Maryland's Phase III Watershed Implementation Plan to Restore Chesapeake Bay by 2025

Cover Photo: Blackwater Wildlife Refuge in late autumn (2017), courtesy of Matthew Rowe

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Acknowledgements

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Maryland's local partners, including counties, municipalities, and soil conservation districts are the boots on the ground implementing and maintaining best management practices (BMP), infrastructure, and capital programs, as well as providing project tracking and technical assistance. These entities were also key partners during the Phase III plan development process and helped determine feasibility and pace of implementation across pollution sectors. Nongovernmental organizations (NGOs), including local and national environmental advocacy organizations, trade and industry groups, private citizens, and business interests, also provided valuable feedback and input into this plan.

Finally, Maryland acknowledges the U.S. Environmental Protection Agency's (EPA) Chesapeake Bay Program for its administrative, technical and modeling support throughout the WIP development process. The program has also been instrumental in bringing together the Chesapeake Bay watershed jurisdictions from outside the state of Maryland to work together on a collaborative restoration effort.

Table of Contents

Main Document

Appendices

Executive Summary

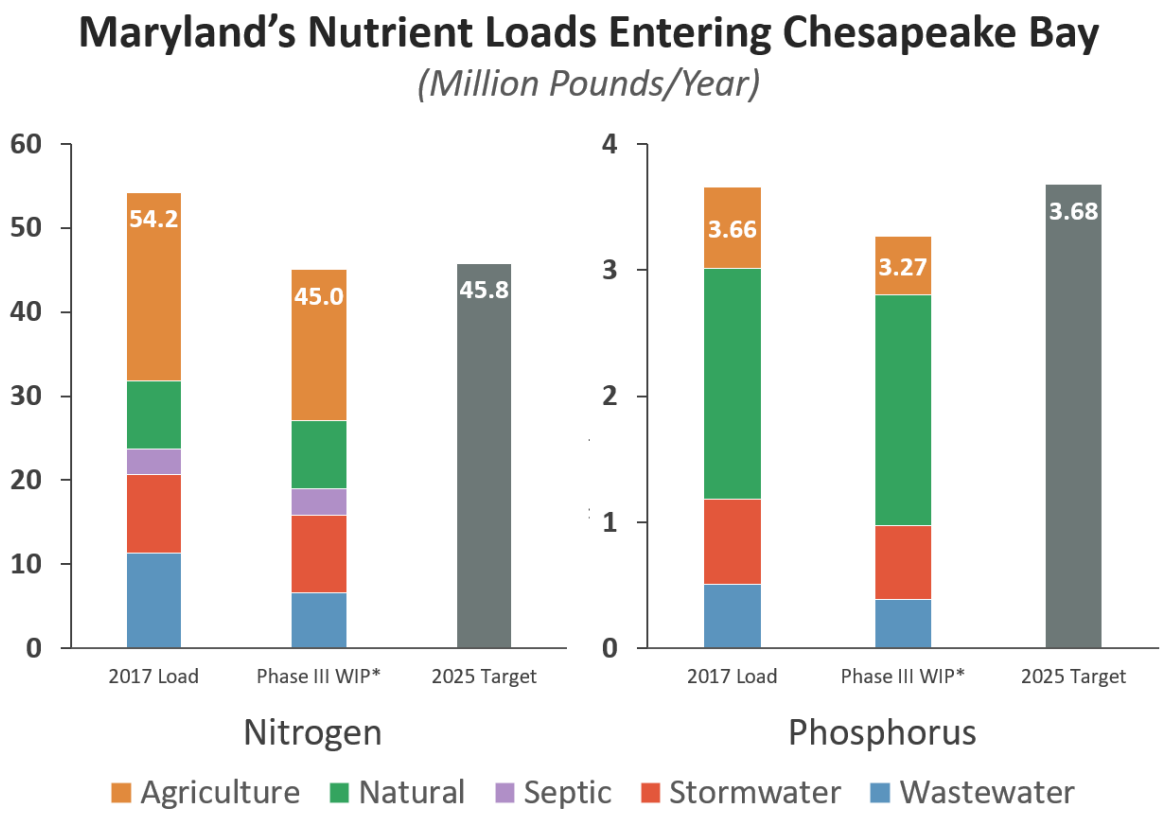
The Chesapeake Bay plays a significant role in Maryland's identity, economy, history and legacy. The State's success in restoring and preserving this national treasure for future generations will require balanced solutions that are cost effective, spur innovation, stimulate market-based approaches and create a restoration economy. Restoration will also test the collective will across seven watershed jurisdictions, spanning from the southern tier of New York State all the way to the capes of Virginia, to live in harmony with the region's natural systems. Having reached the mid-point between development of the 2010 Total Maximum Daily Load (TMDL), which establishes current Chesapeake Bay pollution reduction goals and the ultimate 2025 restoration deadline, the good news is that healthy signs of recovery are being seen in both water quality and living resources like bay grasses and blue crabs. This third phase of Maryland's Chesapeake Bay Watershed Implementation Plan (WIP) identifies the strategies, opportunities, and challenges in not only meeting the 2025 Chesapeake Bay Restoration targets, but also sustaining restoration into the future.

