2021 Annual Report

Nonpoint Source Program

Grant Jiang

DNREC
Division of
Watershed Stewardship

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Table of Contents

Table of Contents **2**
Preface **3**
What is Nonpoint Source Pollution? **4**

The DNREC NPS Program **5**
NPS Program Funding 5
Delaware NPS Issues 6
Vision and Mission 7
Executive Summary 8
Overall Pollution Load Reduction from BMP Implementation 11
Watersheds 12
Appoquinimink River 13
Broadkill River 14
Chester River and Choptank River 15
Christina Basin 16
Inland Bays 17
Nanticoke River 18
Pocomoke River and Wicomico River 19
St. Jones River 20
Upper Chesapeake 21
Project Highlights 22
Delaware Botanic Gardens – A Model for Implementing Stormwater BMPs 22
Delaware Wild Lands and Center for Inland Bays –
Long Field Forest Reforestation at the Great Cypress Swamp 27
Load Reductions 28
2021 Annual BMP Nutrient Reductions for Nitrogen & Phosphorous 29
Future Changes and Challenges 31
List of Partner Organizations/Committee Members 34

Appendices **35**
1. Appendix A – 2021 Milestones 35
2. Appendix B – Water Quality Trend Data 38
Figure 1: Location of C1 Monitoring Sites for Trend Analysis 40
Table 1: Total Nitrogen (TN) Trend Analysis Summary 2008 – 2017 41
Table 2: Total Phosphorous (TP) Trend Analysis Summary 2008 – 2017 41
Mission and Program Staff 42

Preface

The 2021 NPS Annual Report is developed by the Delaware Department of Natural Resources and Environmental Control (DNREC) to meet a grant condition in each annual **Clean Water Act (CWA) Section 319(h)** Grant award to the State of Delaware from the U.S. Environmental Protection Agency (EPA). This programmatic condition in the award states that the report shall contain the following:

Junction and Breakwater Trail Bridge at Munchy Branch

- A brief summary of progress in meeting the schedule of milestones in the approved **Delaware NPS Management Program**;
- Reductions in nonpoint source pollutant loading and improvements in water quality that have resulted from implementation of the management program; and
- Descriptions of priority watershed based plan accomplishments. Accomplishments should be based on the implementation milestone goals/objectives as identified in each priority plan. The goal information can be displayed in the form of a watershed goal/accomplishment chart showing percentage achieved, supplemented by a short narrative that should give the reader a clear understanding of the actions being taken as well as the outputs and outcomes which are occurring from the actions. If monitoring was completed, a summary of that information should also be included.

What Is Nonpoint Source Pollution?

NPS pollution is defined as polluted stormwater runoff associated with rainfall, snowmelt or irrigation water moving over and through the ground. As this water travels, it can collect and carry pollutants such as sediments, nutrients, toxics and pathogens. These pollutants eventually reach lakes, rivers, streams, wetlands, coastal waters and ground waters of Delaware.

A great blue heron on the bank of the St. Jones River, Dover.

NPS pollution is associated with a variety of activities on the land, including farming, logging, urban/construction runoff, onsite sewage systems, streambank degradation and shore erosion. For example, stormwater runoff from large storm events can transport nutrient sources of nitrogen and phosphorus into local streams, rivers and ponds. Under natural conditions, this is beneficial. However, if excessive nutrients enter these water bodies and cause nuisance algae blooms, then these nutrients are deemed pollutants.

The pollution contributed by nonpoint sources is the main reason why many of Delaware's waters are considered "impaired." Impaired waters are those waters that do not meet Water Quality Standards for designated uses (e.g., fishing, swimming, drinking water, shellfish harvesting, etc.). Progress in managing NPS pollution in Delaware is represented in this report. It was produced by the **DNREC NPS Program to meet the Clean Water Act, Section 319(h)** grant conditions and to demonstrate consistency with **EPA's 2018-2022 Strategic Plan**. The main area of EPA's Strategic Plan in which Delaware focuses its work on Goal 1, Core Mission: Deliver real results to provide Americans with clean air, land and water and ensure chemical safety, and Objective 1.2: Provide for clean and safe water.

The DNREC NPS Program

As part of DNREC, **Delaware's NPS Program** is committed to addressing the issue of NPS pollution as it affects Delaware's numerous waterbodies. Efforts include grant funding, education, outreach and partnerships with other organizations that work together to reduce NPS pollution in Delaware.

NPS Program Funding

NPS pollution constitutes the nation's largest source of water quality problems. Approximately 40% of the United States rivers, lakes and estuaries surveyed to date are not clean enough to meet basic uses, such as fishing or swimming, due to NPS pollution.

To counter the ever-expanding NPS pollution problem, Congress established the NPS Pollution Management Program under **Section 319** of the Clean Water Act (CWA) in 1987. This program provides states with grants to implement NPS pollution controls to achieve goals that are described in NPS pollution management program plans.

On Aug. 4, 1988, Delaware's original NPS Program was approved by the EPA, making it one of the first programs in the nation to comply with **Section 319** of the CWA. Delaware administers its NPS Program utilizing the Five-Year Nonpoint Source Program Management Plan that was most recently updated in 2019. Using CWA **Section 319** federal grant funding, Delaware's NPS Program administers a competitive grant program to solicit best management practices (BMP) implementation project proposals that address NPS pollution and enhance water quality efforts.

The grant provides funding for projects designed to reduce NPS pollution in Delaware's impaired waterbodies. Reduction of NPS pollution is most often achieved through incorporation of specific BMPs into project workplans. Whenever possible, funds are focused in sub-watersheds where NPS control activities are likely to have the greatest positive impact. Funded restoration activities are implemented using the most effective measures and practices available in order to achieve water quality improvements.

Eligible types of management program implementation activities include the following:

- Non-regulatory NPS reduction programs
- Technical assistance
- Financial assistance
- Education
- Training
- Technology transfer
- Demonstration projects

Proposals are solicited annually from potential grant applicants through an advertised request for proposal (RFP) process. These grant application proposals are reviewed, evaluated and prioritized to determine which are most suitable for implementation funding. At least 40% of the overall project cost must be represented by non-federal matching funds.

Delaware NPS Issues

More than 90% of Delaware's waterways are considered impaired. The state's list of impaired waters in the most recently issued **2020 State of Delaware Combined Watershed Assessment Report (305(b))** and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs, includes assessment units (waterbodies and stream segments) throughout the state with 10 different impairments. The most common impairments are NPS-related pollutants including pathogens and nutrients (nitrogen and phosphorus).

Most impairments come from nonpoint sources which are harder to control. As Delaware is a groundwater-driven state, removing NPS pollutants becomes an even more difficult and complex problem to solve. Due to the rate that groundwater travels through the system, many NPS pollutants that entered the systems 30 years ago are just now entering surface water bodies at the present day. As such, the effectiveness of current agricultural BMPs will not be realized until much further in the future.

"Impaired waters" are polluted waters. More technically, they are waters that do not meet water quality standards for their designated uses, such as recreation, fishing or drinking. Impaired waters could be suffering from excess nutrients, low dissolved oxygen, toxins, bacteria, heat or any combination of these problems.

Reduction of NPS pollution is achieved through the incorporation or installation of specific BMPs addressing agriculture, silviculture, construction, septic systems and hydromodification activities. To encourage and support the BMP installation, the NPS Program administers a competitive grant program currently made possible through **Section 319** of the CWA. While this federal financial support has proven successful in complementing Delaware's NPS efforts, the NPS Program routinely seeks additional finances to expand activities to more systematically address Delaware's NPS concerns.

Additional roles and responsibilities of the NPS Program include geospatial BMP tracking and reporting, management of the Chesapeake Bay Implementation Grant (CBIG), management of the **Surface Water Matching Planning Grant (SWMPG)** and **Community Water Quality Improvement Grant (CWQIG)** administered through the **Water Infrastructure Advisory Council (WIAC)**, management of the agricultural State Revolving Fund (SRF) Program, support for developing Pollution Control Strategies (PCS), and watershed plan development and/or coordination.

Vision and Mission

DNREC envisions a Delaware that offers a healthy environment where people are committed to the protection, enhancement and enjoyment of the environment; where Delawareans' stewardship of natural resources ensures the sustainability of these resources for the appreciation and enjoyment of future generations; and where people recognize that a healthy environment and a strong economy support one another.

DNREC's mission is to protect and manage the state's vital natural resources, protect public health and safety, provide quality outdoor recreation, and to serve and educate the citizens of the First State about the wise use, conservation, and enhancement of Delaware's environment.

The **NPS Management Program** is a dynamic and open-ended program intended to facilitate and promote statewide efforts to manage NPS pollution. The following priorities guide this program:

1. The NPS Program will support the identification and quantification of those problems that are caused specifically by NPS pollution through assessment updates;

2. The NPS Program will be implemented and updated to realistically reduce NPS pollution in a cost-effective manner;

3. The NPS Program will address NPS pollution through a program that balances education, research, technical assistance, financial incentives and regulation;

4. The NPS Program will follow a non-degradation policy in areas where surface and ground waters meet state water quality standards and to realistically improve water quality in areas that do not meet these standards;

5. The NPS Program will continue to use a coordinated approach for implementation and maintain an open-ended framework to incorporate new initiatives and support interactive approaches based on the effectiveness of existing policies and implementation mechanisms; and

6. The NPS Program will support the development and implementation of Pollution Control Strategies (PCS) and/or nine element (a-i) watershed implementation plans for watersheds of identified impaired or threatened waters in accordance with the Unified Watershed Assessment List.

In Delaware, DNREC is the lead agency for the development and implementation of the NPS 319 Program, through its Division of Watershed Stewardship.

Executive Summary

The **DNREC NPS Program** has focused this annual report on nine priority watersheds in Delaware: the Appoquinimink River, Broadkill River, Chester and Choptank River, Christina Basin, Inland Bays, Nanticoke River, Pocomoke and Wicomico River, St. Jones River and the Upper Chesapeake. All of these priority watersheds suffer from impairments linked to nonpoint source water pollution.

In Federal Fiscal Year (FY) 2020 (Oct. 1, 2019 to Sept. 30, 2020), the Delaware NPS Program received $1,199,500 in federal **Section 319**(h) grant funds to focus on nonpoint source water pollution reduction efforts. For Federal FY21 (Oct. 1, 2020 to Sept. 30, 2021), the NPS Program was awarded $1,233,200.

This annual report documents the activities and highlights of the DNREC NPS Program during the 2021 calendar year. It also fulfills the reporting requirements contained in **Section 319** of the federal CWA. The NPS Program annually prepares this report to inform stakeholders on the state's progress in the area of NPS water pollution reduction. Although this report should not be considered a complete enumeration of all NPS pollution reduction activities, it describes the most important features and accomplishments of the NPS Program.

In 2021, the DNREC NPS Program continued to reduce water pollutant levels by working towards achievement of milestone targets. Milestone targets are near-term or long-term commitments that promote a steady pace of progress towards water quality improvement. This report identifies accomplishments during the 2021 calendar year that helped Delaware achieve long-term and short-term milestones (Appendix A), which have been identified in the state's NPS Management Program. Milestone activities successfully implemented during 2021 to support and/or enhance the program include, but are not limited to: providing grant funding, education and outreach, and enhancing partnerships with other organizations to work together to reduce NPS pollution in Delaware.

