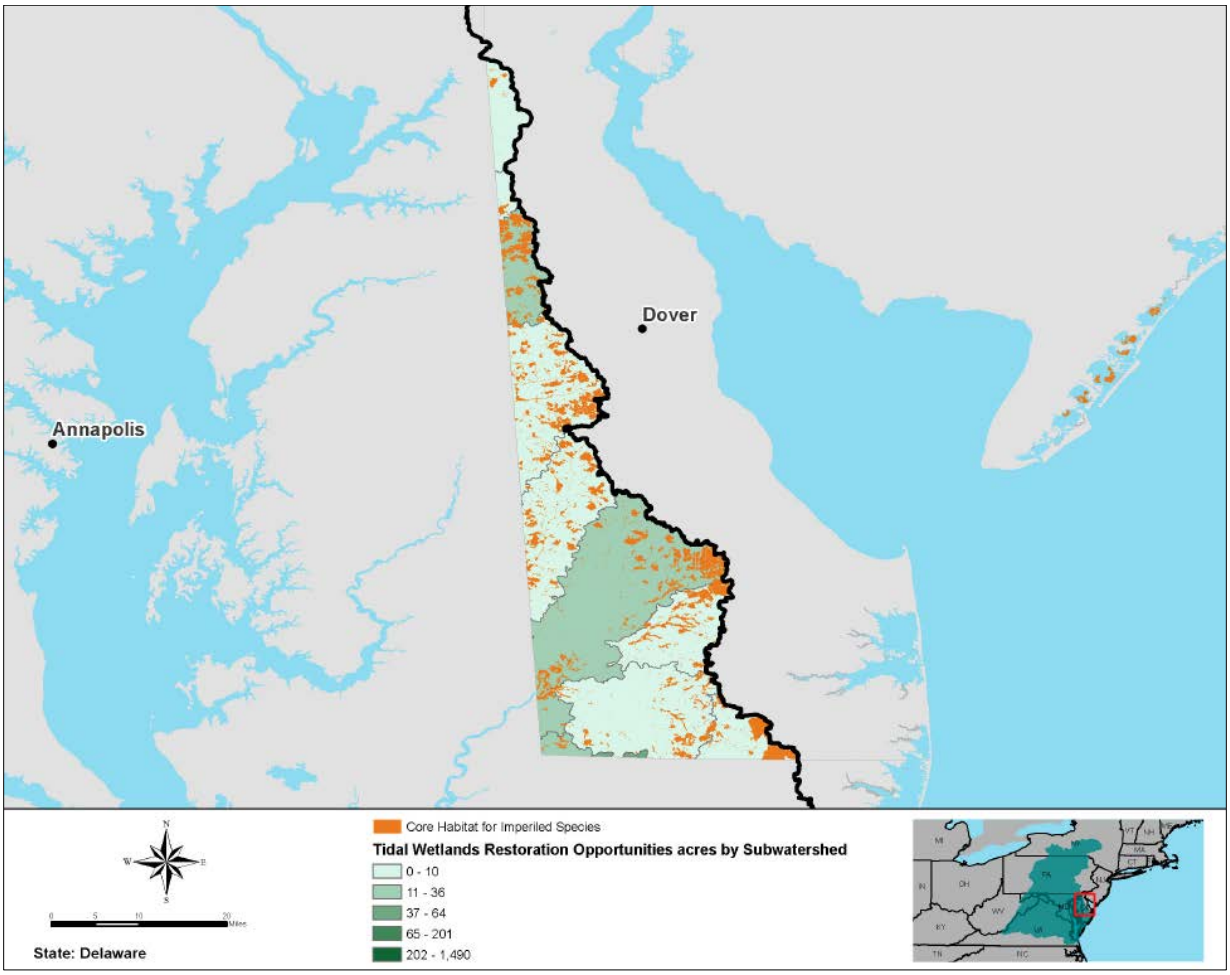

Figure 14. Core habitat for imperiled species in relation to existing tidal wetlands restoration *Opportunities* in Delaware

2.1.6.5 Identify Opportunities to beneficially use dredged material for Wetland Enhancement and Restoration

The purpose of this analysis was to identify wetland enhancement and restoration *Opportunities* located within a three-mile buffer of USACE navigation projects to identify potential beneficial use of dredged material for nontidal wetlands enhancement and restoration. The following data was used in this analysis (see the Planning Analyses Appendix for more details on the data used):

- *U.S. Army Corps of Engineers (USACE) navigation projects (dredged channels)*
- *Wetlands Restoration and Enhancement Opportunities Assessment Results* (CBCP)

The results of this analysis are shown in Figures 13 (nontidal) and 14 (tidal) and in Table 8. The Upper Nanticoke River (HUC 0208010904) and Broad Creek (HUC 0208010902) Subwatersheds in Delaware have nontidal wetland enhancement and restoration opportunities located within a three-mile buffer of a USACE navigation channel. There is limited tidal wetland restoration opportunities located within a three-mile buffer of a USACE navigation channel. The Wicomico

River (HUC 0208011003) and Lower Nanticoke River (HUC 0208010905) Subwatersheds have tidal wetland enhancement opportunities within a three-mile buffer of a USACE navigation channel.

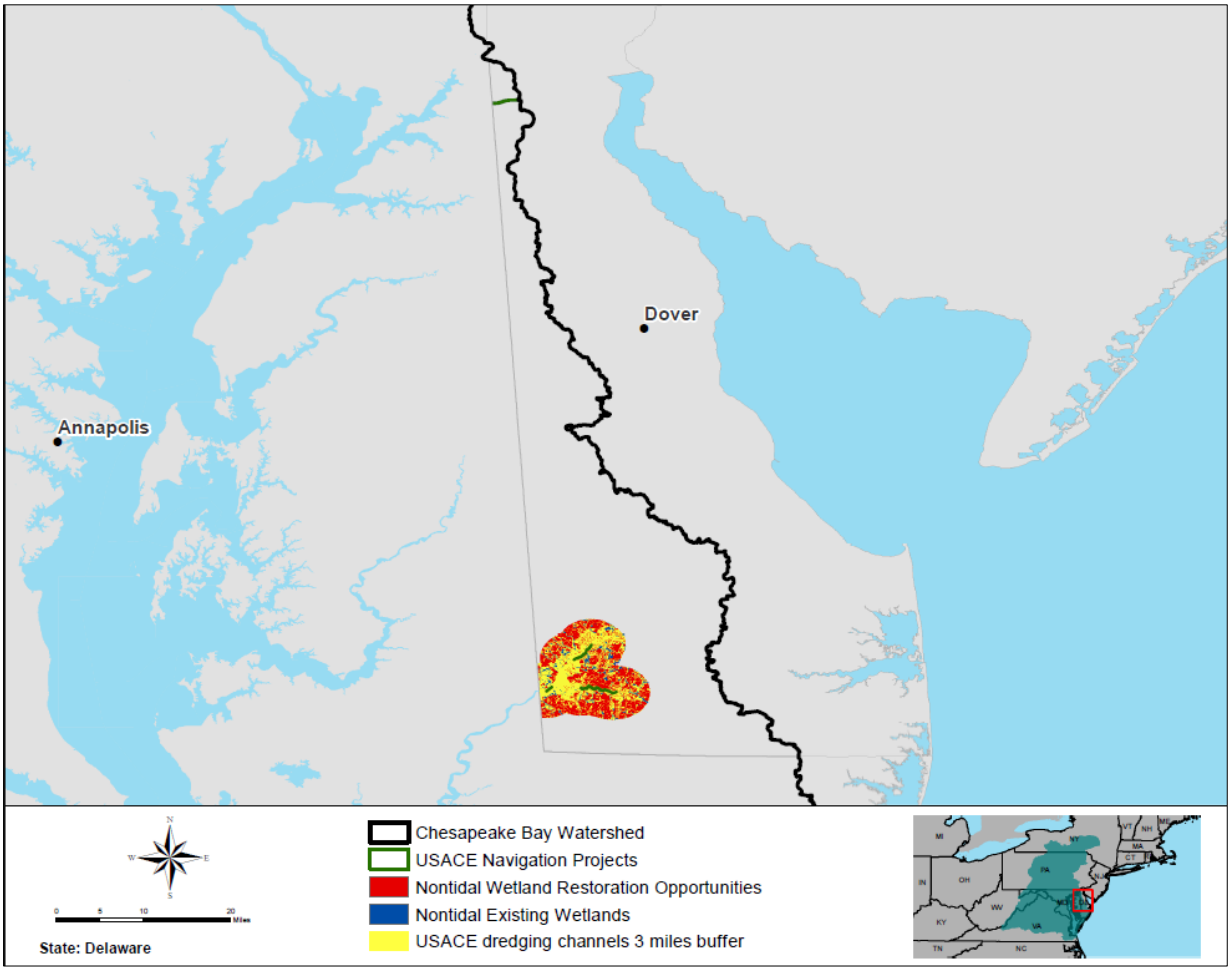

Figure 15. Potential beneficial use of dredged material and nontidal wetland enhancement and restoration opportunities in Delaware

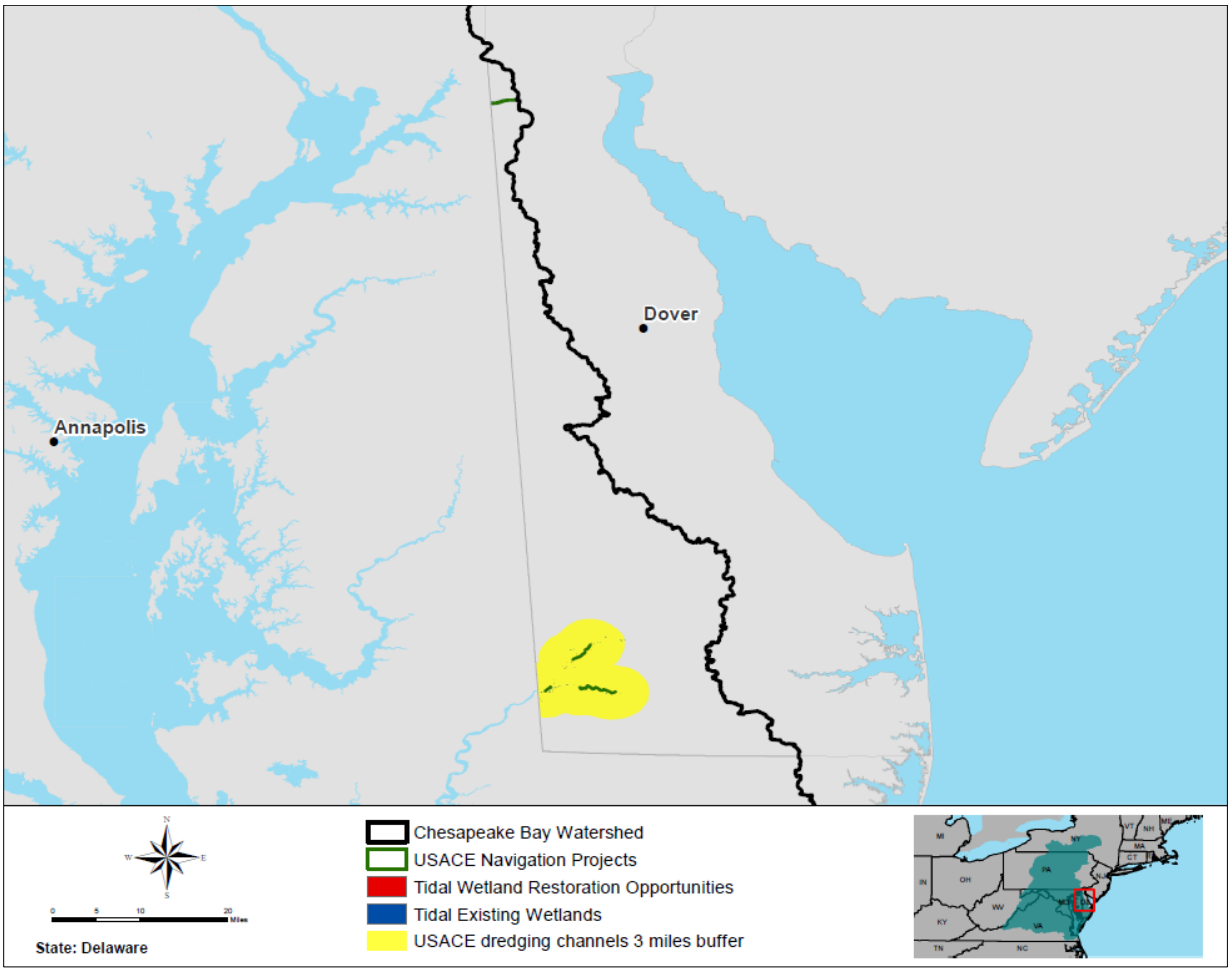

Figure 16. Potential beneficial use of dredged material and tidal wetland enhancement and restoration opportunities in Delaware

Table 8. Potential beneficial use of dredged material and nontidal wetland enhancement and restoration opportunities in Delaware

Subwatershed Name	Nontidal Wetland Restoration Opportunities within Three-Mile Buffer of USACE Channels (Acres)	Existing Nontidal Wetlands within Three-Mile Buffer of USACE Channels (Acres)	Tidal Wetland Restoration Opportunities within Three-Mile Buffer of USACE Channels (Acres)	Existing Tidal Wetlands within Three-Mile Buffer of USACE Channels (Acres)
Upper Choptank River	22,799	4,932	2	240
Wicomico River	16,561	11,373	56	9,975
Marshyhope Creek	15,113	4,842	2	132
Chester River	13,641	4,326	7	488
Broad Creek	11,202	1,166	1	43
Lower Nanticoke River	2,850	6,538	3	5,661
Elk River	757	77	0	3
Bald Cypress Branch-Pocomoke River	688	226	1	1
Deep Creek	237	69	0	10

2.1.6.6 Wetlands Threats Opportunities Assessment:

The Wetlands Threats Opportunities Assessment investigated whether wetland restoration *Opportunities* are at risk to climate change, anticipated increases in flooding and coastal storms, and projected development in the Chesapeake Bay Watershed. This analysis incorporated the results of the CBCP Threats Analysis with the CBCP Wetlands Restoration Opportunities Assessment and the Wetlands Enhancement Opportunities Assessment to understand habitats that may be lost or impaired by future threats.

This analysis showed that there are no nontidal or tidal threats to wetland restoration and enhancement opportunities in Delaware. The results of the Tidal Wetlands Threats Opportunities Assessment is shown in Figures 15 and 16 and in Table 9. There is a small amount of tidal threats to wetland restoration opportunities in the Wicomico River (HUC 0208011003) and Elk River (HUC 0206000202) Subwatersheds. There is a significant tidal threat to wetland enhancement opportunities in the Wicomico River (HUC 0208011003) and the Lower Nanticoke River (HUC 0208010905) Subwatersheds.