The Phase III WIP builds upon lessons learned in Phase I and II[1], and charts a course to 2025 that is locally-driven, achievable, and balanced. In developing the Phase III WIP, Maryland agencies met with county public works and planning departments, municipalities, soil conservation districts, NGOs, and the public to better understand which restoration strategies are working, which are not, what additional plans and restoration actions are anticipated between now and 2025, and where resources and collaborations are needed to achieve them. This information was compiled, along with information regarding local pollution sources, progress to date and any pollution reductions required by permit or contract, into local summaries that establish local planning goals. These local goals combined with state-level pollution reduction strategies are projected to achieve Maryland's 2025 Chesapeake Bay restoration targets.

Implementing Maryland's Phase III WIP Will Achieve the 2025 Chesapeake Bay Restoration Targets

Maryland's 2025 pollution reduction targets for bay restoration are 45.8 million pounds total nitrogen (TN) and 3.68 million pounds of total phosphorus (TP). In meeting the targets, the state will also meet its sediment goals. These 2025 nitrogen and phosphorus targets were calculated to include increased pollution impacts expected from growth in human and livestock populations through 2025. Figure 1 below shows Maryland's 2017 progress to date and the projected future reductions in total nitrogen and total phosphorus, respectively, with Maryland's Phase III WIP in place. The projected total nitrogen reductions are expected to be under the 45.8 million pound nitrogen target by 780,000 pounds. Maryland is already on track to meet its phosphorus target. Since phosphorus attaches itself to sediment, the projected phosphorus reductions through 2025 indicate that Maryland is also on track to meet its sediment target. These calculations have been confirmed by the Chesapeake Bay Program's (CBP) science and modeling framework, effectively demonstrating that Maryland will meet its federally assigned Chesapeake Bay pollution reduction targets by 2025.

[1] mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Pages/wip.aspx



Source: Maryland Phase III WIP Scenario; CAST 2019

*****Phase III WIP reductions subject to change upon EPA review.

Figure 1: *Current and projected total nitrogen and phosphorus loads by sector relative to Chesapeake Bay Restoration targets.*

Maryland's success in meeting its restoration targets is driven by implementing key pollution reduction strategies among major source sectors (Figure 1), which include wastewater, stormwater, septic, natural lands and agriculture. Table 1 below identifies these key nitrogen and phosphorus reduction strategies within each major source sector. For detailed information on every Phase III WIP practice by major sector please see Appendix B of this report

Table 1: *Maryland's Phase III WIP strategy*

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Agriculture	Conservation Technical Assistance (1 million acres of Conservation Plans + Design & Oversight of all BMPs implementation)	1.1 million/yr	53,000/yr	$ 13,817,000
	Nutrient Management Compliance	1.6 million/yr	76,000/yr	$ 3,100,000