- **Grant funding –** For Federal FY21 (Oct. 1, 2020 to Sept. 30, 2021), the DNREC NPS Program was awarded $1,233,200 in federal **Section 319**(h) grant funds to focus on nonpoint source pollution reduction efforts. Grant funding was utilized and leveraged to implement pollutant control projects, BMPs, and actions featured in the table on page 11. The Federal FY22 grant cycle began Oct. 1, 2021 and ends Sept. 30, 2026. The NPS Program submitted a federal **Section 319**(h) grant application to the EPA in May 2021 for FY22.

- **Education and Outreach –** The COVID-19 pandemic began to cause major disruptions beginning in March 2020. In-person meetings, events, trainings, conferences and other workshops were either canceled, postponed indefinitely/and or converted into a virtual format. As of late 2021, the pandemic has continued to cause disruptions with outreach and education events that were previously conducted in-person. Some of these events were transitioned into a virtual format, whereas others were suspended until the public health crisis improves.

Despite logistical challenges posed by the pandemic, the **DNREC NPS Program** remained active in outreach events in both a virtual and in-person format. A breakdown of events and initiatives are as follows:

- In April 2021, the NPS Program assisted with virtual Earth Day and Earth Week events and outreach initiatives including a climate quiz, a video contest which received more than 70 entries, and promotion of the Department's Earth Day and beach grass planting videos;

- NPS Program staff participated in the Delaware Envirothon event and planning processes;

- NPS Program assisted with Chesapeake Bay Awareness Week through a social media campaign for promotional and information purposes from June 5 through June 13, 2021;

- NPS Program staff attended the River Rally and Choose Clean Water Virtual Conference in May 2021;

- On June 27, 2021, the NPS Program helped promote and participated in the Broad Creek Cleanup at the Roger C. Fisher Park in Laurel, Delaware. Twenty volunteers participated in the event, which was hosted by the Nanticoke Watershed Alliance;

- On July 10, 2021, the NPS Program exhibited at the Nanticoke Riverfest in Seaford, Delaware, to distribute informational brochures on how to reduce nonpoint source pollution, connecting with 85 participants;

- Staff from the NPS Program attended the Delaware State Fair in July 2021 and worked in the Department's exhibit building, interacting with approximately 2,000 visitors;

- The NPS Program helped to promote the Nanticoke Watershed Alliance's "Pots for Pollinators" programs conducted on July 24 and Aug. 12, 2021. Both events were well attended and received media coverage from WBOC-TV;

- On Sept. 11, 2021, NPS Program staff participated in the DNREC-sponsored Delaware Coastal Cleanup;

- The NPS Program assisted in the promotion and coordination of the Delaware Watersheds Photo Contest highlighting the Chesapeake Bay Watershed from Sept. 28 through Oct. 26, 2021. The goal of the contest was to highlight the beauty of Delaware's diverse environment while acting as a vivid reminder that what happens on land directly affects what happens in waterways. The division received 83 photographs for the contest. A diverse judging panel consisting of a photographer, scientist and educator determined seven finalists. The winner of the contest was determined by the public through online voting on the Division of Watershed Stewardship Facebook page. A social media campaign accompanied the contest, reaching 45,037 Facebook newsfeeds, resulting in 5,117 direct interactions.

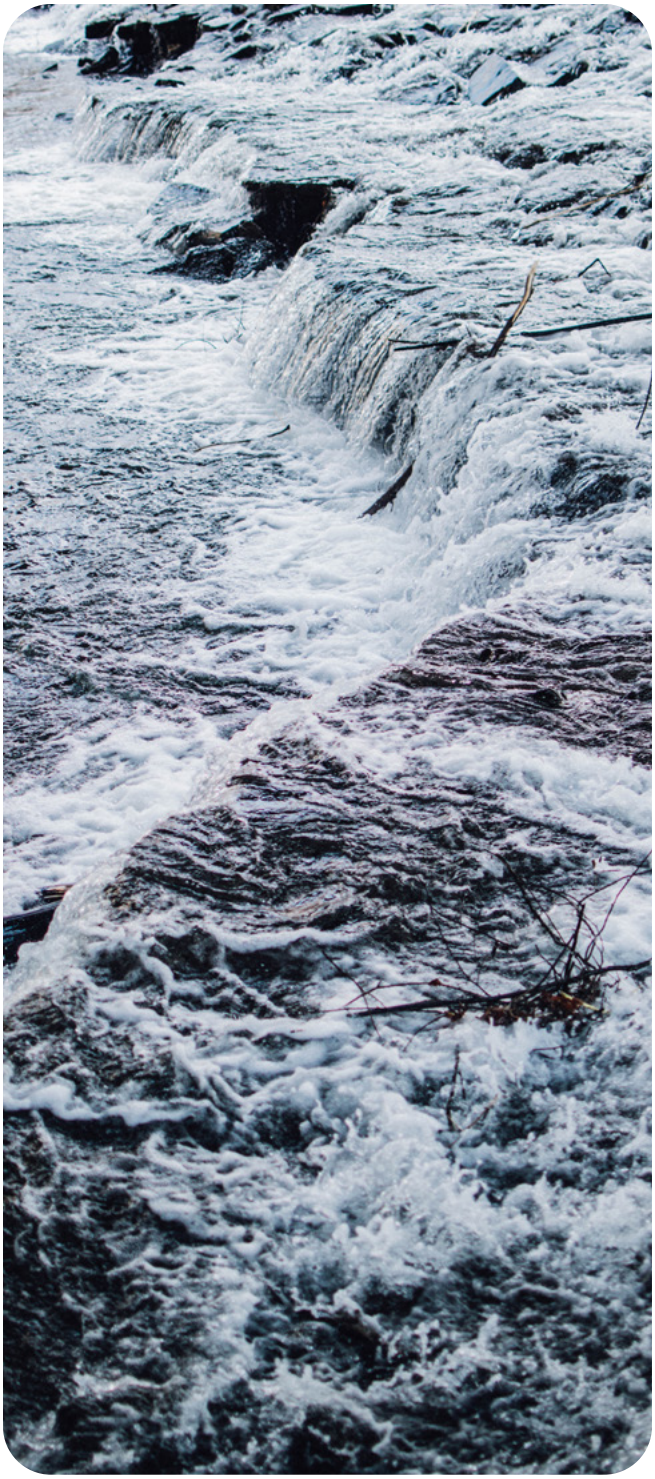
- On Oct. 16, 2021, the NPS Program exhibited at the Blackbird Creek Fall Festival to help promote ways to reduce nonpoint source pollution, with approximately 1,230 people in attendance; and

- The NPS Program developed a **Conservation Reserve Enhancement Program (CREP)** video for the "We're Here for You" conservation outreach campaign. A new CREP outreach PowerPoint presentation was developed and an official CREP webpage on the NPS Program's website was launched.

Partnerships – The **DNREC NPS Program** continues to develop longstanding relationships with existing partners as well as seeking to foster working relationships with new partners. The NPS Program continues to work closely with the county Conservation Districts to implement various agricultural related BMPs in the landscape. Periodic meetings with project implementation partners were conducted throughout the year to discuss possible BMP implementation projects.

In May 2021, the NPS Program hosted the Delaware Nonpoint Source Advisory Committee meeting in a virtual format that brought together various stakeholders from the state, federal and local governments, academia, and non-governmental organizations. With approximately 50 attendees, this event highlighted BMP project implementation funded by the program's various water quality grants and discussed opportunities and challenges moving forward.

The NPS Program continues to participate in a monthly "Luncheon Learn," which shifted to a virtual format as a result of the pandemic. These monthly sessions bring together partner organizations including the University of Delaware, County Conservation Districts, the Farm Service Agency, the Natural Resources Conservation Service, the Delaware Department of Agriculture and the Delaware Association of Conservation Districts to discuss opportunities to improve, enhance, and leverage various programs to address resource concerns throughout the state.



Karla Robert

Christina Basin

Overall Pollution Load Reduction from BMP Implementation

Overall, the NPS Program-funded projects completed during the calendar year in approved watersheds resulted in pollutant load reductions of nitrogen at 1,937,321.5 pounds/year and phosphorus at 65,570.7 pounds/year (see table below for major BMP areas). Delaware continues to ensure that projects funded with **CWA Section 319** dollars make progress towards restoring or protecting waters impaired by NPS pollution.

Pollutant Controls, Practices and Actions	2021 Annual Progress	Unit
Cover Crop (traditional and commodity)	95,124	Acres
Nutrient Relocation (net export from watershed)	37,593	Tons
Nutrient Management	331,456	Acres

Notes:

1. Cover crop acres are reported annually and can vary from year to year due to both financial and weather-related circumstances. This figure represents the total acres of cover crops that were directly funded by **Section 319** grant dollars as well as those acres where grant funded conservation planners provided technical assistance in the signup, implementation and destruction verification of those cover crops within the various priority watersheds.

2. Nutrient relocation (manure relocation) tonnage is reported annually and can vary from year to year due to various agriculture-related logistics including weather and chicken house clean out schedules which are directed by the poultry integrator. Other logistical factors such as fuel cost can cause fluctuations of tonnage relocated annually.

3. Nutrient management acres are reported annually and can vary from year to year due to the duration and expiration dates of nutrient management plans. This figure represents the total nutrient management acres that were directly funded by **Section 319** grant dollars through conservation planners and the Delaware Department of Agriculture's Nutrient Management Program with both technical and financial assistance provided.

Watersheds

Delaware has nine "priority" watersheds that have EPA-approved a-i, nine element watershed implementation plans (WIP) with BMP projects implemented utilizing CWA **Section 319**(h) funds. Each of the priority watersheds are represented individually within this section to highlight the watershed's characteristics and TMDL goals, and to reflect implementation progress (both annually and cumulative) of BMPs that are funded directly with CWA **Section 319**(h) funds.

Delaware's nine priority watersheds with EPA-approved watershed implementation plans are:

- Appoquinimink River
- Broadkill River
- Chester River and Choptank River
- Christina Basin
- Inland Bays
- Nanticoke River
- Pocomoke River and Wicomico River
- St. Jones River
- Upper Chesapeake

Appoquinimink River Watershed

The BMP Progress Reporting Table found on each individual watershed's page are those BMPs funded directly with Clean Water Act (CWA) **Section 319**(h) grant funds through the Delaware NPS Program. The WIP goal is established by the approved a-i, nine element watershed implementation plan and reflects the implementation necessary to achieve the required TMDL nutrient loading reductions.

Notes:

1. The Christina Basin a-i watershed plan does not identify a numerical cover crop acre implementation goal. Based on the identified 2,738 acres of grain production area within the watershed, a best professional judgement of 1,369 acres (50%) would be allocated as the goal due to anticipated cropping rotation practices.

2. The Christina Basin a-i watershed plan does not identify a numerical nutrient management implementation goal. Based on the identified 7,560.6 acres of total agricultural land use in the subwatersheds, and subtracting 322.4 acres of trees and wildlife, the identified goal is 7,238.2 acres which represents grain production and pasture and hay acreage across the subwatersheds.