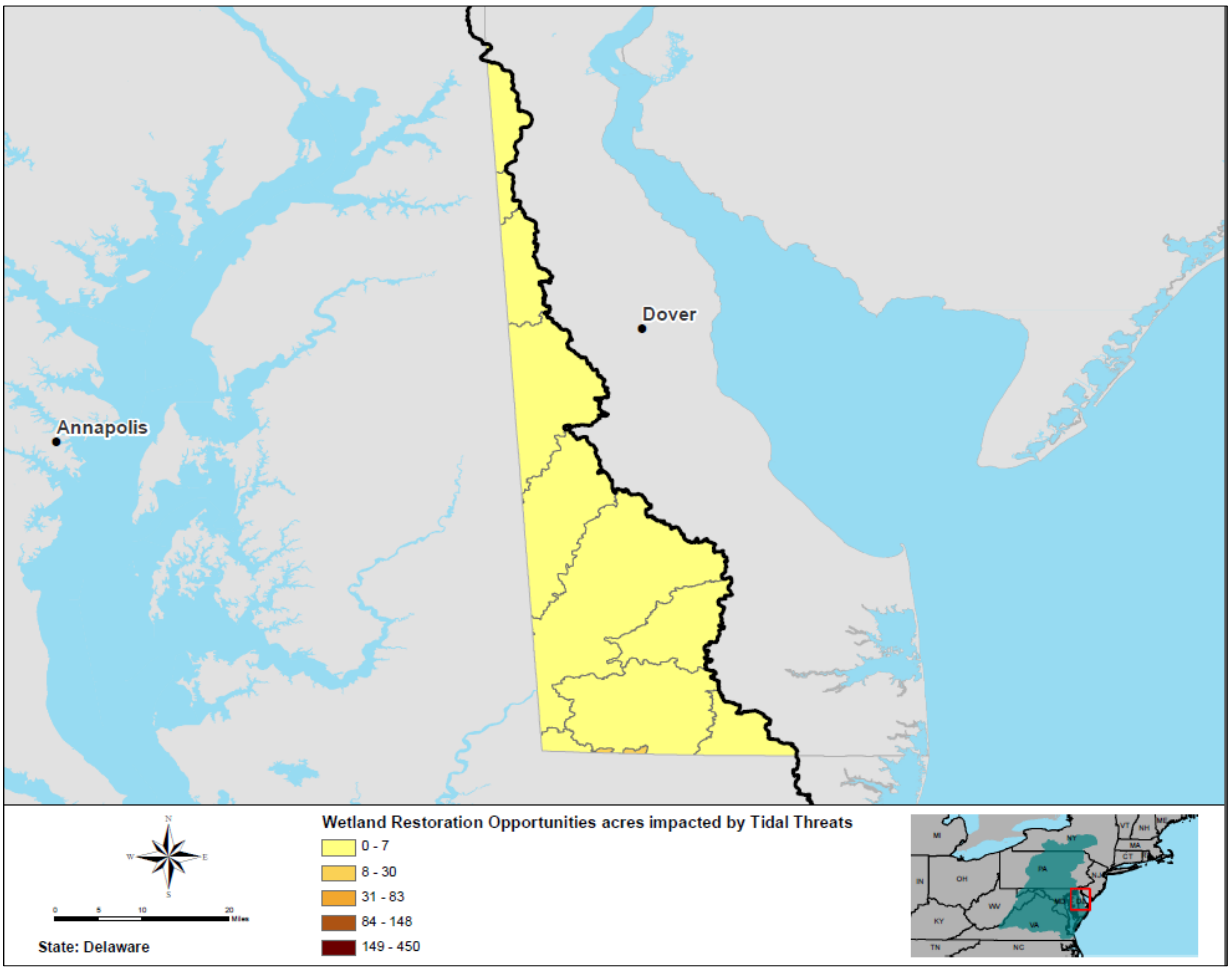

Figure 17. Wetland restoration opportunities at risk to tidal threats in Delaware

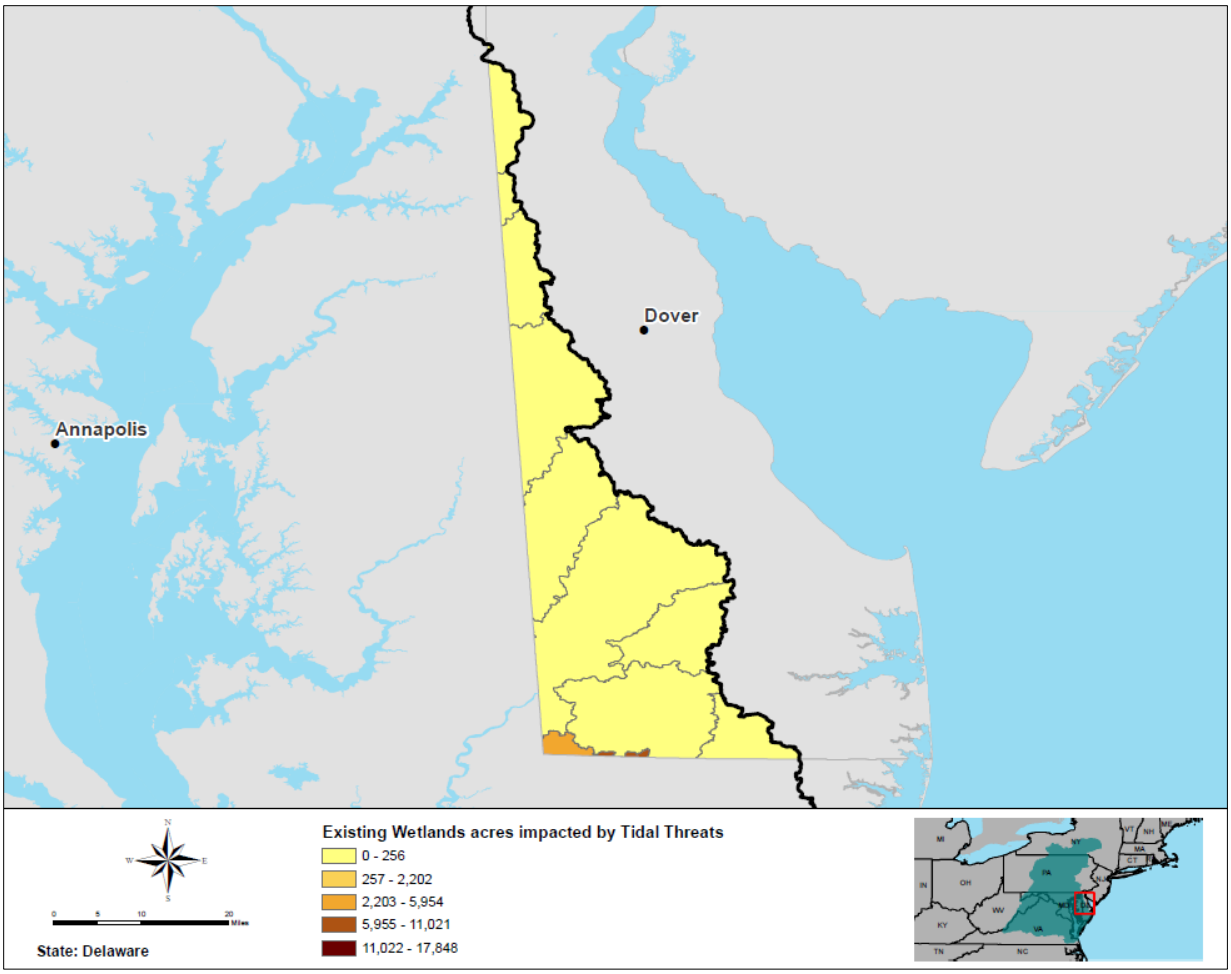

Figure 18. Wetland enhancement opportunities at risk to tidal threats in Delaware

Table 9. Threats to tidal wetland restoration and enhancement opportunities in Delaware

Subwatershed Name	Tidal Threat Impacting Wetland Enhancement Opportunities (Acres)	Tidal Threat Impacting Wetland Restoration Opportunities (Acres)
Wicomico River	8,094	10
Lower Nanticoke River	5,954	0
Elk River	130	1
Chester River	59	0
Sassafras River	6	0
Upper Nanticoke River	5	0
Bald Cypress Branch-Pocomoke River	1	0
Upper Choptank River	0	0
Marshyhope Creek	0	0

2.2 Toxic Contaminants Goal

"Ensure the Chesapeake Bay and its rivers are free of the effects of toxic contaminants on living resources and human health."

2.2.1 Outcome: Toxic Contaminants Research

"*Continually increase our understanding of the impacts and mitigation of toxic contaminants. Develop a research agenda and further characterize the occurrence, concentrations, sources and effects of mercury, polychlorinated biphenyls (PCBs), and other contaminants of emerging and widespread concern. In addition, identify which best management practices might provide the multiple benefits of reducing nutrient and sediment pollution as well as toxic contaminants in waterways."*

2.2.2 Outcome: Toxic Contaminants Policy and Prevention

"Continually improve practices and controls that prevent or reduce the effects of toxic contaminants on aquatic systems and humans. Build on existing programs to reduce the amount and effects of PCBs in the Chesapeake Bay watershed. Use research findings to evaluate the implementation of additional policies, programs, and practices for other contaminants that need to be further reduced or eliminated."

The following data was used in the Toxic Contaminants Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *National Priorities List (NPL) Sites (Superfund Sites) (*downloaded from https://toxmap-classic.nlm.nih.gov/toxmap/superfund/identifyAll.do and cross referenced with EPA for accuracy)

Results of the Toxic Contaminants Opportunities Assessment are shown in Figure 17. There are four NPL sites (Superfund sites) in final status located in the Elk River Subwatershed (HUC 0206000202). Final status is defined as:

> *"[a] site determined to pose a real or potential threat to human health and the environment after completion of [Hazard Ranking System] HRS screening and public solicitation of comments about the proposed site" (USDH&HS 2017)."*

There is one Superfund site in deleted status located in the Broad Creek Subwatershed (HUC 0208010902). Deleted status is defined as:

> "[*a] site deleted from the NPL by the EPA (with state concurrence) because site cleanup goals have been met and no further response is necessary at the site" (USDH&HS 2017)."*

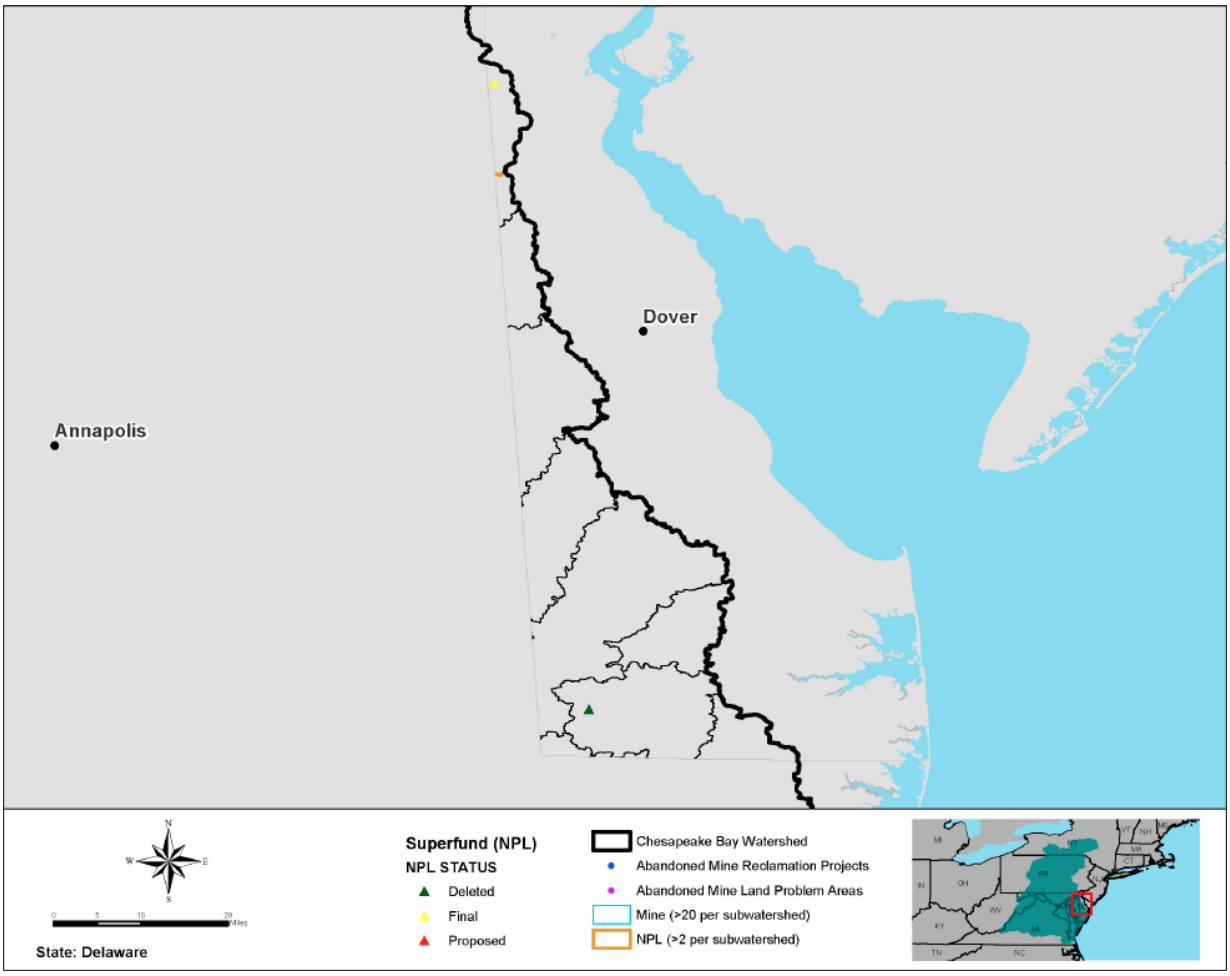

Figure 19. Toxic Contaminants Opportunities Assessment for Delaware

2.3 Healthy Watersheds Goal

"*Sustain state-identified healthy waters and watersheds, recognized for their high quality and/or high ecological value.*"

2.3.1 Outcome: Healthy Watersheds

"Ensure 100 percent of state-identified currently healthy waters and watersheds remain healthy."

The Healthy/High Value Habitats Opportunities Assessment identifies areas in Delaware that have the healthiest habitats. The following data was used in the Healthy/High Value Habitats Opportunities Assessment (see Planning Analyses Appendix for more details on the data used):

- *State-identified Healthy Watersheds* (based on state-derived definitions and classifications of healthy waters and watersheds)
- *Subwatersheds identified as brook trout catchments (*National Hydrography Dataset plus catchments identified as potentially supporting brook trout based on the Eastern Brook Trout Joint Venture Salmonid Catchment Assessment)

- *Black Duck Focus Areas* (CBP)
- *Audubon Important Bird Areas*
- *Index of Ecological Integrity (IEI)*
- *Nature's Network Core and Connector Habitat*

Results of the Healthy/High Value Habitats Opportunities Assessment are shown in Figure 18 and in Table 10. Due to the scale, Figure 18 does not show the locations of the healthiest watersheds in Delaware. According to Table 10, the highest acreage of healthy/high value habitats are located in the southern portion of the state in the Lower Nanticoke (HUC 0208010905) and Wicomico River (HUC 0208011003) Subwatersheds. These watersheds have thousands of acres that have been identified as having healthy ecosystems and habitats, which increases the ecological value of the area. Actions to maintain existing health and conservation efforts are recommended in the subwatersheds identified as *Opportunities.*