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Agriculture	Cover Crops (470,000 acres planted annually)	2.3 million/yr	2,000/yr	$ 25,500,000
	Manure Transport (100,000 tons transported annually)	228,000/yr	26,000/yr	$ 2,000,000
	Verification of existing BMPs	87,500/yr	1,500/yr	$ 500,000
	Implementation of Additional BMPs (The Maryland Agricultural Water Quality Cost-Share (MACS) Program)	652,000	10,600	$ 9,275,000
Natural Lands	Upland Tree Planting and Streamside Forest Buffers (1,150 acres)	8,000	700	$1,683,920
	Wetland Restoration (175 acres)	600	50	$125,000
	Stream Restoration (6 miles)	2,500	2,250	$3,172,520
	Shoreline Management (Living Shoreline Technique) (3,000 ln ft)	150	100	$257,140
	Oyster Aquaculture (350,000 bushels)	10,000	1,000	$2,500,000
Septic	Best Available Technology (BAT) Upgrades (Based on roughly 920 BAT unit upgrades)	40,000	-	$10,100,327
	Connection to Wastewater Treatment Plants **(**WWTP) (Based on roughly 1,600 sewer connections)	16,800	-	$1,296,899
	Pumping (Not available until Septic Stewardship Plans developed by 2021)	-	-	TBD - Septic Stewardship
Stormwater	Complete current Phase 1 Municipal Separate Storm Sewer (MS4) permits restoration requirement (completion dates: 2018 and 2019) *Approximately 20,000 impervious acres*	85,000	40,000	$40,000,000
	Complete new Phase 1 MS4 restoration requirement (completion dates: 2023 and 2024) *Approximately 17,500 impervious acres*	90,000	12,500	$40,000,000

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Stormwater	Complete Current Phase 2 MS4 restoration requirement (completion date: 2025) *Approximately 3,000 impervious acres*	15,000	5,000	$5,000,000
	Miscellaneous implementation on non-MS4 counties (i.e. trading, trust fund) *Approximately 400 impervious acres*	5,000	500	$5,000,000
Wastewater	Complete Bay Restoration Fund (BRF)-Funded Enhanced Nutrient Removal (ENR) upgrades to 67 significant municipal wastewater plants	4,000,000	100,000	Fully Funded Pre-WIP III
	Continue funding ENR upgrades for non-significant municipal plants through the BRF (11 additional plants by 2025, for a total of 16)	25,000	5,000	$50,000,000
	Provide Operations and Management (O&M) Grant through the BRF for facilities achieving nitrogen discharge concentrations of 3.0 mg/L	425,000	No planned additional reductions	$10,000,000
	Incentivize higher treatment levels (beyond 3.0 mg/L of nitrogen) through water quality trading and the Clean Water Commerce Act (through 2021)	No estimate	No estimate	$10,000,000
	Complete upgrades to federal significant municipal plant	3,000	300	No state costs
	Continue minor industrial reductions	No estimate	No estimate	No state costs
	Maintain achievement of significant industrial Waste Load Allocations	No planned additional reductions	No planned additional reductions	No state costs
	Implement sewer projects to address combined sewer overflows (CSOs), sanitary sewer overflows (SSOs) and inflow and infiltration (I/I)	20,000	2,000	$40,000,000

Financial Assurance and Creating a Restoration Economy

An independent 2015 assessment by the University of Maryland Environmental Finance Center[2] (EFC) confirmed that sufficient resources are in place to achieve interim and final restoration targets. In other words, no new state-based fees or taxes are required moving forward as long as Maryland: (1) leverages wastewater treatment plant reductions wisely in the interim while stormwater and septic sectors build capacity for steady progress; (2) continues effective and consistent enforcement of existing environmental regulations; and (3) continues to fully fund state Chesapeake Bay grant programs and directs these resources in the most cost effective manner possible. A cursory analysis of 2019 restoration funding relative to costs suggests Maryland has sufficient fiscal capacity to assure Chesapeake Bay's Water Quality Standards (WQS) will be met. However, it is important to realize that this analysis is based on current year funding and estimated implementation costs. The analysis also did not factor in the substantial federal and local funding sources that fund implementation efforts to achieve Maryland's TMDL targets. A thorough financial analysis is recommended in the near term to confirm Maryland's fiscal capacity to achieve 2025 TMDL targets.