3. The entire Chesapeake Bay watershed has an approved Phase III Watershed Implementation Plan (WIP) with Region 3 EPA.

Appoquinimink River

Watershed Description: The 16-mile Appoquinimink River meanders through farmlands and wetlands in southern New Castle County, Delaware, draining 47 square miles. The headwater drains mostly agricultural lands and feeds four major ponds. The tidal freshwater segment of the Appoquinimink is bound by the head of tide at Noxontown Pond and Silver Lake, and by Drawyer Creek's confluence with the Appoquinimink. The remainder of the watershed consists of a tidal marsh extending to the Delaware River. The Appoquinimink River system consists of five main tributaries: the Appoquinimink River main stem, Deep Creek, Dove Nest, Hangman's Run and Drawyer Creek. There are several shallow, human-made small lakes and ponds in the watershed: Wiggins Mill Pond, Noxontown Pond, Silver Lake and Shallcross Lake. The Appoquinimink River is tidal from the confluence with Delaware Bay to the dam at Noxontown Lake on the main stem, the dam at Silver Lake on Deep Creek, and the confluence with Drawyer Creek. Salinity intrusion from Delaware Bay typically reaches upstream to river kilometer 8.5, past the Drawyer Creek confluence.

Appoquinimink River Watershed

Goals: Total Maxium Daily Loads (TMDLs) were established for the entire Appoquinimink River in December 2003. These TMDLs called for 325,215 lbs/year and 8,578 lbs/year reductions in NPS nitrogen (N) and phosphorus (P), respectively. An implementation plan was developed by a diverse team of citizens and government agency staff and presented to DNREC for promulgation to reach the prescribed TMDLs. Load reductions will be achieved through the implementation of Best Management Practices in agriculture, development, wastewater and private stewardship. The strategy is designed to reduce nutrient loadings from current and future land practices. This combination of actions will lead to the achievement of the TMDL.

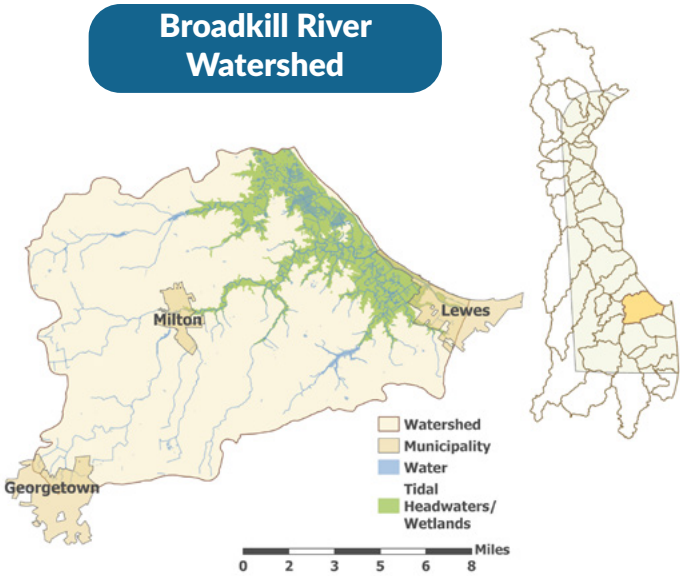
Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	0	Annual	3,460	0	0	0
Nutrient Relocation (net export from watershed)	Tons	80	Annual	N/A	N/A	534	23
Nutrient Management	Acres	13,663	Annual	12,584	108.6	45,775	220
Hardwood Tree Planting	Acres	8.5	12.23	N/A	N/A	660	13
Riparian Buffer (forest and vegetative)	Acres	0	36	6	600	1,832	35
Total Reduction						48,801	291
Watershed Implementation Plan (WIP) Load Reduction Goal						325,215	8,578
% Load Reduction Achieved						15	3

Broadkill River

Watershed Description: The Broadkill River Watershed is located in the east central portion of Sussex County, Delaware. It is bounded on the north by the Cedar Creek Watershed, on the west by the Gravelly Branch and Deep Creek watersheds, on the south by the Lewes-Rehoboth Canal, Rehoboth Bay and Indian River watersheds, and on the east by the Delaware Bay. The mainstem of the Broadkill River is approximately 25 miles long. The major watercourse in this segment is the Broadkill River, which originates at the Town of Milton, and discharges into the Roosevelt Inlet near Lewes. Major impoundments in the area are Waggamons and Diamond ponds located near Milton. The Broadkill River flows generally eastward until it approaches the coast where it turns abruptly and flows south to discharge into the Roosevelt Inlet. The flow of this stream is sluggish and the water is turbid. The watershed drains an area of 107 square miles.

Broadkill River Watershed



Goals: The established Total Maximum Daily Load (TMDL) requires a 40% reduction in NPS nitrogen (N) and phosphorous (P) from the 2002-2003 baseline levels of 1,353,055 lbs/yr (3,707 lbs/day) and 57,597 lbs/yr (157.8 lbs/day), respectively. The NPS nitrogen and phosphorous load reduction is 541,222 lbs/yr and 23,039 lbs/yr, respectively. As a result of land use changes from 2002-2007, the 2007 baseline NPS loads changed to total N of 2,891 lbs/day and P of 124.1 lbs/day. Total N reductions of 667.1 lbs/day (243,700 lbs/yr) and total P reductions of 29.4 lbs/day (10,740 lbs/yr) are required. This shall result in a yearly average total nitrogen and phosphorous load of 2,224.2 lbs/day (811,833 lbs/yr) and 94.7 lbs/day (34,565.5 lbs/yr), respectively, to achieve the 2025 TMDL.

Best Management Practices (BMP) Progress 2021

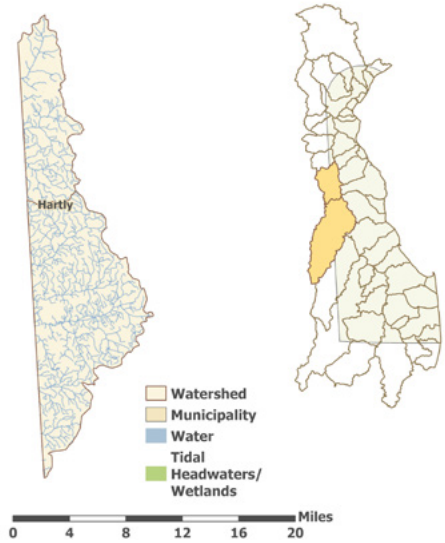
BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	5,584	Annual	9,763.1	57	70,885	330
Nutrient Relocation (net export from watershed)	Tons	670	Annual	3,165	21	3,726	395
Nutrient Management	Acres	28,119	Annual	26,476	106	78,530	9,111
Hardwood Tree Planting	Acres	0	192.7	192	100.4	79.5	2.5
Rain Garden	Structure	0	5.4	N/A	N/A	108	3
Total Reduction						153,328.5	9,841.5
Watershed Implementation Plan (WIP) Load Reduction Goal						243,700	10,740
% Load Reduction Achieved						63	91

Chester and Choptank Rivers

Watershed Description: In Delaware, the majority of the Chester and Choptank watersheds are in Kent County, while a portion of the Chester River originates in New Castle County, Delaware. Both rivers drain into Maryland's Eastern Shore, including Kent County, Queen Anne's County, and Caroline County. The Chester and Choptank watersheds include 88,217.5 acres, or 137.8 square miles of land area. Chester River in Delaware includes a 40-square-mile drainage area with headwaters beginning at the divide between New Castle and Kent counties. Delaware headwater segments, including Cypress Branch, Sewell Branch and Gravelly Run, flow west into both Kent County and Queen Anne's County, Maryland.

The Choptank River Watershed, located immediately south of the Chester River, includes 62,191 acres. Headwater tributaries to the Choptank River include Tappahanna Ditch, Culbreth Marsh Ditch and Cow Marsh Creek.

Chester and Choptank Rivers Watersheds



Goals: The TMDL established for the Chester and Choptank River Watersheds capped the nonpoint source nitrogen loads at the 2001 - 2003 baseline levels of 708 lbs/day (258,600 lbs/year) for Chester and 1,359 lbs/day (496,400 lbs/year) for Choptank. A phosphorus reduction goal of 40% is set from the 2001 - 2003 baseline levels, which equates to 12.3 lbs/day for Chester and 51.1 lbs/day for Choptank. Baseline loads in the Chester and Choptank for phosphorus are 19,940 lbs/year and 46,390 lbs/year, with TMDL allocated loads set to 11,800 lbs/year and 27,720 lbs/year. Total phosphorous load reductions of 26,810 lbs/year are required for the Chester and Choptank.

Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	8,600	Annual	26,260.5	33	81,066	169
Nutrient Relocation (net export from watershed)	Tons	406	Annual	N/A	N/A	1,676	80
Nutrient Management	Acres	17,477	Annual	37,249.6	47	36,243	1,880
Hardwood Tree Planting	Acres	0	377	177.8	212	11,748	293
Water Control Structure	Acres	0	348	3,120.7	11.2	2,602	0
Stream Restoration	Feet	0	1,924	11,722	16.4	260	303
Wetlands Restoration	Acres	0	551	2,113.4	26.1	12,791	441
Total Reduction						146,386	3,166
Watershed Implementation Plan (WIP) Load Reduction Goal						755,000	26,810
% Load Reduction Achieved						19	12

Christina Basin

Watershed Description: The Christina Basin is a 565-square-mile basin contained in the larger Delaware River Basin. The Christina Basin, located in New Castle County in northern Delaware, includes four sub-watersheds:

- Brandywine Creek, 325 square miles
- Red Clay Creek, 54 square miles
- White Clay Creek, 107 square miles
- Christina River, 78 square miles

Although a small portion can be found within Maryland, the Christina Basin falls principally within two states which includes Pennsylvania to the north and Delaware to the south. The Pennsylvania portion is characterized by more open space including agricultural land and forests, while the more urban, southerly portion in Delaware is more residential.

Christina Basin Watershed

The Watershed Implementation Plan development for the Christina Basin Watershed was approved by the EPA in spring 2013.

Goals: The EPA TMDL bases its required reductions on a subwatershed basis. Delaware collects data on a watershed wide level basis. An estimate of nitrogen (N) and phosphorous (P) reduction loads from a subwatershed level basis in Brandywine Creek, Red Clay Creek, White Clay Creek and Christina River were added together to make a total of estimated reductions that are required on a watershed wide level basis to achieve the TMDL. Estimated total nitrogen and phosphorous load reductions required to achieve TMDL requirements are 343.54 lbs/day (125,392.10 lbs/year) and 43.08 lbs/day (15,724.20 lbs/year), respectively.