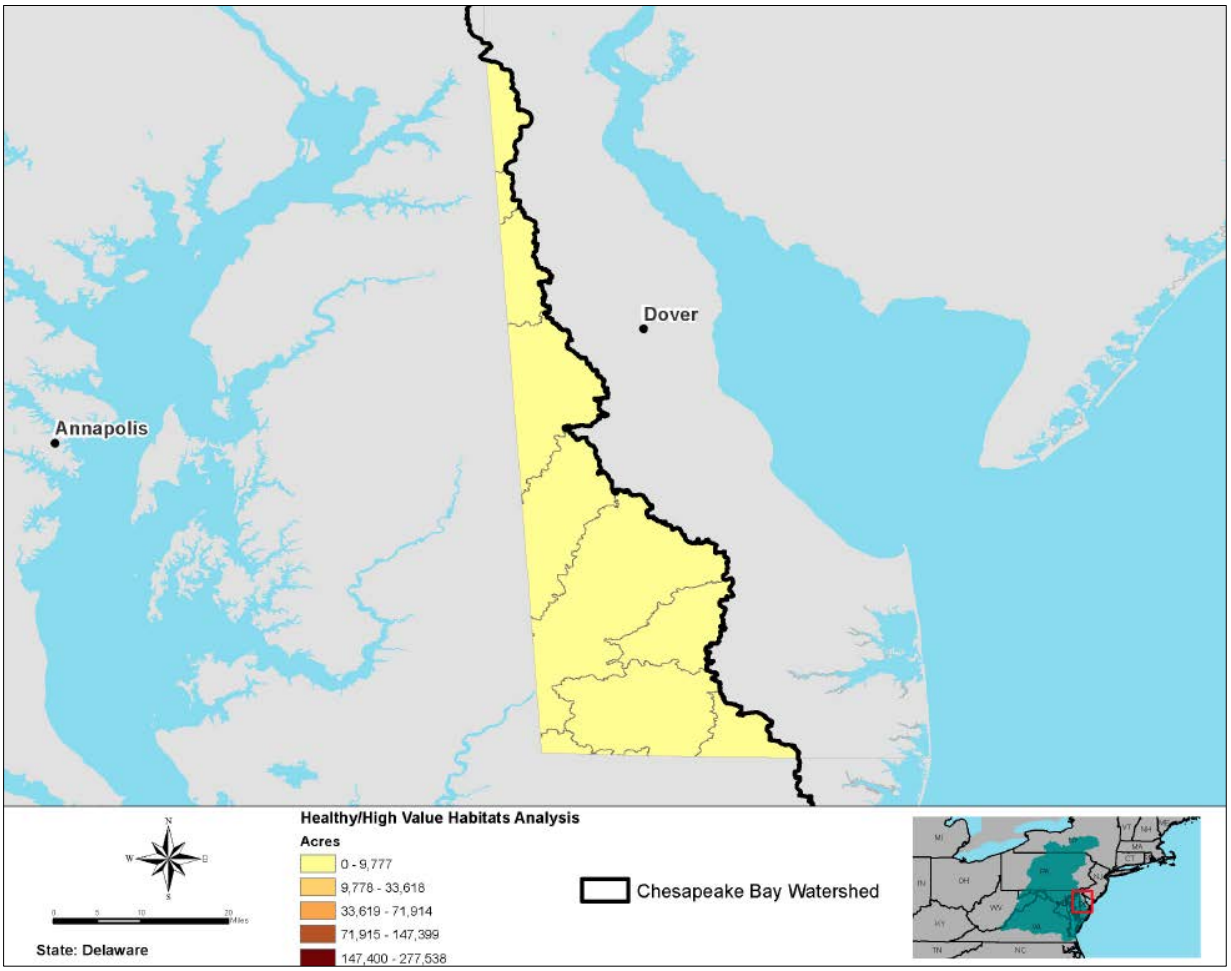

Figure 20. Healthy/high value habitats in Delaware

Table 10. Healthy/High Value habitats in Delaware

Subwatershed Name	Acres of Healthy/High Value Habitats
Lower Nanticoke River	8,681
Wicomico River	5,185
Chester River	2,515
Marshyhope Creek	1,508
Bald Cypress Branch-Pocomoke River	867
Sassafras River	26
Upper Nanticoke River	2
Upper Choptank River	1
Elk River	1

2.4 Land Conservation Goal

"Conserve landscapes treasured by citizens in order to maintain water quality and habitat; sustain working forests, farms and maritime communities; and conserve lands of cultural, indigenous and community value."

2.4.1 Outcome: Protected Lands

"*By 2025, protect an additional two million acres of lands throughout the watershed – currently identified as high-conservation priorities at the federal, state or local level – including 225,000 acres of wetlands and 695,000 acres of forestland of highest value for maintaining water quality."*

The purpose of the Conservation Opportunities Assessment was to identify habitats in need of potential conservation. Areas in potential need of conservation consist of healthy/high value habitats that are currently not conserved and potential habitat enhancement and restoration areas that align with conservation initiatives.

The following data was used in the Conservation Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *Healthy/High Value Habitats Opportunities Assessment Results* (CBCP)
- *Protected Lands Dataset* (CBP)

Results of the Conservation Opportunities Assessment for Delaware is shown in Figure 19 and in Table 11.

The Healthy/High Value Habitats Opportunities Assessment was then overlaid with the following layers to identify those prime habitat enhancement and restoration opportunities that align with conservation initiatives:

- *Habitat Restoration Compilation including the Stream Restoration Riparian Buffer Restoration Opportunities Assessment Results* (CBCP)

- *Wetlands Restoration and Enhancement Compiled Opportunities Assessment Results* (CBCP)

Results of this analysis for Delaware are shown in Figures 20 (nontidal) and 21 (tidal) and in Table 11.

In general, opportunities to conserve unprotected, healthy, high value habitats are concentrated in the Chester River Subwatershed (HUC 0206000204) and in the southern portion of Delaware in the Lower Nanticoke River (HUC 0208010905) and the Wicomico River (HUC 0208011003) Subwatersheds. There are some state and federal lands that are already protected, thus, excluding other areas for conservation because they are already conserved.

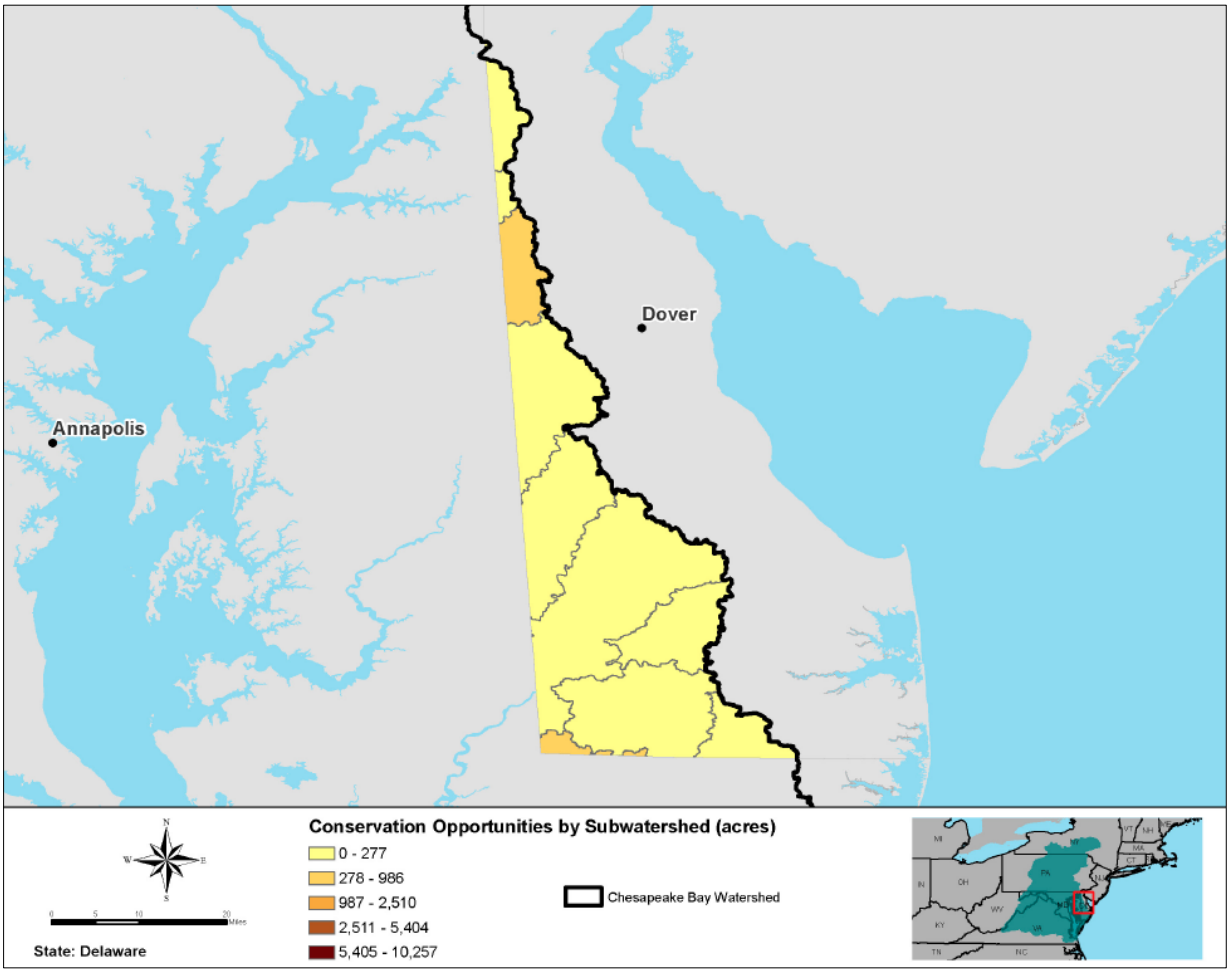

Figure 21. Conservation Opportunities Assessment for Delaware

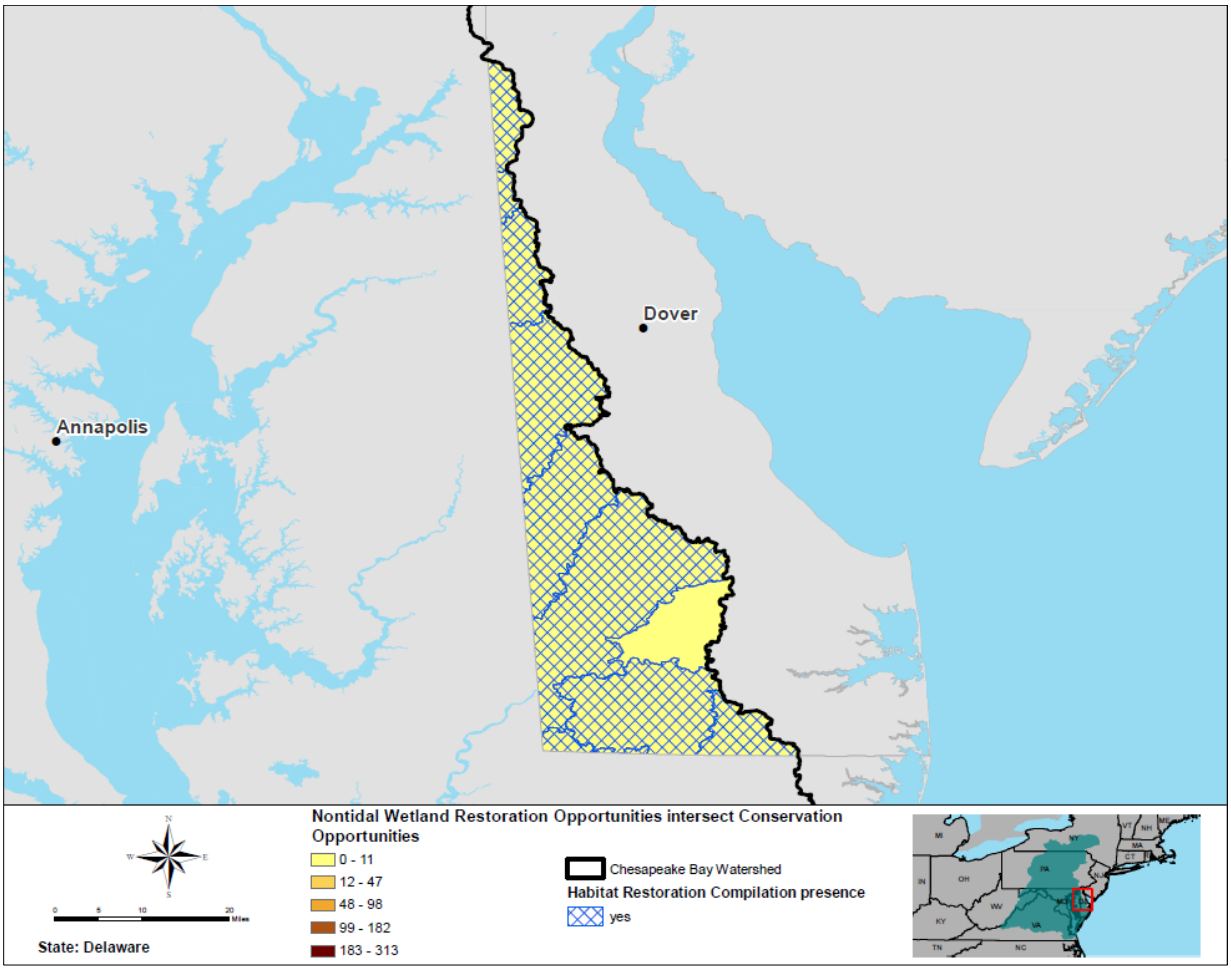

Figure 22. Nontidal conservation and wetland restoration Opportunities that intersect habitat restoration opportunities in Delaware

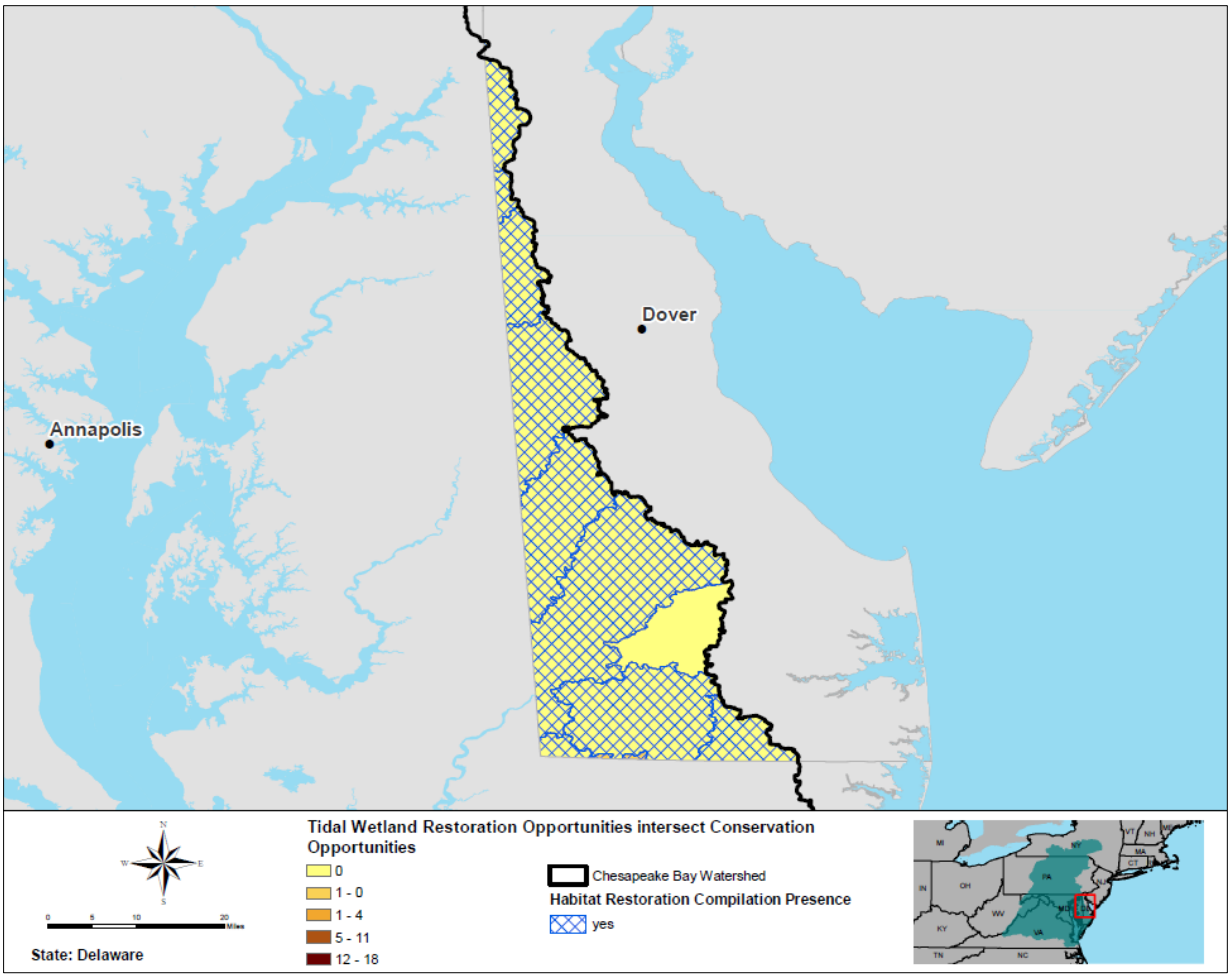

Figure 23. Tidal conservation and wetland restoration Opportunities that intersect habitat restoration opportunities in Delaware

Table 11. Conservation Opportunities Assessment for Delaware

Subwatershed Name	Existing Nontidal and Tidal Wetlands (Acres)	Nontidal and Tidal Wetland Restoration Opportunities (Acres)	Conservation Opportunities (Acres)	Stream Restoration Presence	Riparian Buffer Presence	Habitat Restoration Compilation
Elk River	6,063	53,696	0	yes	yes	yes
Sassafras River	3,281	27,906	1	no	no	yes
Chester River	36,464	122,841	334	yes	yes	yes
Upper Choptank River	32,552	72,165	0	yes	yes	yes
Deep Creek	7,349	14,425	0	yes	yes	yes
Broad Creek	8,425	35,316	0	yes	yes	yes
Marshyhope Creek	28,938	62,213	54	yes	yes	yes
Upper Nanticoke River	22,666	66,232	0	yes	yes	yes
Lower Nanticoke River	28,646	24,345	405	yes	yes	yes
Wicomico River	32,938	33,444	320	yes	yes	yes
Bald Cypress Branch-Pocomoke River	45,449	47,336	41	yes	yes	yes

2.5 Public Access Goal

"Expand public access to the Chesapeake Bay and its tributaries through existing and new local, state, and federal parks, refuges, reserves, trails and partner sites."