Governor Larry Hogan's fiscal year 2019 budget invests a record $1.2 billion in state funds for comprehensive Chesapeake Bay restoration efforts. This record level of funding for key conservation and regulatory programs includes $52.9 million for the Chesapeake and Atlantic Coastal Bays Trust Fund (Trust Fund), marking the third year in a row that the Hogan administration has fully funded Bay restoration efforts. The fiscal year 2019 budget also marks the first time since 2008 that no funding for transfer tax programs, including Program Open Space, is diverted to the General Fund; in total, these programs received $253 million in 2019, an increase of $67 million from the prior fiscal year. As chair of the Chesapeake Executive Council, Governor Hogan fought to preserve full federal Chesapeake Bay Restoration funding and worked to ensure Maryland's farmers get needed federal resources for conservation practices through both the Farm Bill and a CBP partnership Agricultural Technical Assistance directive. Maryland is also working with the CBP partnership to increase federal funds targeted for Bay restoration.

Over Fiscal Years 2000 – 2018, the state spent about $8.4 billion on Chesapeake Bay restoration activities. This amount includes funding for activities that directly reduce nutrient and sediment inputs to the Bay (e.g., cover crops and wastewater treatment plant upgrades), activities that indirectly support Bay restoration (e.g., monitoring, education, outreach), and activities that prevent or minimize future degradation of the Bay (e.g., land conservation). In addition, local jurisdictions are spending approximately $300 million a year to retrofit older communities with stormwater controls that reduce nutrient delivery to the Bay and provide important local co-benefits like flood attenuation and improved stream health.

As Maryland moves forward with implementing the Phase III WIP we will build on our successes and continue to develop and explore financing innovations that stretch funding and grow business opportunities that have both environmental and economic benefits. This can be accomplished by further expanding successful "pay for performance" models that pay for nutrient reductions delivered versus the traditional approach of paying for reductions promised through a proposed project. Maryland will explore

[2] efc.umd.edu/assets/financing_strategy_final_6_5.pdf

more public-private partnerships, such as the oyster program in Anne Arundel County, as well as leverage the financing innovations being explored in the Conowingo WIP (CWIP) to help accelerate overall restoration efforts by bringing in resources from the private sector. There are real and exciting opportunities to restore the Chesapeake Bay by bringing the environmental and finance sectors together to stimulate a restoration economy. Finally, retaining full federal funding for Chesapeake Bay restoration is paramount to meeting and sustaining our 2025 restoration targets, while also leveraging or expanding funding sources like the Farm Bill, as well as EPA's Clean Water State Revolving Fund, with specific strategies on utilizing its Land Conservation Projects program.

Current and Future Challenges to Chesapeake Bay Restoration

While Maryland is on track to meet its 2025 restoration goals with the Phase III WIP strategies, current level of resources and investments, and based upon the latest science, there are several factors that need consideration in order to achieve and sustain restoration into the future. These factors include:

A Changing Climate

Climate change impacts, including increased precipitation and storm events, are causing increased nutrient and sediment loads to the Chesapeake Bay. The current Phase III WIP highlights climate change implementation strategies and plans that reduce nutrient and sediment loads to Chesapeake Bay while simultaneously mitigating or reducing carbon emissions, building resilient communities and ecosystems, and helping with local needs like flood control and sustainable infrastructure. As a national leader on climate change, Maryland has a comprehensive portfolio of climate mitigation and adaptation practices. The Phase III WIP focuses on those climate practices that provide nutrient reductions is not intended to provide a complete inventory of Maryland's climate-related actions.

The CBP partnership understands that additional science is needed to both quantify potential increases in watershed-wide nitrogen load reductions and understand how current pollution reduction practices will perform under a changing climate. Between now and March 2021, the CBP partnership is committed to improving scientific understanding of these impacts, identifying outstanding research needs, and refining nutrient and sediment load estimates for each Bay jurisdiction.