Best Management Practices (BMP) Progress 2021

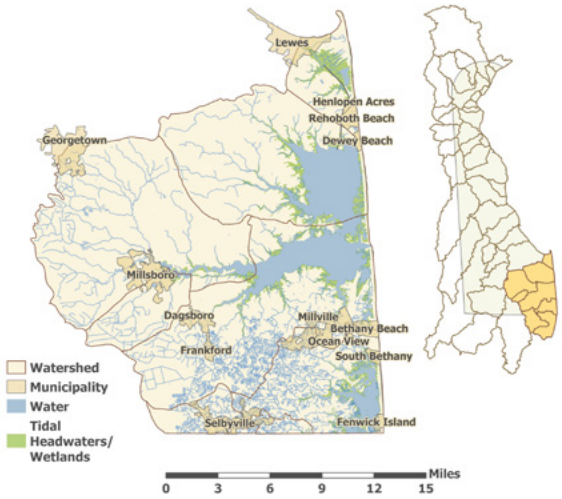
BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	0	Annual	1,369	0	0	0
Nutrient Management	Tons	259	Annual	7,238.2	4	868	42
Rain Garden	Structure	0	36	N/A	N/A	539	0
Stream Restoration	Feet	0	3,815	N/A	N/A	95.5	12.5
Hardwood Tree Planting	Acres	0	0.8	N/A	N/A	41	0
Total Reduction						1,543.5	54.50
Watershed Implementation Plan (WIP) Load Reduction Goal						125,392	15,724
% Load Reduction Achieved						1	0.3

Inland Bays

Watershed Description: The Inland Bays/Atlantic Ocean Basin comprises approximately 313 square miles of eastern Sussex County, Delaware. Starting at Lewes and Cape Henlopen State Park at the southern edge of the entrance to Delaware Bay, the area extends southward approximately 24 miles along the Atlantic shoreline to the Maryland State Line. It includes the coastal towns of Rehoboth Beach, Dewey Beach, Bethany Beach, South Bethany Beach and Fenwick Island. State Route 1 (SR 1) extends parallel to the shoreline and connects the towns.

The three inland bays (Rehoboth Bay, Indian River Bay, and Little Assawoman Bay) are located just landward of the Atlantic Ocean shoreline. Rehoboth Bay contains the Lewes-Rehoboth Canal and Rehoboth Bay Watershed; the Indian River Bay contains the Indian River, Iron Branch and Indian River Bay watersheds; and the Little Assawoman Bay contains the Little Assawoman, Assawoman, and Buntings Branch watersheds.

Inland Bays Watershed



Goals: Goals call for the increased implementation of numerous NPS best management practices (BMPs), especially in the agriculture sector. The approved watershed plan calls for a reduction in NPS total nitrogen loading of 3,764 lbs/day (1,373,860 lbs/year) and total phosphorous loading of 133 lbs/day (48,545 lbs/year). The goals are those that were presented by Inland Bays Pollution Control Strategy (PCS), which is also an approved EPA watershed plan.

Best Management Practices (BMP) Progress 2021

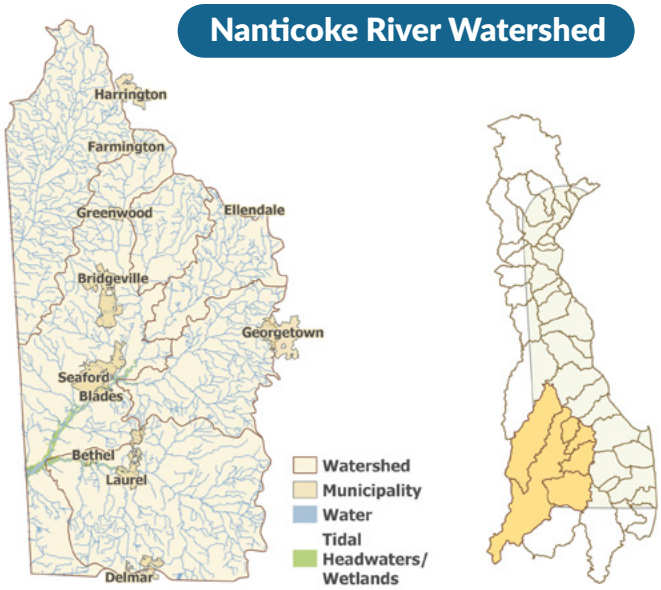
BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	26,425	Annual	37,637	70	337,780	1,040
Nutrient Relocation (net export from watershed)	Tons	9,180	Annual	20,909	44	51,404	3,612
Nutrient Management	Acres	35,076	Annual	53,827	65	98,646	7,576
Riparian Buffer (forest and vegetative)	Acres	15.1	289.1	3,246	9	12,170	404.5
Wetland Restoration	Acres	0	29	4,175	0.7	913	47
Grass Buffers (*CREP CP21)	Feet	0	70.2	1,772	4	1,958	66
Rain Garden	Structure	0	1	3	33.3	15	0
Total Reduction						502,886	12,745.5
Watershed Implementation Plan (WIP) Load Reduction Goal						1,373,860	48,545
% Load Reduction Achieved						37	26

*Note: CREP is the Conservation Reserve Enhancement Program. CP21 is a Grass Buffer conservation practice.

Nanticoke River

Watershed Description: The Nanticoke River Watershed includes the Middle Nanticoke and Upper Nanticoke rivers. The majority of the two rivers originate in Sussex County, Delaware, while a portion of the Middle and Upper Nanticoke rivers originate in Kent County, Delaware. Both rivers drain to the southwest into Maryland's Eastern Shore, including Caroline County, Dorchester County and Wicomico County. The Nanticoke encompasses 315,890.7 acres (493.6 square miles) of land area.

The Middle Nanticoke River refers to the Marshyhope Creek. Headwater tributaries to the Upper Nanticoke River include Gum Branch, Gravelly Branch, Deep Creek and Broad Creek.



Goals: Current goals call for the increased implementation of numerous NPS best management practices (BMPs), especially in the agriculture sector. The milestones allow jurisdictions the opportunity to adapt implementation strategies as necessary to meet the goals and achieve the TMDL standard. According to the approved Nanticoke River Watershed Plan, total nitrogen (N) and phosphorous (P) load reductions of 736,508 lbs/year and 33,941 lbs/year, respectively, are required to achieve the 2025 TDML load allocations of 2,774,736 lbs/year total nitrogen and 83,017 lbs/year total phosphorous.

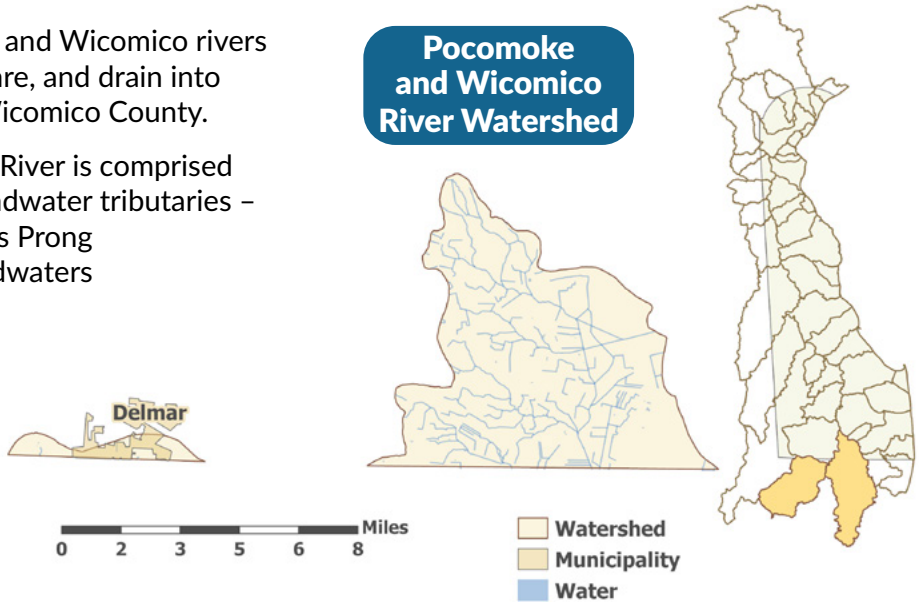
Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	31,973	Annual	43,343	74	430,355	1,200
Nutrient Relocation (net export from watershed)	Tons	22,717	Annual	Maximum Available	-	137,158	8,938
Nutrient Management	Acres	97,349	Annual	143,647	68	274,614	18,700
Hardwood Tree Planting	Acres	51	746	157	475	34,306	1,071
Water Control Structures	Acres	0	1,219	2,394	50.9	9,106	0
Stream Restoration	Miles	0	1.3	465	0.3	911	1,060
Wetland Restoration	Acres	6.5	1,935.5	74,043	2.6	65,731	3,110
Total Reduction						952,181	34,079
Watershed Implementation Plan (WIP) Load Reduction Goal						736,508	33,941
% Load Reduction Achieved						129	100

Pocomoke and Wicomico River

Watershed Description: The Pocomoke and Wicomico rivers both originate in Sussex County, Delaware, and drain into Maryland's eastern shore, primarily in Wicomico County.

The Delaware portion of the Pocomoke River is comprised of 35 square miles and includes four headwater tributaries – Bald Cypress Branch, Gum Branch, Lewis Prong and North Fork Green Branch. The headwaters for the Wicomico River begin at the Delaware-Maryland divide, with the Delaware portion contributing only 2.1 square miles. Four very small stream segments of the Wicomico watershed are located in Delaware, accounting for just 0.7 stream miles.



Goals: A TMDL was established in 2005 for the Pocomoke River. The Pocomoke nitrogen and phosphorous load allocations are 102.75 lbs/day (37,256 lbs/year) and 6.1 lbs/day (2,228 lbs/year), respectively. The Wicomico nitrogen and phosphorus load allocations are 9,103 lbs/year and 708 lbs/year, respectively. Load reductions needed to achieve the 2025 TMDL in the Pocomoke and Wicomico watersheds are 49,060 lbs/year total nitrogen (N) and 3,047 lbs/year total phosphorous (P).

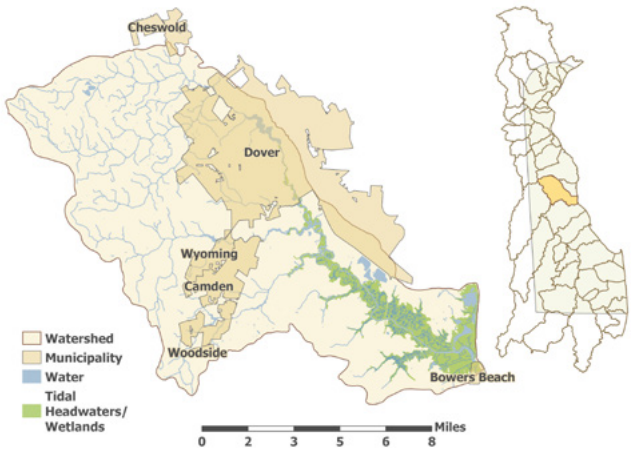
Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	2,228	Annual	2,217.48	100	15,752	88
Nutrient Relocation (net export from watershed)	Tons	1,092	Annual	Maximum Available	-	3,382	430
Nutrient Management	Acres	11,061	Annual	10,067.57	110	17,203	2,389
Hardwood Tree Planting	Acres	0	49.3	23.9	206.3	1,047	71
Water Control Structure	Acres	0	87	189.24	45.9	650	0
Stream Restoration	Feet	0	481	1,712.5	28.1	65	76
Wetlands Restoration	Acres	0	138	153.62	89.8	2,403	222
Total Reduction						40,502	3,276
Watershed Implementation Plan (WIP) Load Reduction Goal						49,060	3,047
% Load Reduction Achieved					83	107	

St. Jones River

Watershed Description: The St. Jones River Watershed is approximately 25.9 square miles (16,576 acres) and is located in the central portion of Kent County, Delaware. It drains 90 square miles of land. The major watercourse in the watershed is the St. Jones River, which has its headwaters in the western part of the county, about 22 miles upstream from the Delaware Bay. Significant ponds in the watershed are Silver Lake, Moores Lake and Wyoming Mill Pond. Flat wetlands, usually forested, exist mostly in the upper portion of the watershed and eventually drain into creeks and streams. Non-tidal riverine wetlands and tidal wetlands line the banks of the river, sometimes up to a half-mile wide toward the mouth of the river. Wetlands comprise 9,669 acres of the watershed and provide critical services such as nutrient removal, erosion control, habitat for plants and wildlife, flood reduction and storm water storage to the citizens of Delaware.