2.5.1 Outcome: Public Access Site Development

"By 2025, add 300 new public access sites to the Chesapeake Bay watershed, with a strong emphasis on providing opportunities for boating, swimming, and fishing, where feasible."

The Socioeconomic Analysis synthesizes information that reflects societal use of resources within Delaware. The compilation characterizes the locations in the watershed that are important for recreation and public access, water supply, and source water protection and those areas where underserved populations are located.

The following data was used in the Socioeconomic Analysis (see Planning Analyses Appendix for more details on the data used):

- *Locations of national, state, and local parks*
- *Public access points* (Nationally designated trails, existing and proposed public access sites compiled by the CBP)
- *Underserved populations* (Minority and low-income populations provided by the CBP)
- *National Inventory of Dams* (Congressionally authorized database documenting dams in the U.S. and its territories; maintained and published by the USACE)

Results of the Socioeconomic Analysis are shown in Figure 22 and in Table 12. The Socioeconomic Analysis for Delaware demonstrates that there are areas in the state consisting of underserved, low-income populations. Some of these subwatersheds have public access sites and recreational parks adjacent to communities characterized as low income. The Wicomico River Subwatershed (HUC 0208011003) has 11 public access sites, 131 recreation parks, and a large area classified as underserved. However, the Marshyhope Creek Subwatershed (HUC 0208010903), one the largest underserved communities, has no recreation parks and only two public access sites. This helps identify areas where stewardship opportunities can aide underserved communities in connecting with the natural environment (i.e., facilitating environmental stewardship by connecting people to the environment).

To determine where conservation may provide societal benefits to the public, the following data were overlaid:

- *Conservation Opportunities Assessment Results* (CBCP)
- *Socioeconomic Analysis Results* (CBCP)

The results of this analysis are depicted in Figure 23 and in Table 12. The subwatershed with the greatest overlap between conservation opportunities (unprotected healthy habitats) and socioeconomic resources is the Lower Nanticoke River Subwatershed (HUC 0208010905), which contains 28 acres of *Opportunities* that are adjacent to and/or overlap with underserved, low-income populations.

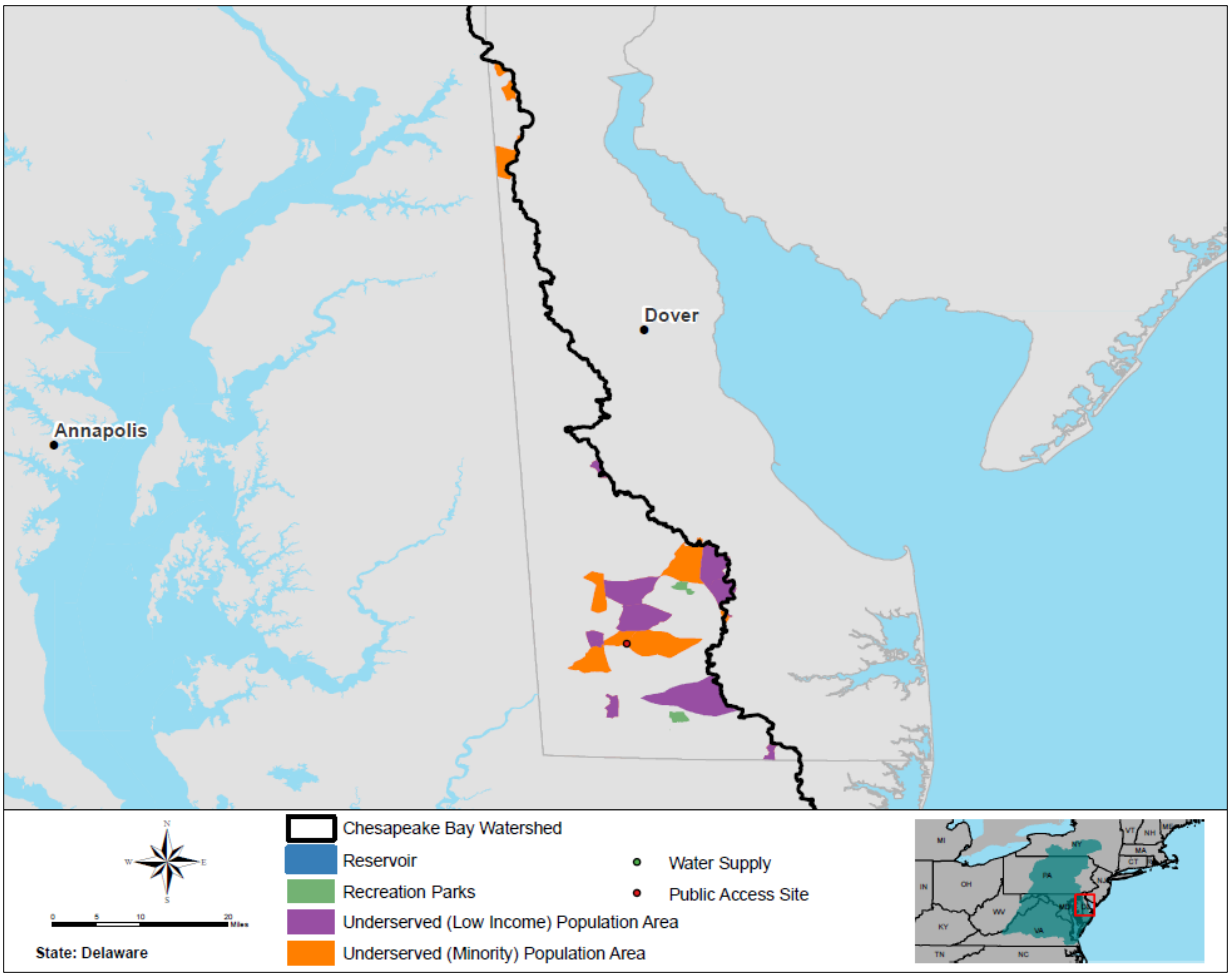

Figure 24. Socioeconomic Analysis for Delaware

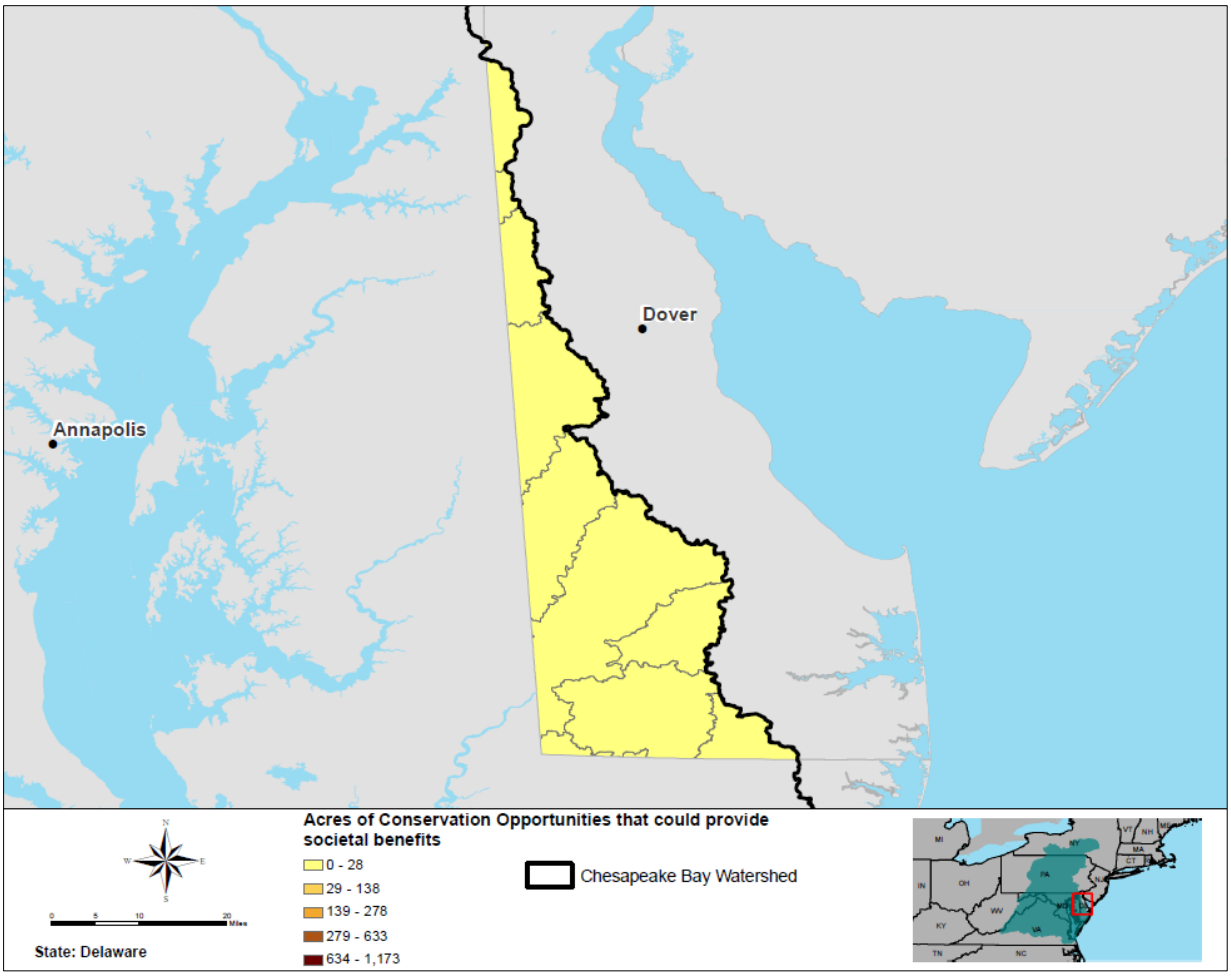

Figure 25. Conversation opportunities that may add societal benefits in Delaware

Table 12. Socioeconomic Opportunities Assessment for Delaware

Subwatershed Name	Recreation Parks (Acres)	Underserved (Minority) Population (Acres)	Underserved (Low Income) Population (Acres)	Public Access Sites Counts	Acreage of Conservation Opportunities that May Add Societal Benefits
Upper Nanticoke River	691	35,729	19,320	8	
Elk River	4,800	7,195	1,184	10	
Sassafras River	6	473		7	
Marshyhope Creek		27,868	12,099	2	11
Lower Nanticoke River		17,307		13	28
Wicomico River	131	41,917	5,547	11	1
Bald Cypress Branch-Pocomoke River	511	4,204	4,151	4	
Deep Creek	198	13,321	3,889	1	
Chester River	268	15,200	4,625	33	15
Upper Choptank River	512	7,434	6,971	8	
Broad Creek	1,050	1,422	11,899	1	

2.6 Climate Resiliency Goal

"Increase the resiliency of the Chesapeake Bay watershed, including its living resources, habitats, public infrastructure and communities, to withstand the adverse impacts from changing environmental and climate conditions."

2.6.1 Outcome: Climate Adaptation

"Continually pursue, design, and construct restoration and protection projects to enhance the resiliency of the Chesapeake Bay and its aquatic ecosystems against the impacts of coastal storm erosion, coastal flooding, more intense and more frequent storms, and sea level rise."

The Threats Analysis identifies areas within Delaware that are threatened by urbanization and climate change, as well as areas prone to increased/persistent future flooding.

The following data was used in the Nontidal Threats Analysis (see Planning Analyses Appendix for more details on the data used):

- *Nontidal flooding* (USGS)
- *Future projected development* (USACE North Atlantic Coast Comprehensive Study (NACCS))
- National Fish Habitat Assessment (NFHAP)

The following data was used in the Tidal Threats Analysis (see the Planning Analysis Appendix for more details on the data used):

- *Areas projected to have more frequent 'normal' flooding* (NACCS and USGS 30-meter Digital Elevation Model)
- *Future projected development* (NACCS)
- *Sea level rise curves* (Projected using the USACE Sea Level Rise High Scenario in year 2100 based on USGS Sea Level Rise Calculator)
- *Resources at risk to coastal storms* (NACCS)
- *Coastal Vulnerability Index* (USGS)

The analysis showed that there are no potential future nontidal threats in Delaware. Results of the Tidal Threats Analysis are shown on Figure 24 and in Table 13. Generally, Delaware is at low risk to potential future tidal threats; however, there is one subwatershed that stands out among the subwatersheds in Delaware; the Lower Nanticoke River Subwatershed (HUC 0208010905), which is shared with Maryland, has 20,392 acres of threatened lands.