Population Growth Beyond 2025

Projected growth in both human and animal populations, and their impact to Bay water quality, were accounted for in developing the 2025 targets. Moving beyond 2025, however, as these populations continue to increase, growth in pollutant loads is also expected from more wastewater, septic systems, manure and greater stormwater loads when lands are converted and developed. When this anticipated growth is coupled with expected climate change impacts, sustaining the state's restoration targets will be challenging, requiring innovative and collaborative approaches to achieve restoration targets.

Conowingo Dam

The CBP partnership estimates that after full Phase III WIP implementation, an additional Baywide reduction of 6 million pounds of nitrogen and 0.26 million pounds of phosphorus is needed in order to mitigate the increased pollution resulting from Conowingo Dam infill and meet downstream WQS. Through Clean Water Act Section 401 water quality certification (WQC) authority, Maryland has assigned this pollution reduction responsibility to Exelon, Conowingo Dam's owner. The CBP partnership also agreed to complement Maryland's WQC efforts by working collaboratively and helping to reduce the increased pollutant loads now flowing over Conowingo Dam. These additional Conowingo loads are being accounted for in a separate CWIP that pools CBP partnership funding into a single fund, explores innovative financing strategies, and public/private partnerships, as well as targets cost effective practices in locations that have the greatest water quality benefits to the Bay. The draft CWIP will be open to public comment according to a schedule that is still under development by the CBP partnership.

Local Implementation Challenges

Maintenance and Verification

Much of the on-the-ground implementation to achieve Maryland's Bay restoration targets occurs at the local government level. Our local government partners are installing physical infrastructure, whether larger capital projects like upgrading wastewater plants or smaller scale stormwater retrofits, designed to reduce pollution at its source. Like all infrastructure projects, pollution reduction practices must be properly installed and maintained to achieve their intended function. Maryland has approved verification protocols to ensure pollution reduction practices are working properly and can continue to be counted towards Bay restoration credit. [3] Local jurisdictions, soil conservation districts, and other partners who are implementing these projects on the ground have identified maintenance, verification, funding, programs and accounting as resource challenges that could impact restoration progress.

Restoration Capacity

Local partners also need continued resources to build restoration capacity, whether in the form of permitting assistance, technical assistance, knowledge transfer, more dedicated staff and/or financial incentives. These needs vary regionally, by sector, as well as within individual jurisdictions. Since there is no one-size-fits-all solution to local implementation challenges, ongoing local engagement and capacity building will be necessary throughout the implementation process to ensure restoration progress.

Maryland's Approach to Addressing Current and Future Chesapeake Bay Restoration Challenges

[3] Maryland BMP verification protocols are available at .mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/BMP%20Verification/MD_Verification%20Protocols_Master_Doc.pdf

Tackling the significant challenges to Bay restoration requires agreement on a principled approach to restoration that is backed by diverse strategies and contingencies implemented through a robust accountability and adaptive management framework. Some of the key principles Maryland is using to address these challenges and sustain restoration into the future include:

Balancing Regulations and Incentives

Maryland has many regulatory tools under both the federal Clean Water Act and state law that set numeric pollutant discharge limits and conditions for restoration or other requirements on the regulated community. Some examples across sectors include: federal National Pollutant Discharge Elimination System (NPDES) permit limits on wastewater treatment plant pollution discharges; federal and state restoration requirements for areas under MS4 permits, which require stormwater management retrofit practices; state requirements for agricultural nutrient management plans; and state BAT requirements for onsite (septic) systems in the Critical Area (within 1,000 feet of tidal shorelines). At the same time Maryland has pollution sources within the stormwater, agricultural and septic sectors, such as small communities with no Bay restoration requirements for pre-law stormwater discharges (non-MS4s) that nevertheless play an important role in ultimately achieving Bay restoration targets. Maryland utilizes both federal and state funding programs to finance Wastewater Treatment Plant (WWTP) upgrades, stormwater management retrofits, agricultural BMPs, natural land restoration and conservation, and septic upgrades. Additionally, local financing structures and private investments are employed to implement restoration across all the sectors. Maryland uses a balanced approach of effective regulations and financial incentives to drive restoration progress across sectors, and in priority areas that achieve the largest pollution reductions.