St. Jones River Watershed



The St. Jones Watershed has 5,236 acres of protected lands, including 3,750 acres preserved in the St. Jones River Reserve, a component of the Delaware National Estuarine Research Reserve (DNERR).

Goals: Reduce the overall levels of nitrogen (N) and phosphorus (P) in the waterway by 40% from the 2002-2003 baseline loads. This shall result in a yearly total nitrogen load of 860.3 lbs/day (314,010 lbs/year) and total phosphorous load of 63.01 lbs/day (22,990 lbs/year).

Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	5,487	Annual	6,246.31	88	16,819	18
Nutrient Relocation (net export form watershed)	Tons	0	Annual	6,480.12	0	0	0
Nutrient Management	Acres	17,583	Annual	35,849	49	11,857	318
Hardwood Tree Planting	Acres	0	1.7	N/A	N/A	16	0.2
Grass Buffers (CREP CP21)	Acres	0	8.5	1,174	0.7	5.5	1
Riparian Buffers	Acres	0	7	1,161	0.61	65	1
Total Reduction						28,762.5	338.2
Watershed Implementation Plan (WIP) Load Reduction Goal						317,368	23,141
% Load Reduction Achieved						9	1.5

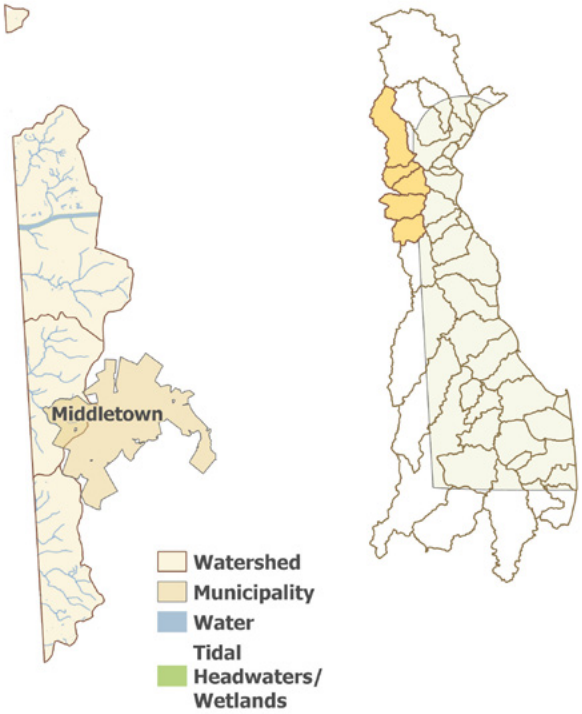
Upper Chesapeake

Watershed Description: The Upper Chesapeake Watershed includes the Elk, Bohemia and Sassafras Rivers and the C&D Canal, all of which originate in New Castle County, Delaware, and drain to the west into Maryland's upper Eastern Shore primarily in Cecil County. The Upper Chesapeake includes 23,351.7 acres or 36.5 square miles of land area.

The Upper Chesapeake as a whole is made up of a mixture of land uses, primarily including agriculture, forest and developed lands. Over two-thirds of the Upper Chesapeake is agricultural use (38.6%) or developed land (34.2%) with the remaining land use largely comprised of forest (27.2%).

Goals: The watershed plan for the Upper Chesapeake states that load reductions proposed meet the allocations for the Upper Chesapeake in the Bay TMDL. By targeting the most effective best management practices (BMPs) to the critical areas with the greatest recovery potential, the total nitrogen (TN) agriculture load can be decreased from 112,510 to 60,365 lbs/year. The agricultural total phosphorous (TP) loads can be reduced from 19,235 to 6,134 lbs/year. The TN urban load is the second largest load and can be reduced from 67,790 to 60,138 lbs/year. Urban TP loads can be reduced from 4,332 to 3,668 lbs/year. The TN from septic systems can be reduced from 32,709 to 29,722 lbs/year.

Upper Chesapeake Watershed



Best Management Practices (BMP) Progress 2021

BMP Name	Units	2021 Progress	Cumulative Progress	WIP Goal	% Achieved	Practice and N Load Reductions (lbs/year)	Practice and P Load Reductions (lbs/year)
Cover Crop (traditional and commodity)	Acres	1,186	Annual	7,439.1	16	28,328	59
Nutrient Relocation (net export from watershed)	Tons	911	Annual	Maximum Available	-	3,762	179
Nutrient Management	Acres	12,238	Annual	14,279.8	86	25,378	1,317
Hardwood Tree Planting	Acres	0	49.55	N/A	N/A	1,544	38
Water Control Structure	Acres	0	87	155.4	56.0	650	0
Stream Restoration	Feet	0	481	2,732	17.6	65	76
Wetlands Restoration	Structure	0	138	247	55.9	3,204	110
Total Reduction						62,931	1,779
Watershed Implementation Plan (WIP) Load Reduction Goal						62,784	13,765
% Load Reduction Achieved						100	13

Project Highlights

Delaware Botanic Gardens – A Model for Implementing Stormwater BMPs

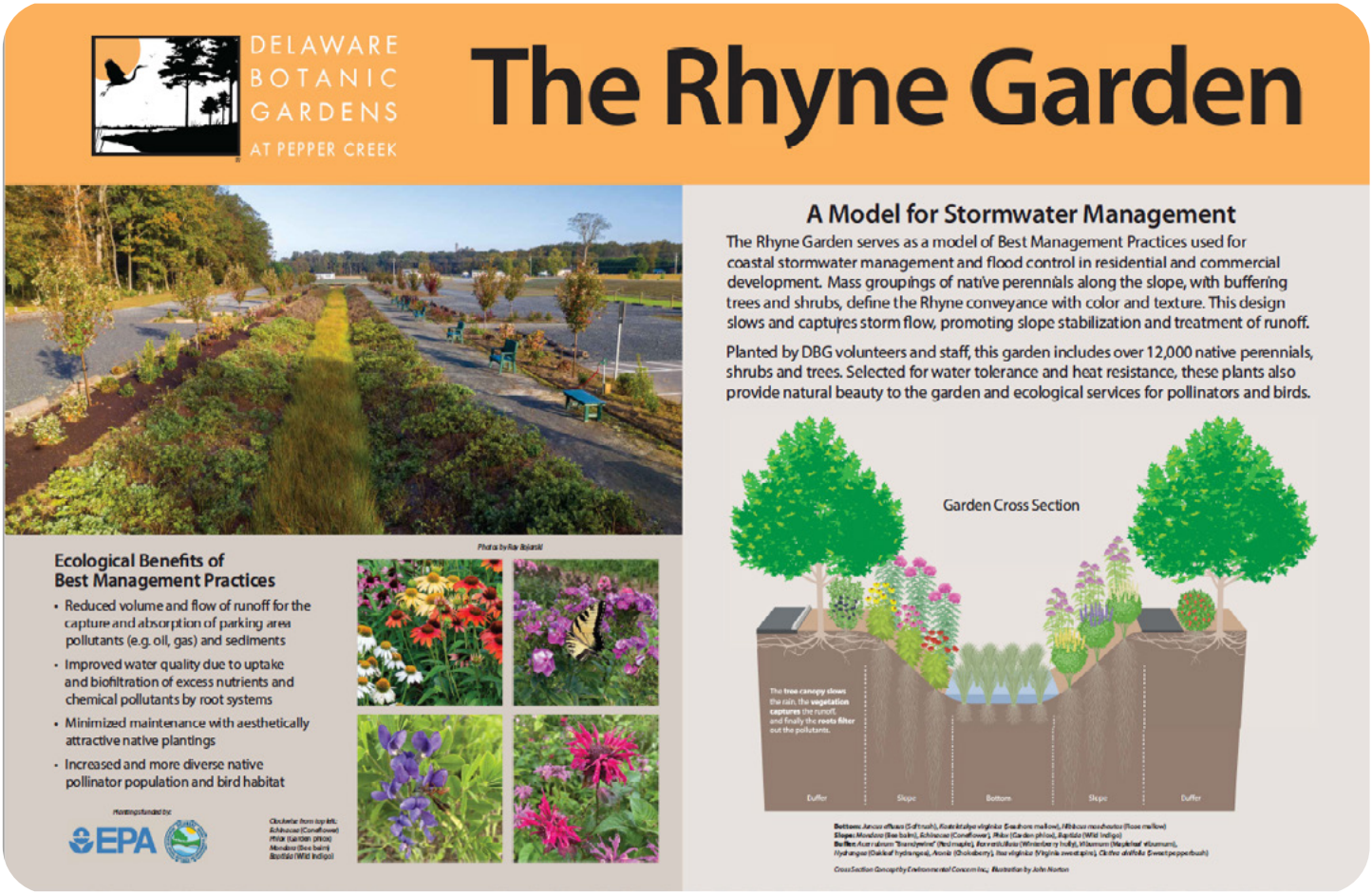
The Delaware Botanic Rhyne Garden and Stormwater Conveyance (Spring 2021)

The **Delaware Botanic Gardens** (DBG) at Pepper Creek utilized NPS **Section 319** grant funds to enhance stormwater management facility BMPs at their site in Dagsboro, Delaware. The DBG is situated on 37 acres along Pepper Creek, which flows into the Indian River Bay Watershed, making up one of Delaware's three Inland Bays. The Inland Bays consist of three interconnected bodies of water in southeastern Sussex County: the Rehoboth Bay, Indian River Bay and Little Assawoman Bay, all of which are further divided into subwatersheds. The DBG maintains a year-round living habitat to demonstrate the vital impacts of plants on the lives of the region's citizens and their environment. The DBG also includes agricultural land and waterfront areas along Pepper Creek.

The DBG submitted a proposal to enhance existing stormwater management facilities to help filter nonpoint source pollution. This project also served as a demonstration model for stormwater management and water quality. Existing dry ponds/basins had a biosoil layer incorporated and numerous plantings of native shrubs, flowers and grasses were established to help the stormwater management facility enhance water quality. The stormwater swale in the main parking lot was retrofitted to function as a bioretention facility. This facility, named the Ryhne Garden, has various native herbaceous species planted over an approximately 12,800-square-foot area to help filter nonpoint source pollutants being transported by stormwater runoff from the parking lot area.

These stormwater facility BMP enhancement projects included the planting of over 12,000 herbaceous perennials, over 30 semi-mature native trees, and over 300 native shrubs. The DBG also incorporated an education and outreach component into this initiative in the form of interpretive signage, guided tours, and video promotion of the BMPs as a demonstration site to visitors.

Delaware Botanic Garden Piney Neck Road Stormwater Basin Enhancements



A Model for Stormwater Management Interpretive Signs.