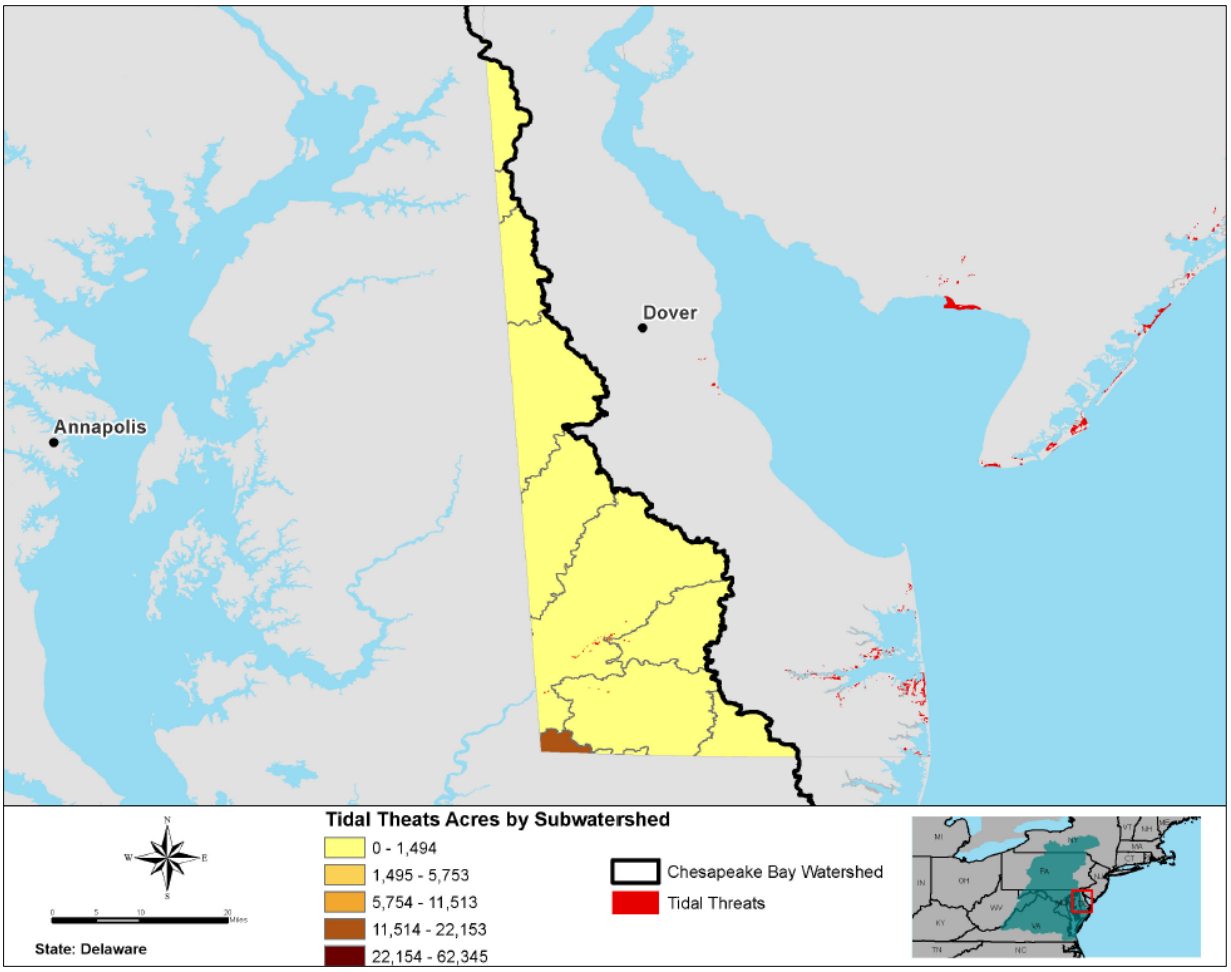

Figure 26. Tidal Threats Analysis for the State of Delaware

Table 13. Tidal Threats Analysis for Delaware

Subwatershed Name	Tidal Threats (Acres)
Lower Nanticoke River	20,392
Elk River	1,107
Wicomico River	930
Chester River	129
Upper Nanticoke River	95
Bald Cypress-Pocomoke River	79
Sassafras River	21
Deep Creek	20
Broad Creek	7

SECTION 3

Watershed Planning Considerations outside the 2014 Bay Agreement

3.1 Rare, Threatened, and Endangered Species and USFWS Species of Concern

The following maps (Figures 25 through 28) display areas in Delaware that have federally listed threatened and endangered species as well as species identified as critical by the USFWS. The species have been placed into the following categories based on their primary habitat needs — aquatic, beach, stream, and wetland dependent. The following maps display the number of species per subwatershed that fall into the aquatic, beach, stream, or wetland categories and whether they are federally listed, critical, or both. The Chester River (HUC 0206000204) and the Lower Nanticoke River (HUC 0208010905) Subwatersheds support the highest concentration of aquatic species in Delaware.

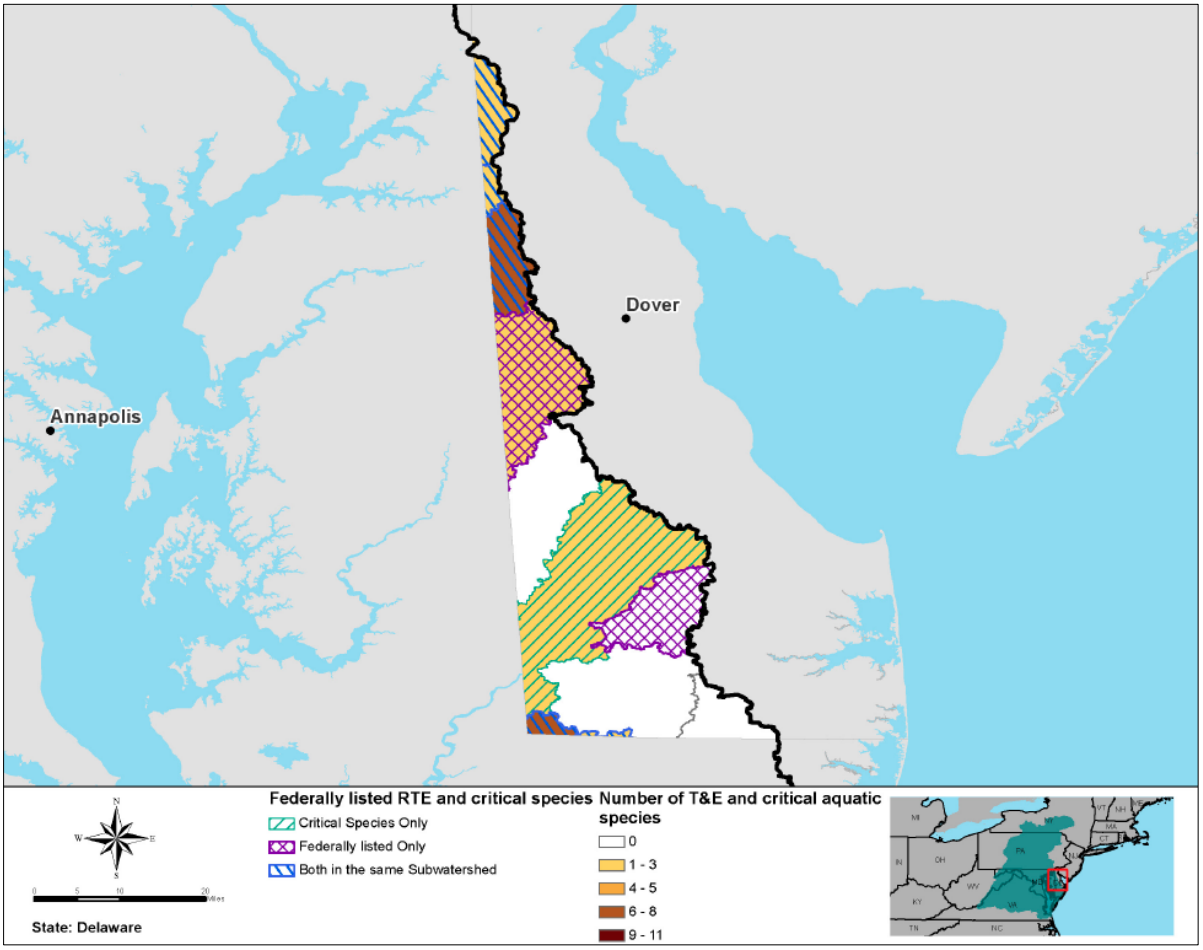

Figure 27. Occurrence of rare, threatened, and endangered and U.S. Fish and Wildlife Service critical aquatic species in Delaware

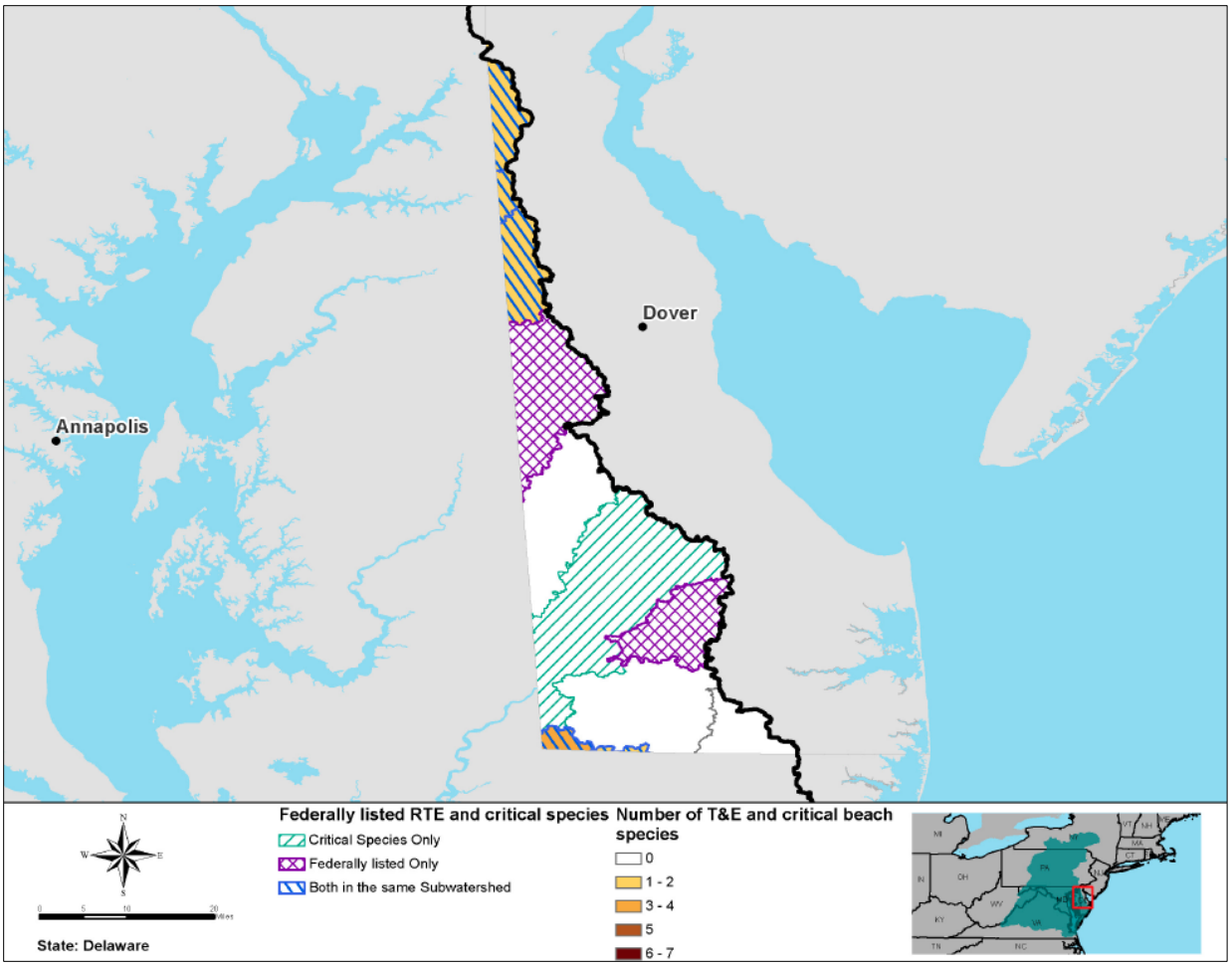

Figure 28. Occurrence of rare, threatened, and endangered and U.S. Fish and Wildlife Service critical beach species in Delaware

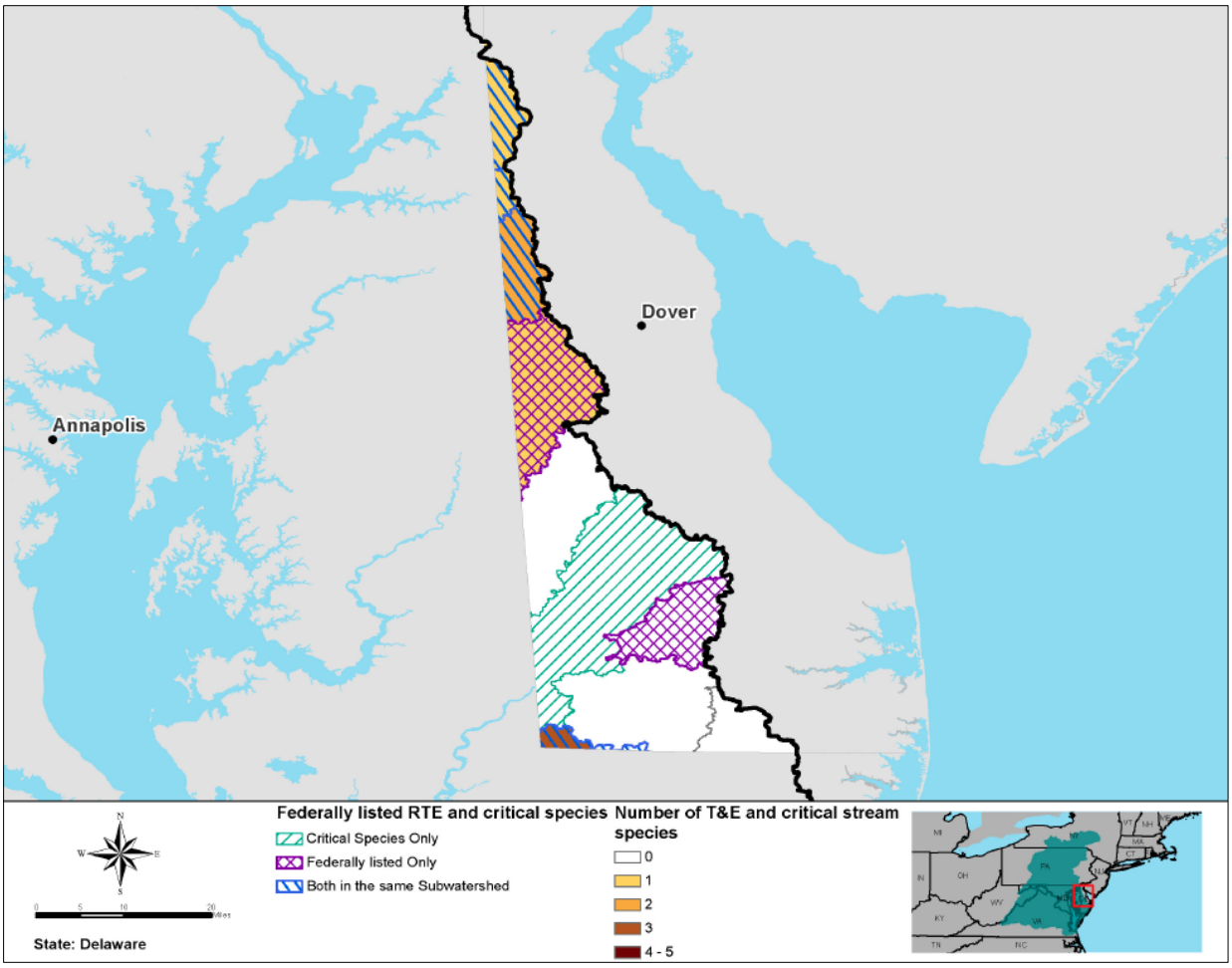

Figure 29. Occurrence of rare, threatened, and endangered and U.S. Fish and Wildlife Service critical stream species in Delaware