Implementation of this project originally began in 2020, and continued in 2021. In spring 2021, DBG designed and prepared two 36” x 24” stormwater BMP interpretive signs for installation at either end of the Ryhne Garden conveyance. One of the signs included a cross-section model of the plant types, structures, conveyance zones (buffer, slope, bottom) and functionality in their filtering of stormwater runoff. The DBG began to implement the outreach and education component of these stormwater BMP projects in 2021. Trained Docents began leading public tours that highlighted the enhancement of the stormwater BMPs and their ability to further filter nonpoint source pollutants while providing enhanced aesthetic appeal. The overall goal of the outreach component was to showcase these projects to serve as a model for enhancing existing stormwater BMPs in the landscape.

A Model for Stormwater Management Interpretive Signs.

Delaware Wild Lands and Center for the Inland Bays
Long Field Restoration at the Great Cypress Swamp

The Delaware Wild Lands (DWL) organization and the Center for the Inland Bays (CIB) collaborated to restore approximately 14 acres of marginal agricultural land to native forest at the DWL's 10,600 acre Great Cypress Swamp property in Sussex County, Delaware. This project included planting approximately 10,000 native trees and shrubs.

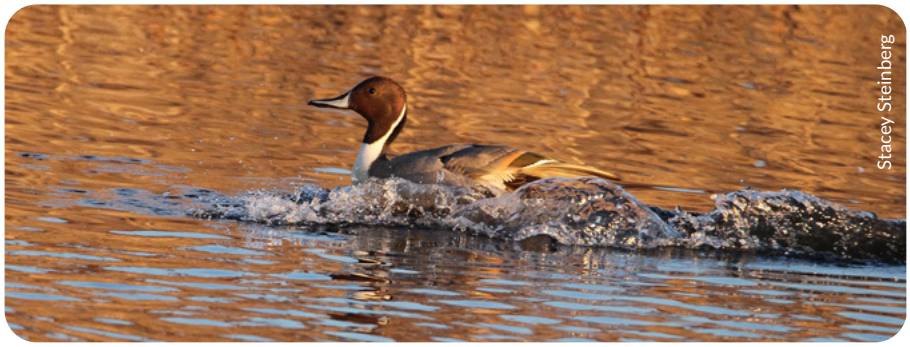
Among the project goals with the reforestation effort was to expand the amount of contiguous forested land, improve forest health, enhance natural benefits provided by contiguous forests and other conserved land areas including bird and wildlife habitat, improve carbon sequestration, and reduce the impacts of agricultural runoff on water quality by transitioning crop production acres to forested acres.

Bald cypress, Atlantic white cedar, mixed oak trees, and buttonbush were planted as part of the reforestation effort. DWL staff regularly monitor the site to control invasive species and ensure the planted cuttings and seedlings become established.

This reforestation project was a coordinated effort that showcases the ability to leverage funding from multiple sources: an Arbor Day Foundation grant, a U.S. Fish and Wildlife Service Grant, as well as non-federal funding.

Load Reductions

In 2021, the DNREC NPS Program load reductions were calculated for many of the **Section 319**-funded projects implemented on a watershed scale. The load reductions are calculated using guidance established during the pollution control strategy development process.



Chester and Choptank Watershed

2021 Project Load Reductions/Year by Watershed

Project	Nitrogen (lbs.)	Phosphorus (lbs.)
Appoquinimink River	48,801	291
Broadkill River	153,328.5	9,841.5
Chester and Choptank Watersheds	146,386	3,166
Christina Basin	1,543.5	54.5
Inland Bays	502,886	12,745.5
Nanticoke River Watershed	952,181	34,079
Pocomoke and Wicomico Watersheds	40,502	3,276
St. Jones River	28,762.5	338.2
Upper Chesapeake Bay Watershed	62,931	1,779
Total	1,937,321.5	65,570.7

2021 Annual BMP Nutrient Reductions
Nitrogen (N) and Phosphorous (P)

Total Nitrogen (N) Load Reductions by Watershed

Nitrogen Load Reductions (lbs./year)	Upper Chesapeake	Chester Choptank	Nanticoke	Pocomoke Wicomico	St. Jones River	Inland Bays	Broadkill River	Appoquinimink River	Christina Basin	Total N (lbs./years)
Cover Crops	28,328	81,066	430,355	15,752	16,819	337,780	70,885	0	0	980,985
Nutrient Relocation	3,762	1,676	137,158	3,382	0	51,404	3,726	534	0	201,642
Nutrient Management	25,378	36,243	274,614	17,203	11,857	98,646	78,530	45,775	868	589,114
Hardwood Tree Planting	1,544	11,748	34,306	1,047	16	0	79.5	660	41	49,441.5
Riparian Buffer	0	0	0	0	65	12,170	0	1,832	0	14,067
Grass Buffer	0	0	0	0	5.5	1,958	0	0	0	1,963.5
Water Control Structures	650	2,602	9,106	650	0	0	0	0	0	13,008
Stream Restoration	65	260	911	65	0	0	0	0	95.5	1396.5
Wetland Restoration	3,204	12,791	65,731	2,403	0	913	0	0	0	85,042
Rain Garden	0	0	0	0	0	15	108	0	539	662
Total Nitrogen Reductions	**62,931**	**146,386**	**952,181**	**40,502**	**28,762.5**	**502,886**	**153,328.5**	**48,801**	**1,543.5**	**1,937,321.5**

Total Phosphorous (P) Load Reductions by Watershed

Phosphorous Load Reductions (lbs./year)	Upper Chesapeake	Chester Choptank	Nanticoke	Pocomoke Wicomico	St. Jones River	Inland Bays	Broadkill River	Appoquinimink River	Christina Basin	Total P (lbs./years)
Cover Crops	59	169	1,200	88	18	1,040	330	0	0	2,904
Nutrient Relocation	179	80	8,938	430	0	3,612	395	23	0	13,657
Nutrient Management	1,317	1,880	18,700	2,389	318	7,576	9,111	220	42	41,553
Hardwood Tree Planting	38	293	1,071	71	0.2	0	2.5	13	0	1,488.7
Riparian Buffer	0	0	0	0	1	404.5	0	35	0	440.5
Grass Buffer	0	0	0	0	1	66	0	0	0	67
Water Control Structures	0	0	0	0	0	0	0	0	0	0
Stream Restoration	76	303	1,060	76	0	0	0	0	12.5	1,527.5
Wetland Restoration	110	441	3,110	222	0	47	0	0	0	3,930
Rain Garden	0	0	0	0	0	0	3	0	0	3
Total Phosphorous Reductions	**1,779**	**3,166**	**34,079**	**3,276**	**338.2**	**12,745.5**	**9,841.5**	**291**	**54.5**	**65,570.7**

Future Changes and Challenges

Delaware has developed this report to highlight accomplishments made in 2021 to reduce nitrogen, phosphorus, and sediment nonpoint source pollution. The charts and tables on pages 28 to 30 signify the continued progress in reducing loads to impaired watersheds. Additional commitments were made by DNREC and EPA with the development of annual milestones identified in Delaware's 2019 NPS Management Plan. These milestones describe the outcomes and key actions expected over a determined timeframe.

Aerial View of Broadkill River Watershed

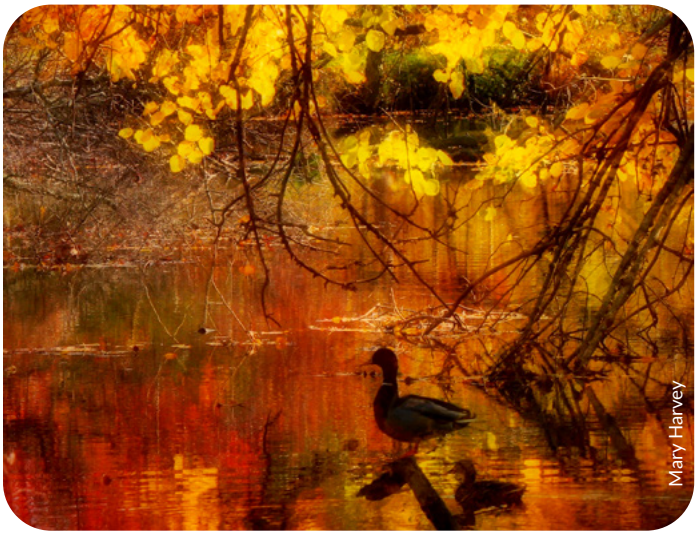
The NPS Management Plan includes objectives that address nonpoint sources of surface and ground water pollution as appropriate, including drinking water sources, in alignment with the goals of the CWA. Objectives of the plan include both implementation steps and how results will be tracked (e.g., water quality improvements or load reductions). Additionally, long-term goals and short-term milestones are integrated with other key environmental and natural resource programs. The Nonpoint Source Program's goals and objectives are periodically revised to reflect progress or problems encountered, develop strategies to make progress towards achieving the goals, and develop indicators to measure progress. Updates to the NPS Milestones can be found in Appendix A.

Delaware continues to make progress toward meeting water quality goals with continued commitments of funding implementation activities to address the agricultural and urban sectors. The DNREC NPS Program continues to develop new working relationships with BMP implementation partner organizations to further water quality enhancement efforts.

For example, many of the key personnel working within the Delaware Conservation Districts help to write nutrient management plans, install agriculture BMPs and help farmers to identify resource concerns. Additional DNREC staff work with private landowners on buffers, wetland and stream restoration projects, as well as septic system pump-outs, repairs, and/or replacements.

The Delaware Department of Agriculture staff works with farmers and the agricultural community to continue the implementation and enforcement of the Nutrient Management Law and Regulations. The Delaware NPS Program continues to provide funding to the Department of Agriculture's Nutrient Management Program toward manure relocation efforts and personnel to help implement the nutrient management program, assist with nutrient management plan cost share practices, and help track and report agricultural BMP practices that are inspected by the program.

While some goals have yet to be reached, Delaware has continued to make substantial progress and has invested significant effort into programmatic changes, such as regulations, permits and reorganizing programs. Although these additional efforts improve accountability, they do not necessarily have an immediate impact on nutrient reductions. Delaware's agricultural community works every day to conserve and protect our water resources, with many of our farmers implementing BMPs that are not accounted for or reported. The program has captured some of the previously unreported BMP data through statewide transect surveys and Chesapeake Bay-related verification efforts.



Chester and Choptank Watershed

The cropland residue and cover crop transect surveys were established in 2014 and continued on an annual basis until the COVID-19 pandemic disrupted the survey in 2020. The cropland surveys help quantify the amount of residue cover remaining on the field after the commencement of planting in the spring so farmers can get credit for conservation tillage practices. The cover crop surveys conducted throughout the state help capture any additional, non-cost share funded, cover crop implementation acres established by farmers that would otherwise function in reducing nutrient and sediment losses but not be reported and credited as such.

The cover crop surveys were conducted over a five year period (2014 to 2019), providing a five year period of baseline data. This baseline data could be used to make statistical projections of cropland residue associated with conservation tillage and cover crop acreage in subsequent years for all three counties in the state.

Funding for cover crop cost share programs has increased farmer participation and allowed the state to increase cover crop BMP implementation acreages. In 2019, an additional $2.9 million in state FY20 funds was allocated for conservation cost share practices specifically designated for cover crops. As a result of this increased funding, implementation of cover crop acres across all counties in Delaware increased. However, the COVID-19 pandemic in 2020 caused budgetary hardships at the state level. The additional $2.9 million in state funds that was awarded in 2019 dropped to $1 million in 2020 for state FY21. Improved budgetary outlooks for state FY22 resulted in an appropriation of $3.2 million. The state budget situation is ever evolving, so there are possibilities of funding amounts fluctuating across fiscal years dependent upon the budgetary climate.

In terms of regulations, Delaware promulgated new Onsite Wastewater Regulations in 2013, to help Delaware to meet future nutrient reduction goals for septic connections, pump-outs, and advanced treatment systems. In February 2019, the Delaware Sediment and Stormwater Regulations were updated and implemented, covering all land-disturbing activities greater than 5,000 square feet. Also, in 2019, the Sediment and Stormwater Program drafted, submitted and received approval for a new Construction General Permit (CGP). The CGP is required for any land-disturbing activities greater than one acre that require National Pollutant Discharge Elimination System (NPDES) permit coverage. Delaware's new CGP went into effect March 11, 2021.

DNREC's NPS Program in recent years has undergone an internal reorganization which aligned the following programs: 319 NPS program, Chesapeake Bay Implementation Program and the Conservation Reserve Enhancement Program (CREP), as well as additional funding and resources through Delaware's Water Infrastructure Advisory Council (WIAC). The NPS Program now manages and administers two grants under the WIAC umbrella, including the Surface Water Matching Planning Grant (SWMPG) and the Community Water Quality Improvement Grant (CWQIG). The NPS Program also manages the Chesapeake Bay Implementation Grant (CBIG) for water quality BMP implementation within the Chesapeake Bay Watershed. The newly-enhanced NPS Program has proven its efficiency by centralizing and reducing data reporting requirements while increasing grant funding availability and leveraging capacity for federal grants while expanding partnerships.

Inland Bays Sunset

A future goal of the NPS Program is to further enhance the Chesapeake Bay Implementation Team's BMP Tracker database to store statewide BMP data instead of just Chesapeake Bay watershed-specific data. Established in late 2019, the new database still needs work to merge historical data from an older database before hopefully expanding it to encompass statewide BMP data. A contractor was hired in 2021 to assist with the historical data migration to the BMP Tracker Tool.

The Division of Watershed Stewardship's Watershed Assessment and Management Section (WAMS) is leading the effort to develop, through contractor assistance, a BMP planning and tracking tool called the Delaware Targeting and Planning Tool (DTAP), which will eventually work in conjunction with the BMP Tracker tool. The DTAP will help users with the planning process to identify, target and more efficiently position BMPs within watersheds to maximize the financial capacity of various grants that provide funding toward those implementation efforts.

Looking forward, DNREC's NPS Program will continue to make progress toward its goals and will work to align funding with water quality priorities. Although Delaware faces many challenges, DNREC remains committed to working with partners at the state, local and federal levels to reduce NPS pollution entering our waterbodies.

List of Partner Organizations/Committee Members

The hard work and many hours of agency staff members, organization members and private individuals who have partnered with the **NPS Program** in 2021 to address, reduce, identify and/or measure NPS pollution in Delaware is greatly appreciated. It is a credit to our partners as they have cooperated in the face of many challenges to help support the initiatives of the NPS Program.

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Appendices

Appendix A - 2021 Milestones

Type	Timeline	Milestone	Comments/Status Updates
Short Term	FY19 to FY24	Increase number of outreach and education interactions by 10% over FY 2018 baseline (approx. 8,500 and 3,500 interactions, respectively)	2021 Update: A 10% increase in the number of outreach and education interactions over the FY18 baseline of 8,500 and 3,500 interactions during FY19 to FY24 respectively, would be a combined total of 13,200 outreach and education interactions over the FY19 to FY24 timeframe. In 2019, the NPS Program staff had a total of 7,500 interactions. In 2020, the NPS Program staff had a total of 1,637 interactions. In 2021, the NPS Program staff had a total of 11,199 interactions (4,316 in-person and 6,883 virtual). The 2019, 2020, and 2021 total interactions represent 154% of the interaction total goal during this measured timeframe of FY19 through FY24. Since 2019 there have been a total of 20,336 outreach and education interactions.
Short Term	FY19 to FY24	Increase estimated nutrient load reductions from implementation of NPS BMPs in non-Chesapeake Bay and Chesapeake Bay priority watersheds by at least 5% and 20%, respectively. The modeling tools used for the Chesapeake Bay will be used for all watersheds to assess progress from the determined 2002-baseline year. Using the Chesapeake Assessment Scenario Tool (CAST), loads will be assessed to enumerate progress in the Management Plan.	2021 Update: Due to formatting and collection differences between the Grant Reporting and Tracking System (GRTS) submission and CB Program Progress submission, it is difficult to standardize data for a CAST analysis outside of the CB Watershed. Through use of Chesapeake Bay Regulatory and Accountability Program grant (CBRAP) funding, the program has developed a new BMP Tracking and Reporting Tool which was used for CB watershed progress submission beginning in 2019. In the future, the anticipation is to further develop the BMP Tracker Tool to handle statewide BMP data and utilize a new targeting and planning tool that hopefully can calculate statewide load reductions. Currently, until these new platforms are fully functional, an EPA approved load reduction spreadsheet model is being utilized for load reduction calculations. Based on load reductions calculated for all priority watersheds with the DNREC load reduction tool, the following observations were noted when comparing to 2020 estimated load reduction data across priority watersheds where **Section 319 grant funds** are utilized for BMP implementation. Nitrogen and phosphorous load reductions in non-Chesapeake Bay watersheds were greater than 5% as compared to the previous reporting year. In Chesapeake Bay watersheds, estimated load reductions were greater than 20% as compared to the previous reporting year. For 2021, as compared to 2020, it appeared there was an increase in cover crop acre implementation, nutrient management acre reporting, and nutrient (manure) relocation tonnage for the reporting year.

Type	Timeline	Milestone	Comments/Status Updates
Short Term	FY19 to FY24	Characterize baseline conditions and establish timeframe for subsequent monitoring following BMP implementation in priority watersheds that do not have established baselines and re-evaluate old baselines.	2021 Update: The currently approved a-i watershed implementation plans (WIP) have WIP reduction goals included in the individual watershed progress report for all identified priority watersheds. BMP implementation and reporting to the NPS program is calculated and compared to the established WIP goals for each priority watershed. NPS baseline loads have been established by the DNREC Watershed Assessment & Management Section (WAMS) for all priority watersheds within the NPS Program. Revaluation of baseline loads is at the discretion of WAMS.
Short Term	FY19 to FY24	Demonstrate stable or improving water quality trends for the sub-watersheds of the Inland Bays and Chesapeake Bay relative to data established from 1990 to present.	2021 Update: Delaware maintains a General Assessment Monitoring Network (GAMN) of approximately 138 stations. Twenty-two of the stations are monitored monthly and the remaining stations are monitored monthly for two years and bi-monthly for three years according to a five-year rotating basin schedule. Each station is monitored for conventional parameters such as nutrients, bacteria, dissolved oxygen, pH, alkalinity and hardness. Some stations are monitored for dissolved metals. The data from this monitoring is entered into EPA's Storage and Retrieval (STORET) database and used for the State of Delaware Combined Watershed Assessment (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs Report and other uses by interested parties. More information about Delaware's Water Quality monitoring is available online at: **dnrec.alpha.delaware.gov/watershed-stewardship/assessment/water-quality-monitoring/** In addition to uploading data to STORET, the Department also works in cooperation with the University of Delaware to share available water quality data in a more user friendly format in the Delaware Water Quality Portal at this URL: **demac.udel.edu/waterquality** **Trend Analysis for Nitrogen and Phosphorus at 11 Surface Water Sites:** The following information was utilized from the most recent 2020 Integrated 303(d) and 305(b) Report. Water quality monitoring at select monitoring sites throughout the state is conducted and analyzed as part of the integrated report. Of the 11 monitoring sites analyzed for trends from 2008 – 2017, two are located in the Inland Bays watershed and two in the Chesapeake Bay watershed. Total nitrogen (TN) is improving at the two Inland Bays monitoring sites and worsening at the two Chesapeake Bay sites. Total phosphorus (TP) is worsening at the two Inland Bays monitoring sites. In the Chesapeake Bay watershed, one monitoring site is improving and the other is worsening for TP.

Type	Timeline	Milestone	Comments/Status Updates
Short Term	FY19 to FY24	Remove an identified impairment from a Land River Segment currently included on Delaware's list of impaired waterways.	2021 Update: The 7.5 mile segment of Tappahanna Ditch (DE-110-001-00) in the Choptank River watershed was removed from Delaware's list of impaired waters for bacteria according to the state's 303(d), 305(b) integrated report.
Long Term	FY19 to FY24	Show significant progress towards completion of implementation activities for all Delaware's priority watersheds with approved Nine Element Watershed Plans.	2021 Update: This progress is continually assessed and tracked through BMP data submissions to the NPS Program. Progress is reported in the GRTS system and reflected holistically in the NPS Program Annual Reports. In 2021, the NPS Program contracted with an environmental consulting firm to update the Little Assawoman Bay watershed implementation plan. Anticipated completion is in 2022.
Long Term	FY19 to FY24	Demonstrate water quality improvement in 20% or more of the priority and monitored priority watersheds as reported in the NPS Annual Report.	2021 Update: This will be assessed through water quality monitoring trend analyses in the future, since this milestone was recently established in the 2019 Delaware NPS Management Plan. Water quality monitoring and trend data are maintained by the DNREC WAMS.
Long Term	Annually through FY30	Show annual increases in funding and quantities of BMPs implemented in priority watersheds.	2021 Update: In 2021, the state FY22 budget appropriated $3.2 million in state general funds towards cover crop implementation efforts. This represented an increase of $2.2 million from the previous FY20 appropriation of $1 million. The FY21 funds resulted in a significant increase in cover crop acres implemented by farmers in all three counties of Delaware, and the FY21 funds for cover crops implemented in the fall of 2021 is expected to have similar results. These cover crop implementation acres were implemented across the priority watersheds established by the DNREC NPS Program. Additional funding was provided by the EPA through the Chesapeake Bay Implementation Grant (CBIG) in 2020 and 2021 for BMP implementation in Most Effective Basins (MEB). With this additional grant funding, 8,285 acres of cover crops were implemented in MEB of the Chesapeake Bay watershed in 2020/2021.
Long Term	Annually through FY30	Remove one water body currently listed for nutrient pollutants from the 303(d) List.	2021 Update: To be assessed and determined annually as additional BMPs are incorporated into priority watersheds. DNREC WAMS continuously monitors water quality trends throughout the various STORET monitoring stations in the state. The 7.5 mile segment of Tappahanna Ditch (DE-110-001-00) in the Choptank River watershed was removed from Delaware's list of impaired waters for bacteria. As continued BMP implementation is funded by grant efforts, and water quality monitoring trends are analyzed, any water body delisting for nutrients will be reflected in this report.

Appendix B – Water Quality Trend Data

Delaware maintains a General Assessment Monitoring Network (GAMN) of approximately 138 stations. Twenty-two of the stations are monitored monthly and the remaining stations are monitored monthly for two years and bi-monthly for three years according to a five-year rotating basin schedule. Each station is monitored for conventional parameters such as nutrients, bacteria, dissolved oxygen, pH, alkalinity, and hardness. Some stations are monitored for dissolved metals. The data from this monitoring is entered into EPA's STORET database and used for the State of Delaware Combined Watershed Assessment (305(b)) and Determination for the Clean Water Act Section 303(d) List of Waters Needing TMDLs Report and other uses by interested parties. More information about Delaware's Water Quality monitoring is available online at: **dnrec.alpha.delaware.gov/watershed-stewardship/assessment/water-quality-monitoring**.