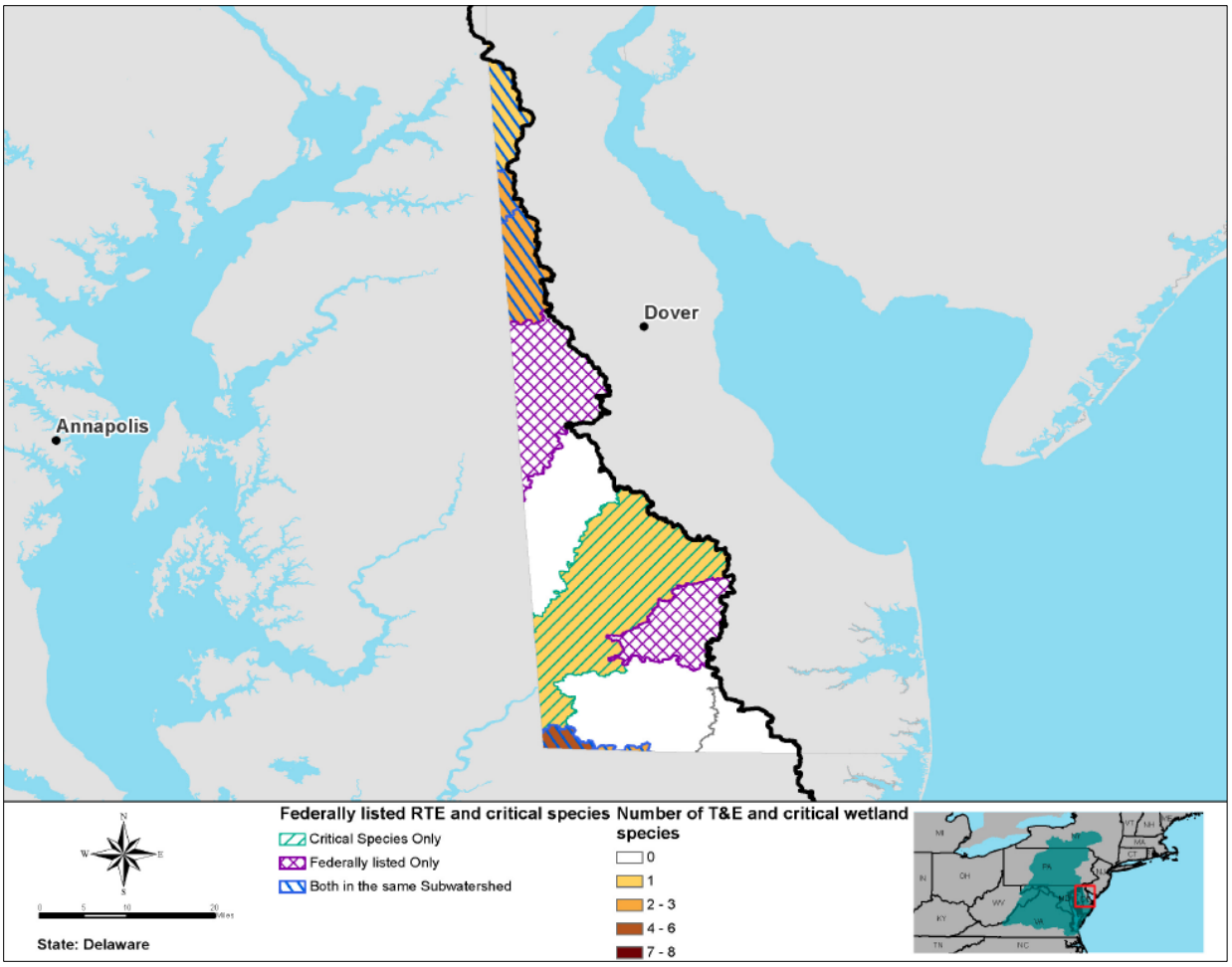

Figure 30. Occurrence of rare, threatened, and endangered and U.S. Fish and Wildlife Service critical wetland species in Delaware

3.2 Wetland Migration

As sea levels rise, the ability of a marsh to migrate inland will be an important factor to determine the future location of tidal wetlands. In 2015, the National Oceanic and Atmospheric Administration (NOAA) (2015) developed a model based on previous work by The Nature Conservancy that evaluates the potential for tidal wetlands to migrate inland. A cost distance approach was taken that considers elevation and land use adjacent to existing wetlands to estimate the inland migration potential. The results of NOAA's modeling were incorporated with the CBCP analyses as described below. The intent was to identify where wetland restoration opportunities should consider inland migration corridors.

1. Overlay the existing wetlands layer to show the connectivity of migration corridors to existing wetlands. The results are presented in Figure 29 and Table 14.

2. Determine which subwatershed have the greatest opportunity for wetland migration. Tally the acres of greens and blues in each subwatershed. Provide the results in the standard color ramp determined by the Jenks method. The results are presented in Figure 30.

3. Overlay the migration/cost corridor data on top of the tidal wetland restoration opportunity results. The results are presented in Figure 31.

4. Overlay the migration/cost corridor data on top of the threats to existing tidal wetlands opportunity results.

The following data was used in the Wetland Migration Opportunities Assessment (see the Planning Analyses Appendix for more details on the data used):

- *Marsh Migration Model* (NOAA 2015)
- *Tidal Wetlands Enhancement and Restoration Opportunities Assessment* (CBCP)

The Wetland Migration Opportunities Assessment showed that the Chester River (HUC 0206000204) and Lower Nanticoke River (HUC 0208010905) subwatersheds have opportunities for wetlands restoration and enhancement, as well as potential for low cost wetland migration.

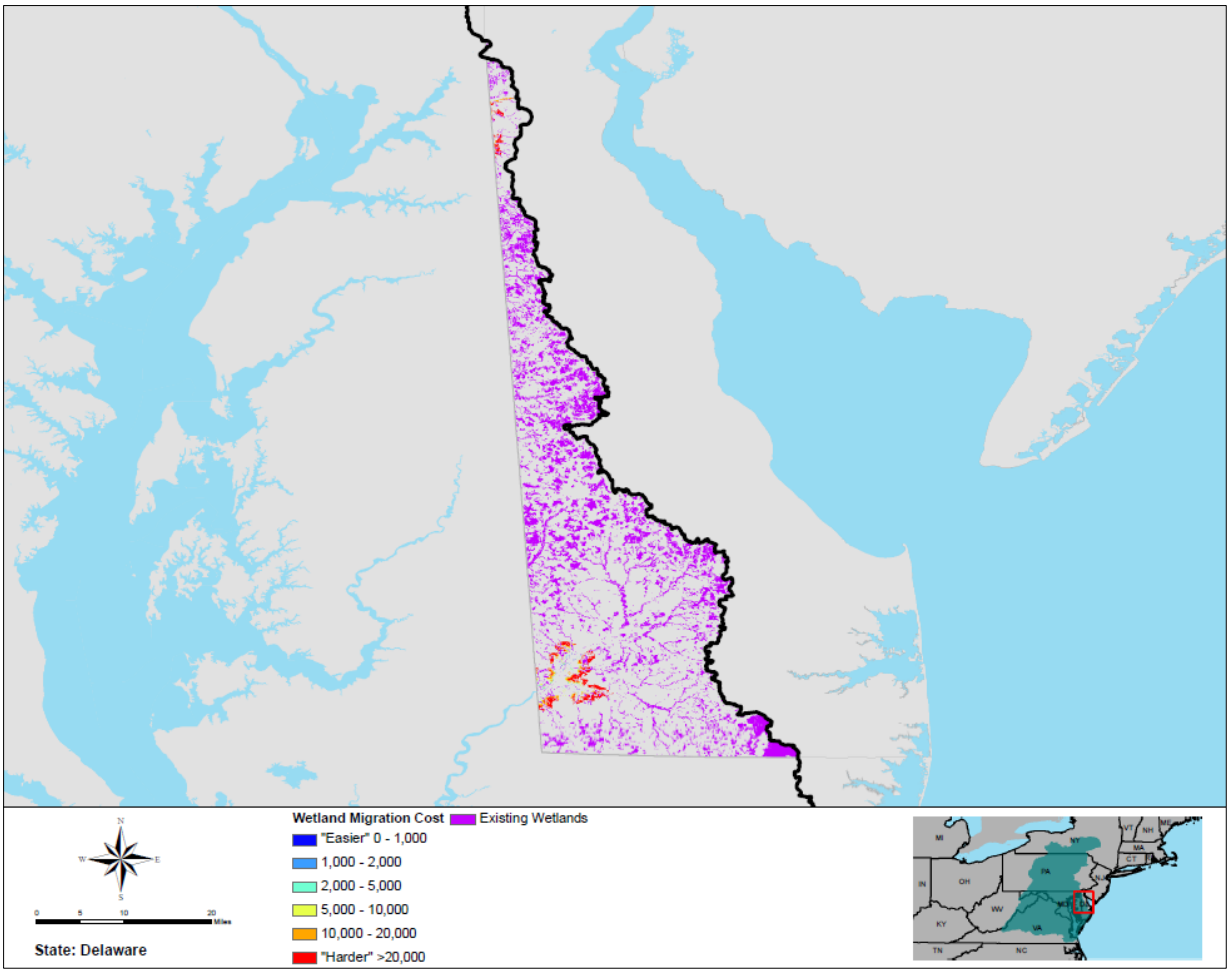

Figure 31. Connectivity of migration corridors to existing wetlands in Delaware

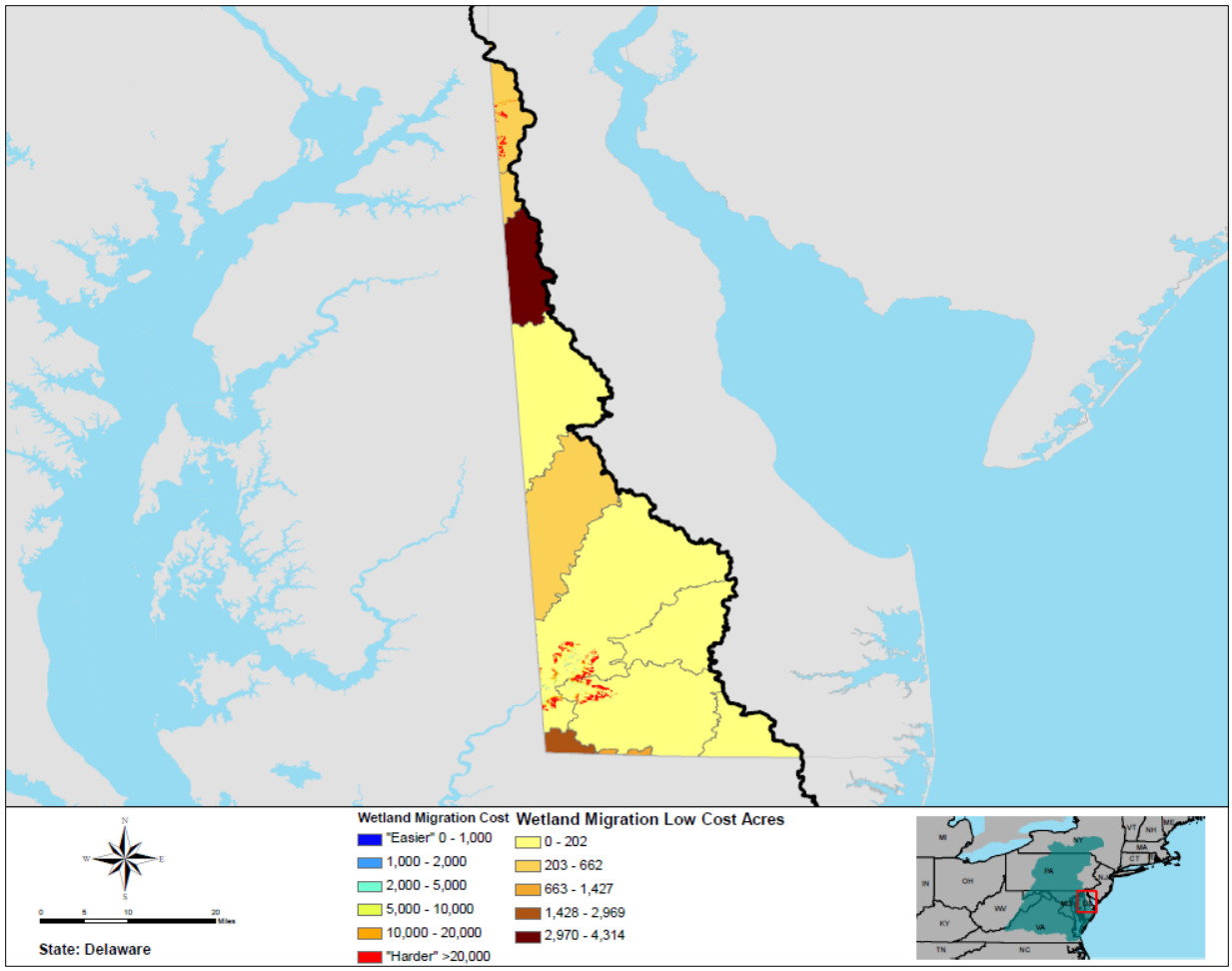

Figure 32. Subwatersheds with the greatest opportunity for wetland migration in Delaware

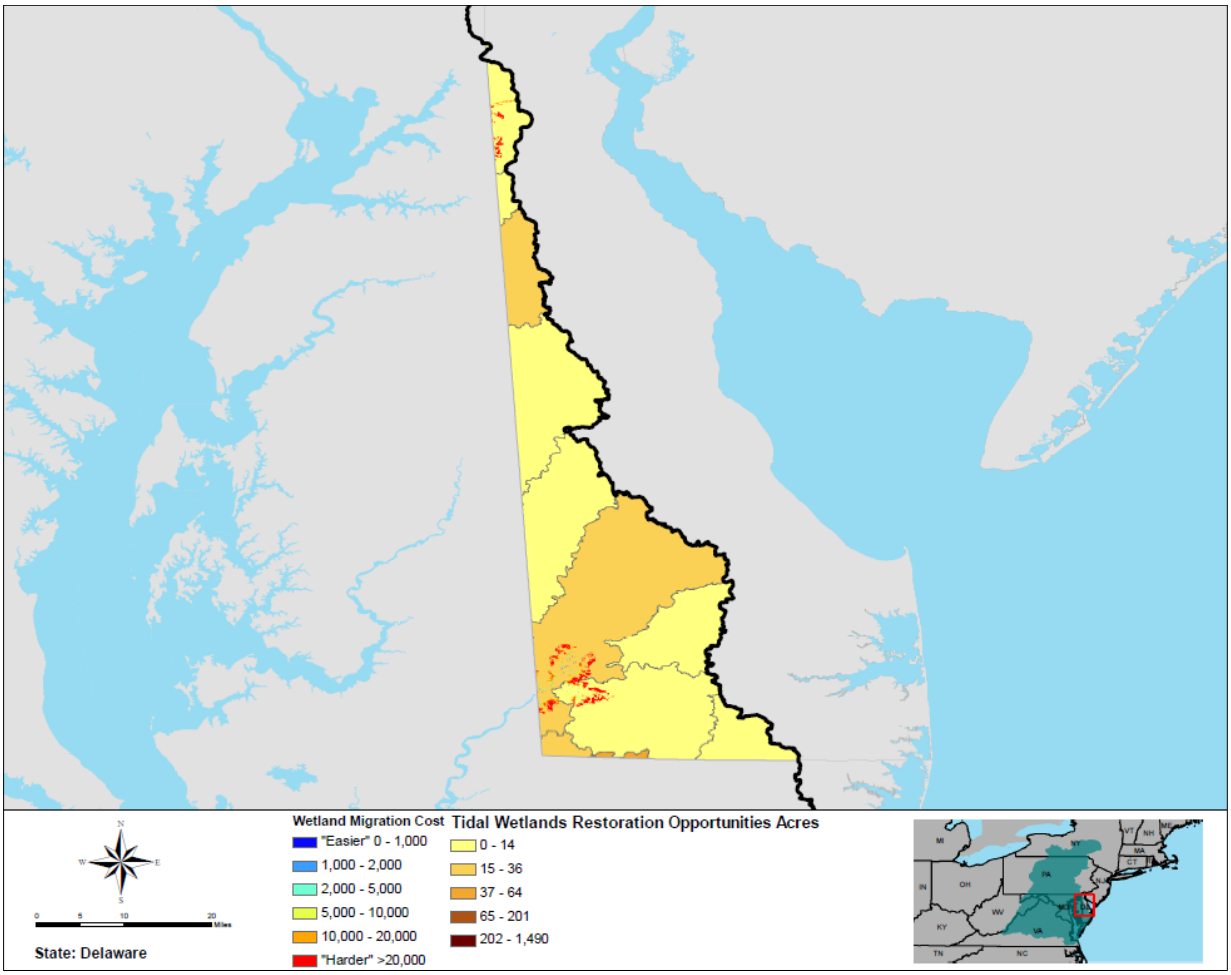

Figure 33. Wetland migration cost and tidal restoration opportunities in Delaware

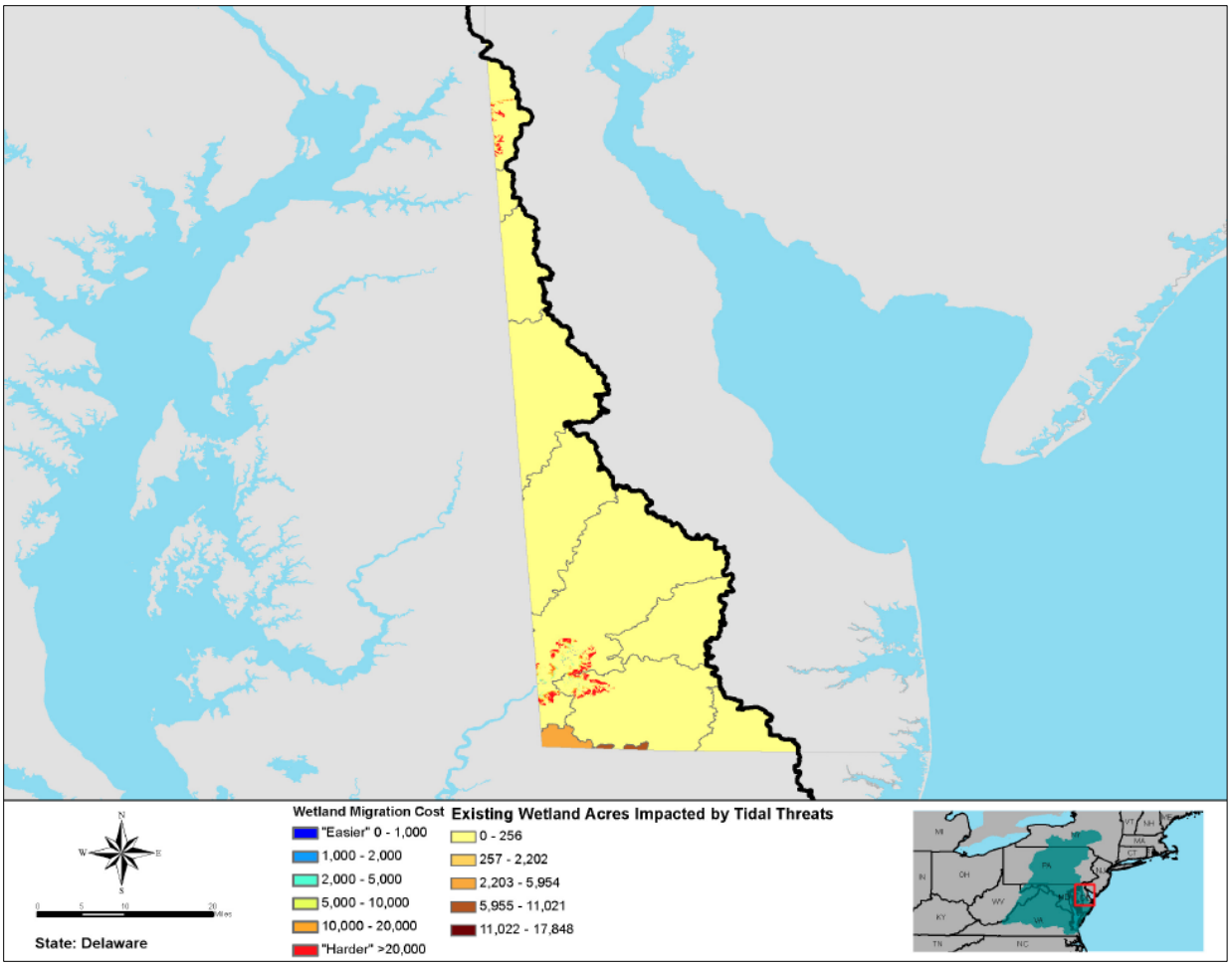

Figure 34. Wetland migration cost and wetland threats in Delaware

Table 14. Wetland Migration Opportunities Assessment in Delaware

Subwatershed Name	Wetland Migration Low Cost (Acres)
Chester River	3,688
Lower Nanticoke River	1,639
Wicomico River	887
Sassafras River	457
Elk River	452
Marshyhope Creek	368
Upper Choptank River	202
Bald Cypress Branch-Pocomoke River	190
Broad Creek	13

3.3 Regional Flow and Connectivity

Nature's Network developed data that characterizes the ability of flora and fauna to move across the landscape. This regional flow data characterizes areas within a range of constrained flow to high diffuse flow (Figure 33 and Table 15) (see the Planning Analyses Appendix for definitions of each category.) The purpose of this analysis is to discern where there are important areas of regional flow, as determined by the Nature Conservancy (2016), which could benefit from tidal and/or nontidal wetland restoration. By aligning areas for potential wetland restoration with regional flow, opportunities to improve connectivity and ease of passage are identified. To investigate this concept, the CBCP overlaid the combined wetland restoration opportunities with the regional flow data. The acreage that is identified by Nature's Network as being a regional flow corridor of any degree was summed within each subwatershed. The total acreage of restoration opportunity was classified into 5 groups utilizing the Jenks (Natural Breaks) method in ArcGIS. The top 2 groups of watersheds based on acreage of opportunity are identified as *Opportunity* subwatersheds. Those subwatersheds with the greatest overlap between wetland restoration opportunity (acres) and regional flow data include: Bald Cypress Branch-Pocomoke River (HUC 0208011102), Wicomico River (HUC 0208011003), and Marshyhope Creek (HUC 0208010903) subwatersheds.

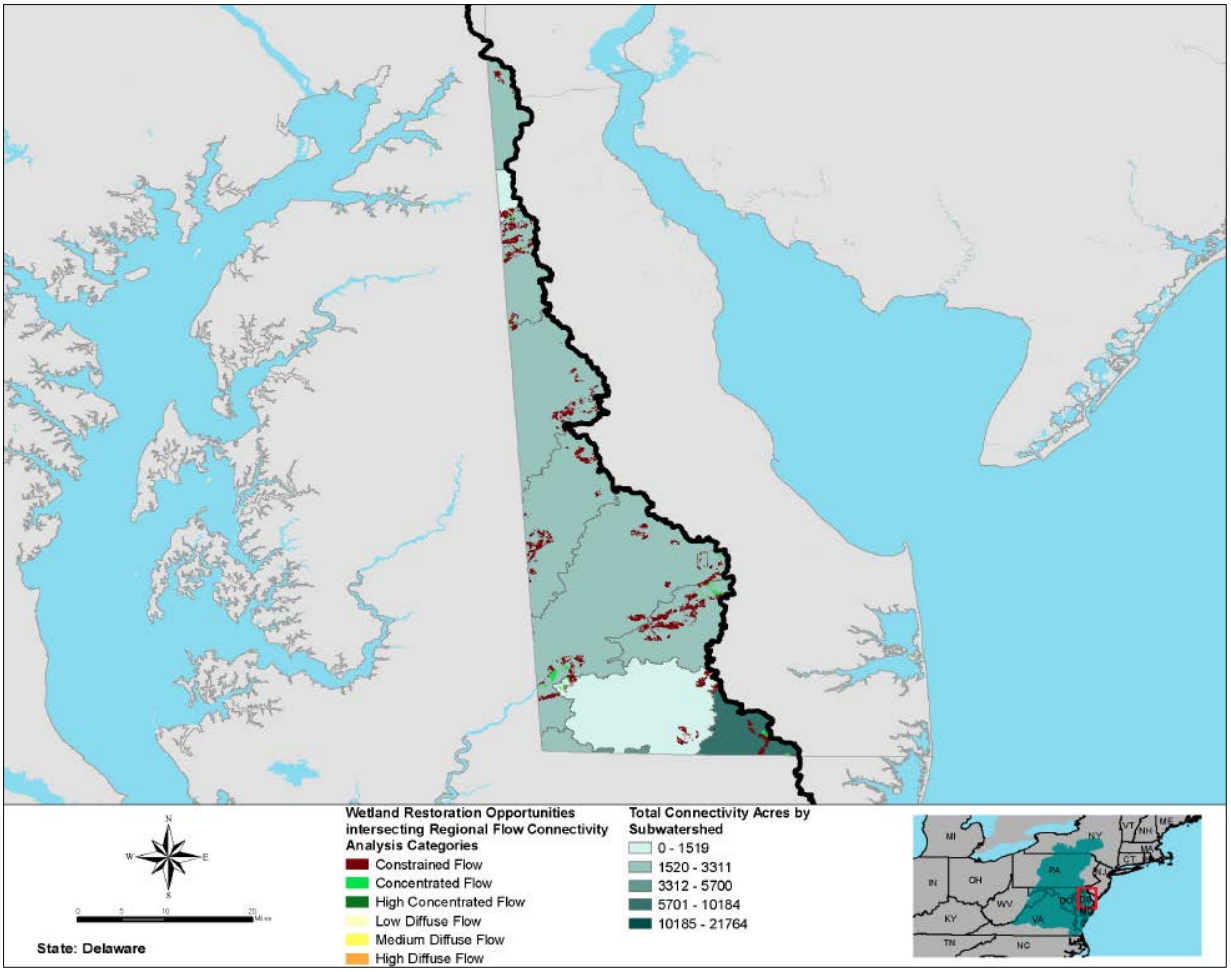

Figure 35. Acres of wetland restoration opportunities that could beneficially impact regional flow in Delaware

Table 15. Acres of wetland restoration opportunities that could beneficially impact regional flow in Delaware

Subwatershed Name	Wetland Restoration Opportunities Intersecting Regional Flow (Acres)
Bald Cypress Branch-Pocomoke River	7,482
Wicomico River	3,907
Marshyhope Creek	3,221
Elk River	2,968
Upper Nanticoke River	2,888
Chester River	2,825
Lower Nanticoke River	2,797
Deep Creek	2,546
Upper Choptank River	2,143
Broad Creek	1,025
Sassafras River	299

3.4 Road-Stream Crossings

A number of human activities can disrupt the continuity of river and stream ecosystems. The most familiar human-caused barriers are dams. Fish passage projects and dam removals have been a focus of the Chesapeake Bay Fish Passage Workgroup (FPWG) since 1989, and many dams and fish passage structures have been installed, opening thousands of miles of potential fish habitat. In recent years, there is growing concern about the role of road-stream crossings, especially culverts, in altering habitats, disrupting river and stream continuity, and blocking fish passage. Over 160,000 road-stream crossings exist in the Chesapeake Bay Watershed. In Delaware there are 1,247 road-stream crossings. However, few culverts in the Chesapeake Bay Watershed have been assessed for fish passage. Of those in Delaware, 57 have been surveyed (Figure 34).

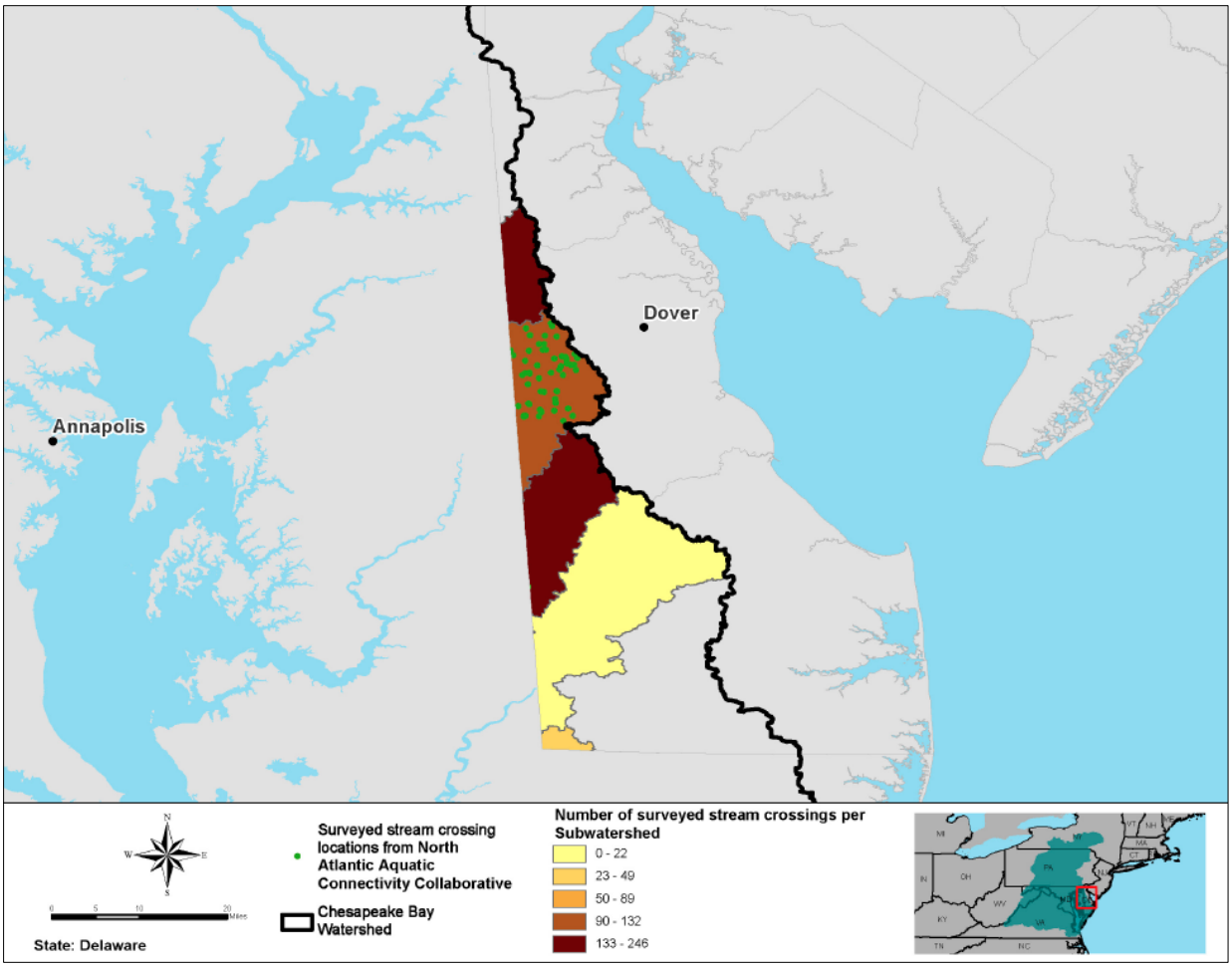

Figure 36. Surveyed stream crossings in Delaware

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SECTION 4
Integration Analysis

The *Opportunity* maps can guide various stakeholders and focus efforts. The purpose of the Integration Analysis was to evaluate the results of the individual Opportunity Assessments to identify where multiple 2014 Bay Agreement goals and outcomes or co-benefits that could be achieved. The resulting *Restoration Roadmap* is a compilation of the *Opportunity Assessments* which highlights co-benefits and the potential to address multiple problems with an integrated water resources management approach.

In Delaware, the following *Opportunities Assessments* identified subwatersheds with opportunities aligning with the 2014 Bay Agreement goals and outcomes:

- Nontidal wetlands restoration
- Wetlands restoration where dredged material may be used
- Wetlands restoration to benefit avian wildlife
- Connectivity – regional flow
- SAV restoration
- Riparian forest buffers
- Stream restoration
- Future threats – tidal
- Eroding shorelines
- Wetland migration
- Toxic contaminants
- Watershed stressors (water quality improvements)
- Healthy/High Value Habitats at risk to tidal threats (policy)
- Fish Passage

Due to the fact that there are a number of analyses that occur only in estuarine or tidal areas (oyster restoration, SAV, etc.), these data were separated and included in scoring only in those subwatersheds where 2014 Bay Agreement goals and outcomes have the potential to occur, eliminating bias towards tidal/estuarine areas at the mouth of the watershed when compared to the basin states further from the mainstem of the Chesapeake Bay. This allows for consistency between all analyses where subwatersheds were placed in disparate categories.