In addition to uploading data to STORET, the Department also works in cooperation with the University of Delaware to share available water quality data in a more user-friendly format in the Delaware Water Quality Portal at: **demac.udel.edu/waterquality**.

The Department's Watershed Assessment and Management Section (WAMS) periodically conducts a statewide water quality trend assessment. Based on the most recent statewide assessment, the following graphics provide a visual indicator of water quality trends in Delaware's priority watersheds for total nitrogen (TN), total phosphorous (TP) and total suspended solids (TSS). Thumbs up indicate improving water quality trends while thumbs down represent negative water quality trends for the identified nutrients and sediment.

Water Quality Trends for Priority Watersheds

Watershed	Total Nitrogen (TN)	Total Phosphorous (TP)	Total Supended Solids (TSS)
Appoquinimink River	👍	👍	👍
Broadkill River	👎	👍	👍
Chester and Choptank	👍	👍	👎
Christina Basin	👍	👍	👍
Inlands Bays	👍	👍	👍
Naticoke River	👍	👍	👎
Pocomoke and Wicomico River	👍	👍	👎
St. Jones River	👍	👍	👍
Upper Chesapeake	👍	👍	👍

The water quality trend visualization graphics displayed are the result of the most recently conducted statewide water quality trend analysis in 2015.

Trend Analysis for Surface Waters (Nitrogen and Phosphorous):

As part of the 2018 Integrated Report, trend analysis for total nitrogen (TN), and total phosphorus (TP) was performed to assess water quality changes in Delaware surface waters. This trend analysis also tracked progress made toward achieving nutrient target loads established for various watersheds in Delaware as the result of the Total Maximum Daily Load (TMDL) Program. For this analysis, flow-normalized concentrations and loads, and their changes over a 10-year period (2008-2017), was estimated using an R statistical package called "Exploration and Graphics for RivEr Trends (EGRET)", (Hirsch and DeCicco, 2015). This statistical package uses a multiple regression method called "Weighted Regressions on Time, Discharge, and Season (WRTDS)", (Hirsch and others, 2010). As the name indicates, WRTDS method estimates daily concentration by establishing a regression relationship between concentration, stream flow, and time of the year (season). "Flow-normalized" concentration refers to concentration during normal flow condition. Using flow-normalized concentration would eliminate the impact of flow variations on nutrient concentrations and loads and would allow investigating water quality changes that are occurring as the result of management actions.

The WRTDS method has been widely used by many agencies for conducting trend analysis. For example, the United States Geological Survey (USGS) is relying on this method to assess water quality changes in non-tidal tributaries of the entire Chesapeake Bay Watershed. To perform trend analysis for Delaware surface waters based on WRTDS method, daily mean stream flow and nutrients concentration for the 11 monitoring sites in Delaware that are collocated with a USGS stream gauging stations (C1 sites) were retrieved from the USGS website at: **maps.waterdata.usgs.gov/mapper/index.html** and from the Environmental Protection Agency's modernized STORET website at: **waterqualitydata.us**.

Figure 1 on page 40 shows the location of the C1 monitoring sites used for this analysis and Table 1 and Table 2 on page 41 provides information about the location of these 11 monitoring sites and the collocated USGS stream gaging station as well as the drainage area above the stream gaging station.

Figure 1: Location of C1 Monitoring Sites for Trend Analysis

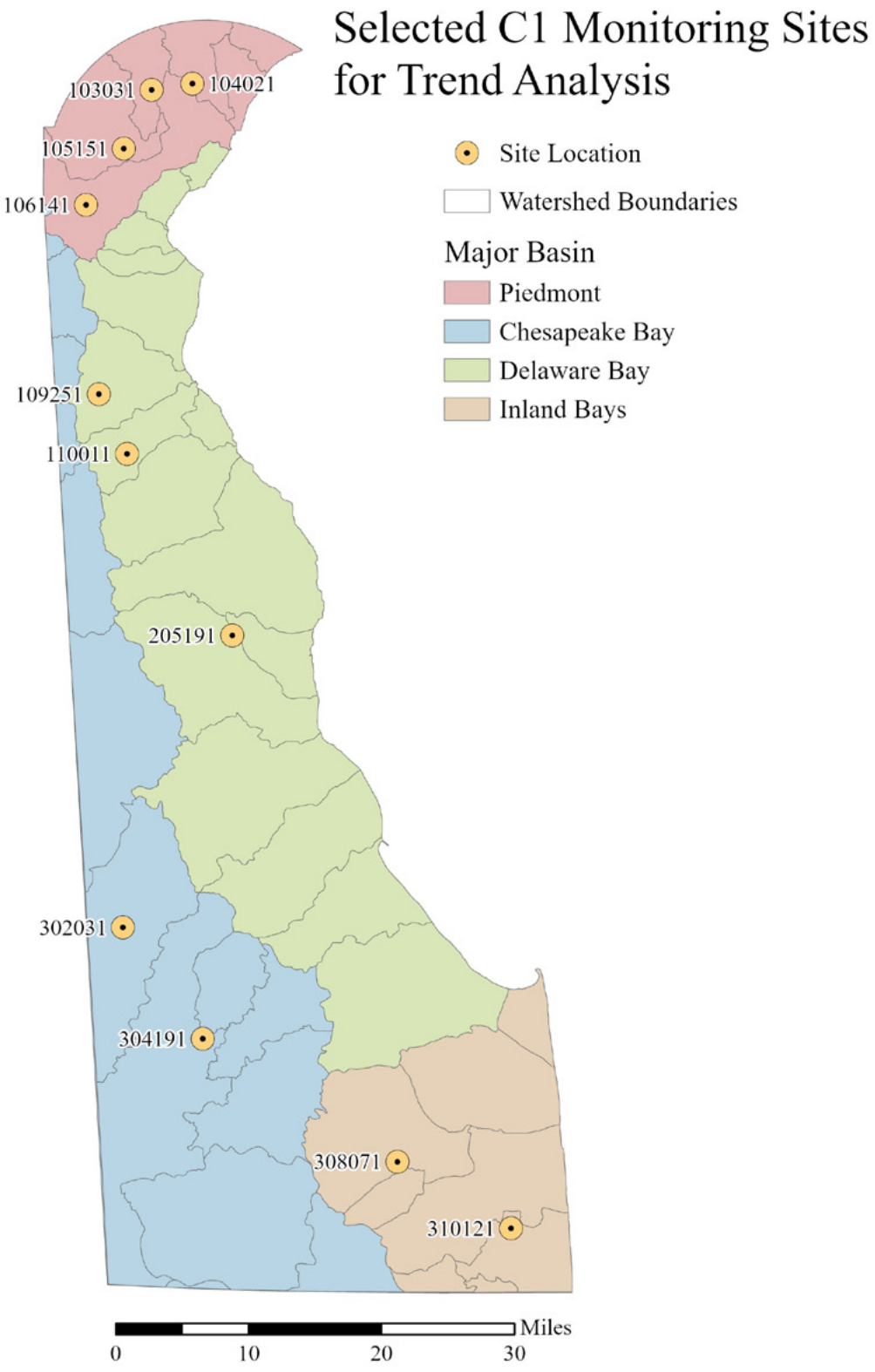

Table 1 summarizes the trend analyses for Total Nitrogen TN. TN is improving at nine sites and worsening at two sites (Nanticoke River and Marshyhope Creek). Table 2 shows Total Phosphorous TP concentration is improving at five sites and worsening at six sites on page 41.

Table 1: Total Nitrogen (TN) Trend Analysis Summary 2008 – 2017

Monitoring Site ID	Site Description	Data used start year	Data used end year	Concentration change from 2008-2017 (mg/l)	Improving/ Worsening Trend
103031	Red Clay at Lancaster Pike (Rt. 48)	1999	2017	-0.43	Improving
104021	Brandywine Creek at New Bridge Rd. (Rd. 279)	1999	2017	-0.53	Improving
105151	White Clay Creek at Delaware Park Blvd.	1999	2017	-0.50	Improving
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1999	2017	-0.47	Improving
109251	Appoquinmink River trib., Deep Creek Br. at Summit Bridget Rd. (Rt.71)	2008	2017	-0.87	Improving
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	2002	2017	-0.43	Improving
205191	St. Jones River, Silver Lake at Spillway (Dover City Park)	1999	2017	-0.26	Improving
302034	Marshyhope Creek at Fishers Bridge (Rd. 308)	1998	2017	0.42	Worsening
304191	Nanticoke River, at Rifle Range Rd. (Rt. 545)	1989	2017	0.23	Worsening
308071	Indian River, Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1998	2017	-0.45	Improving
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd. 368)	1999	2017	-1.50	Improving

Table 2: Total Phosphorous (TP) Trend Analysis Summary 2008 – 2017

Monitoring Site ID	Site Description	Data used start year	Data used end year	Concentration change from 2008-2017 (mg/l)	Improving/ Worsening Trend
103031	Red Clay at Lancaster Pike (Rt. 48)	1999	2017	-0.0270	Improving
104021	Brandywine Creek at New Bridge Rd. (Rd. 279)	1999	2017	0.0004	Worsening
105151	White Clay Creek at Delaware Park Blvd.	1999	2017	-0.0057	Improving
106141	Christina River at Sunset Lake Rd. (Rt. 72)	1999	2017	0.0059	Worsening
109251	Appoquinmink River trib., Deep Creek Br. at Summit Bridget Rd. (Rt.71)	2008	2017	0.0082	Worsening
110011	Blackbird Creek at Blackbird Station Rd. (Rd. 463)	2002	2017	-0.0077	Improving
205191	St. Jones River, Silver Lake at Spillway (Dover City Park)	1999	2017	-0.0096	Improving
302034	Marshyhope Creek at Fishers Bridge (Rd. 308)	1998	2017	0.0500	Worsening
304191	Nanticoke River, at Rifle Range Rd. (Rt. 545)	1989	2017	-0.0058	Improving
308071	Indian River, Millsboro Pond outlet at John Williams Hwy. (Rt. 24)	1998	2017	0.0080	Worsening
310121	Little Assawoman Bay, Beaver Dam Ditch at Beaver Dam Rd. (Rd. 368)	1999	2017	0.0620	Worsening

DNREC's **Nonpoint Source Program** administers a competitive grant made possible through **Section 319** of the Clean Water Act (CWA). The grant provides funding for projects designed to reduce nonpoint source (NPS) pollution in Delaware. NPS pollution may be defined as any pollution that originates from a diffuse source (such as an open field or a road) and is transported to surface or ground waters through leaching or runoff. Reduction of NPS pollution may often be achieved through incorporation of specific best management practices (BMPs) into project workplans. Projects may target any source of NPS pollution, but most frequently involve agriculture, silviculture, construction, marinas, septic systems, and hydromodification activities.

In addition to funding projects that achieve reductions in NPS pollution, the DNREC NPS Program is committed to addressing these issues through educational programs, publications, and partnerships with other organizations working to reduce NPS pollution in Delaware.

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