The subwatersheds in Delaware with the highest potential to achieve the most 2014 Bay Agreement goals are:

- Chester River (HUC 0206000204)
- Lower Nanticoke River (HUC 0208010905)
- Upper Nanticoke River (HUC 0208010904)
- Elk River (HUC 0206000202)
- Marshyhope Creek (HUC 0208010903)
- Wicomico River (HUC 0208011003)
- Upper Choptank River (HUC 0206000502)

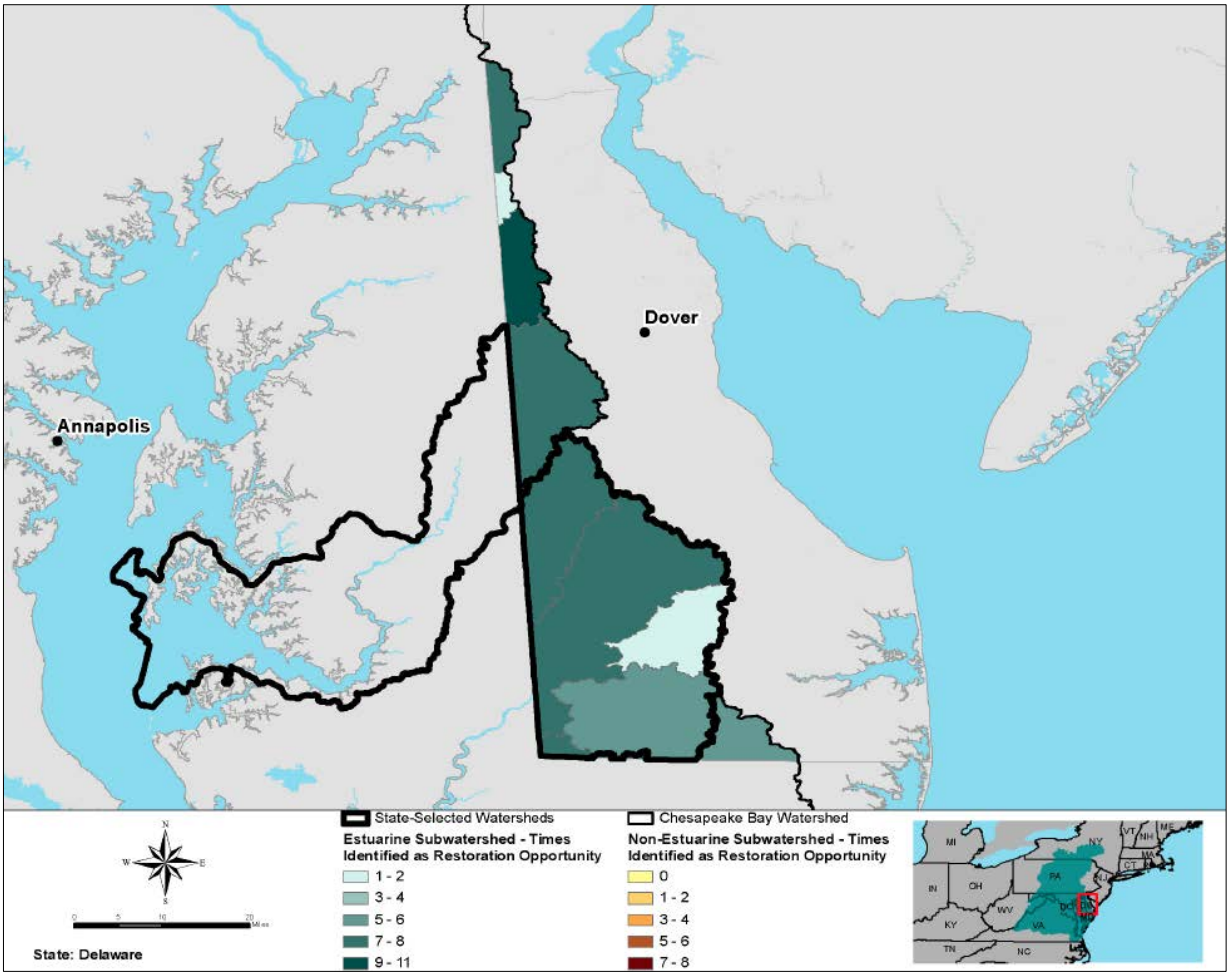

Figure 35. *Restoration Roadmap* for Delaware

Table 16. *Restoration Roadmap* for Delaware*:* Compilation of Opportunity Assessments (1 = yes; 0 = no)

Drainage States	HUC 10 Number	Subwatershed Name	Nontidal Wetland Restoration Opportunity	Tidal/Nontidal Wetland Restoration Opportunity Where Dredged Material May be Used	Wetland Restoration Opportunity to Benefit Avian Wildlife	Connectivity – Regional Flow Opportunity	SAV Restoration Opportunity	Riparian Forest Buffer Opportunity	Stream Restoration Opportunity	Future Threats – Tidal Opportunity
DE	0208010904	Upper Nanticoke River	1	1	1	0	0	1	1	0
DE, MD, PA	0206000202	Elk River	1	0	1	0	0	1	1	0
DE, MD	0206000203	Sassafras River	0	0	1	0	0	0	0	0
DE, MD	0208010903	Marshyhope Creek	1	1	1	0	0	1	1	0
DE, MD	0208010905	Lower Nanticoke River	0	0	1	0	0	0	1	1
DE, MD	0208011003	Wicomico River	1	1	1	0	0	0	1	0
DE, MD	0208011102	Bald Cypress Branch-Pocomoke River	1	0	1	1	0	1	1	0
DE	0208010901	Deep Creek	0	0	1	0	0	0	0	0
DE, MD	0206000204	Chester River	1	1	1	0	1	1	1	0
DE, MD	0206000502	Upper Choptank River	1	1	1	0	0	1	1	0
DE	0208010902	Broad Creek	1	1	1	0	0	0	1	0

Table 16. Restoration Roadmap for Delaware: Compilation of Opportunity Assessments

Drainage States	HUC 10 Number	Subwatershed Name	Eroding Shorelines Opportunity	Wetland Migration Opportunity	Toxic Contaminants Opportunity	Water Stressor Analysis Opportunity	Healthy/High Value Habitats at Risk to Tidal Threats (Policy) Opportunity	Times Identified as *Opportunity*	Times Identified as *Opportunity* including Fish Passage
DE	0208010904	Upper Nanticoke River	0	0	0	1	0	6	7
DE, MD, PA	0206000202	Elk River	0	0	1	1	0	6	7
DE, MD	0206000203	Sassafras River	0	0	0	1	0	2	2
DE, MD	0208010903	Marshyhope Creek	0	0	0	1	0	6	7
DE, MD	0208010905	Lower Nanticoke River	0	1	0	1	1	6	7
DE, MD	0208011003	Wicomico River	0	0	0	1	1	6	7
DE, MD	0208011102	Bald Cypress Branch-Pocomoke River	0	0	0	1	0	6	6
DE	0208010901	Deep Creek	0	0	0	1	0	2	2
DE, MD	0206000204	Chester River	1	1	0	1	0	9	10
DE, MD	0206000502	Upper Choptank River	0	0	0	1	0	6	7
DE	0208010902	Broad Creek	0	0	0	1	0	5	6

SECTION 5

State-Selected Watershed Action Plan Summary

The State-Selected Watershed Action Plans undertook a detailed analysis for each jurisdiction with the goal of identifying site-specific, project-scale for implementation. The watershed being evaluated in detail for Delaware is the Nanticoke River Watershed. The full action plan for the Nanticoke River Watershed is appended to this chapter. Figure 36 depicts the results of the action plan investigation. Utilizing the results of the CBCP baywide analyses, local data, and candidate restoration projects submitted by stakeholders, 9 areas are identified as focal points for developing projects that could address multiple CBA goals and outcomes. Table 17 summarizes the potential opportunities identified in each polygon.

Table 17. Summary of activities in proposed focus areas for project identification in the Nanticoke River Watershed

Nanticoke River Watershed Project Focus Areas									
Activity	A	B	C	D	E	F	G	H	I
Stream Restoration					X			X	
Riparian Buffer Restoration		X	X	X	X	X	X	X	X
Riparian Buffer Conservation		X	X		X	X	X		
Wetland Restoration	X	X	X	X	X	X	X	X	X
Wetland Conservation	X	X	X	X	X	X	X		X
Removal of Fish Blockages				X	X		X	X	
Stakeholder-Submitted Candidate Project									X

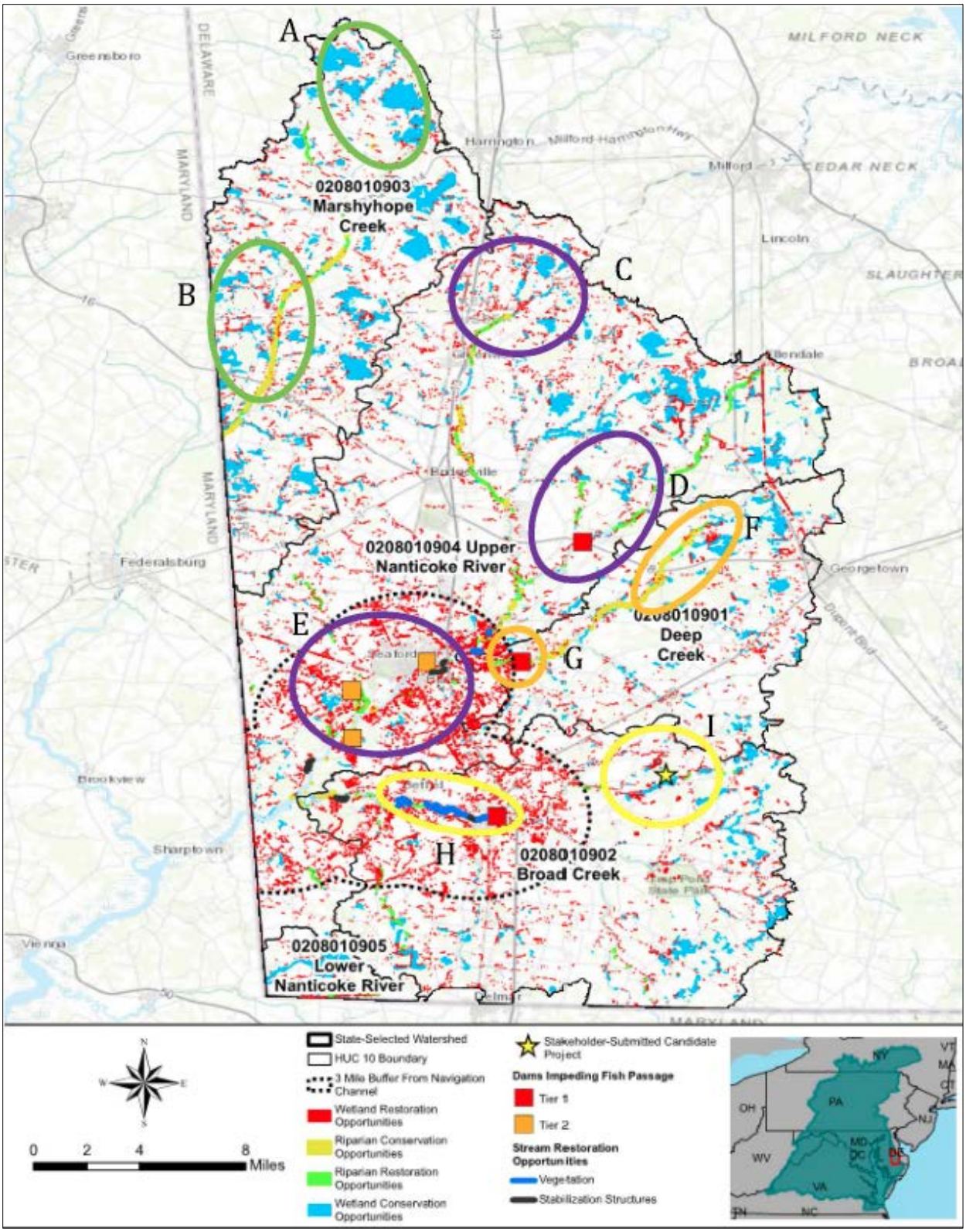

Figure 36. Proposed focus areas for project identification in the Nanticoke River WatershedThis page intentionally left blank.

SECTION 6

Funding and Implementation Strategy

The Federal Leadership Committee for the Chesapeake Bay, including EPA and the Departments of Agriculture, Commerce, Defense, and the Interior, invested more than $536 million in watershed restoration in fiscal year 2016. Funding is directed to state and local governments, educational institutions, nonprofit organizations, and territorial and tribal agencies. These groups often provide additional funding—cash or in-kind—to further facilitate restoration efforts.

This section details a summary of federal, state, and nongovernmental programs and organizations that could be pursued for assistance in implementation efforts.

6.1 Federal Funding

The *Catalog of Federal Funding Sources for Watershed Protection* is a searchable online database of financial assistance sources (grants, loans, and cost-sharing) available to fund a variety of projects. The database may be searched by:

- Key word (e.g., wetlands, infrastructure, education, forestry);
- Type of organization (e.g., nonprofit groups, state, tribal, educational institution);
- Match requirement (yes or no); and
- Federal agency.

A search of all criteria provided programmatic information by agency that may be useful for different needs and opportunities identified in the CBCP. This information is available in the CBCP Existing Watershed Conditions and Threats Report in Table 39 of Section 12.3. Each program is linked to a web page that details the most current information regarding the funding source, including program overview, current and past funding levels, lowest/median/highest awards, match requirements, contact information, and eligible organizations.

6.2 Non-Governmental Resources

Outreach and public engagement, advocacy, volunteer and community support, monitoring, and research are examples of activities that many nongovernmental and nonprofit groups do as part of their mission. These groups often are more nimble than larger governmental agencies. They are on the ground and aware of opportunities and constraints at the parcel scale. Networking with community groups can bring much needed resources to the aid of communities with the capacity to facilitate restoration efforts. Tables 40 and 41 in Sections 12.4 and 12.5 of the CBCP Existing Watershed Conditions and Threats Report catalogs a list of groups that support habitat conservation, management, and restoration efforts that are complementary to Chesapeake Bay goals.

6.3 Public-Private-Partnerships

A public-private partnership is typically a contractual agreement between a state or locality and a private organization or nongovernmental organization that commits them to provide an environmental or recreational service. Public/Private partnerships will be an essential component for implementation of various CBCP measures, including those associated with restoration, water quality, recreation, stewardship, and conservation. For example, public-private partnerships have become a popular and effective method to achieve stringent water quality standards required to meet stormwater initiatives in the Chesapeake Bay Watershed. Another successful and viable example of a public-private partnership approach is the execution of voluntary, long-term real estate protections by local citizens in the Chesapeake Bay Watershed. Other successful partnerships that have been implemented in the watershed are citizen water quality monitoring programs and programs where students grow oyster spat for reef restoration projects. Other public-private partnerships exist in which schools grow vegetation that they then plant at local restoration sites, providing a viable function for the school and promoting stewardship and interpretation throughout the watershed. Overall, the implementation of public-private partnerships will be an essential component to ensure successful implementation of the CBCP.

SECTION 7
References

Source information for all geospatial data is provided in Annex 3 of the Planning Analyses Appendix.

U.S. Department of Health & Human Services (USDH&HS). 2017. What are the Superfund "NPL" statuses? https://toxmap.nlm.nih.gov/toxmap/faq/2009/08/what-are-the-superfund-site-npl-statuses.html