Using Wastewater Treatment Plant Capacity Wisely While Driving Long-term and Sustained Progress in Slower Paced Sectors

Accelerated pollution reductions at wastewater treatment plants and on farms are largely driving Maryland's success in meeting the 2025 Bay restoration targets. As Maryland's population grows and the number of households being served by public wastewater rises, discharges from wastewater plants will increase. Continued steady progress in both the stormwater and septic sectors is required to ensure that ongoing pollution reductions keep pace with any increased loads due to climate change and population growth. MS4 permits now cover greater than 90 percent of Maryland's developed landscape and are legally enforceable mechanisms to ensure steady restoration progress in that sector over the long term. Continued steady progress in the septic sector will be assured through upgrades, innovative technologies, sewer hookups and the recent Septic Stewardship law that helps local jurisdictions with septic maintenance through pumpouts.

Creating a Restoration Economy and Driving Innovation

In addition to traditional funding approaches, the Hogan administration is pursuing market-based strategies designed to stimulate a restoration economy and reduce costs. Nutrient credit trading is one such tool that allows non-mandated pollution reductions from one entity to be purchased by another entity. This creates a marketplace that will drive innovation across sectors to develop the most cost

effective pollution reduction practices. At the same time, other innovative financing strategies like the Clean Water Commerce Act and the CWIP drive innovation by creating funding streams for the most cost effective practices and developing collaborative funding models like public-private partnerships to reduce public costs of restoration. Aligning Maryland's greenhouse gas (GHG) reduction actions with Bay restoration actions that have significant carbon sequestration benefits can leverage and diversify financing to accelerate pollution reduction practices. Maryland is also actively pursuing water reuse technologies that help with long term water supply sustainability for our citizens, as well as reduce pollution loads to Chesapeake Bay[4].

Locally-Driven Restoration and Co-benefits

Chesapeake Bay restoration will not be successful without sufficient capacity and close collaboration with local partners. County governments, municipalities, soil conservation districts, farmers, citizens and NGOs are the boots on the ground implementing restoration practices through permits or grant/incentive programs. To ensure the continued progress of local partnerships, restoration practices must not only be cost effective and achievable, but also provide benefits to local communities and address local challenges like flooding. Understanding and resolving restoration barriers through continuing local engagement and targeted strategies, as well as controlling ongoing maintenance costs, will be particularly important to sustain restoration in the long-term. Maryland will also work closely with local partners to identify strategies that address barriers through the adaptive implementation process of two-year milestones, progress evaluations, accelerating strategies that are cost effective and meet local needs, while embracing a continuous improvement philosophy to build on successes and learn from shortcomings. Maryland is already forming a workgroup to improve technical assistance delivery to local partners, as well as working with those partners to develop a strategic implementation plan for addressing local restoration challenges.

Accounting for and Leveraging Conservation and Protection Programs

One of the best ways to sustain Bay restoration is to ensure that Maryland's ecologically significant lands, aquatic and wildlife resources are protected. These protections preserve the lowest pollution loading land uses from converting to higher pollution land uses that will set Maryland further behind in its restoration goals. Maryland is making sure its land conservation programs are fully accounted for in the Bay restoration effort while fully funding land conservation programs for future acquisitions. Maryland is also reviewing current conservation and protection program effectiveness, through monitoring results and other measures, in achieving conservation and protection goals; and evaluating these programs to further leverage restoration opportunities on conserved and protected lands.

Holistic Ecosystem Management

Although Maryland's Phase III WIP is designed to achieve the TMDL nitrogen, phosphorus, and sediment targets and be consistent with EPA's expectations, Maryland is also strongly committed to the

[4] mde.maryland.gov/programs/Water/waterconservation/Pages/water_reuse.aspx

broader goals outlined in the current (2014) Chesapeake Bay Agreement[5]: These include sustainable fisheries, vital habitats, reducing toxic contaminants, healthy watersheds, land conservation, stewardship, public access, environmental literacy and climate resiliency. These other watershed goals provide critical feedback loops that improve water quality, whether through restored fisheries providing nutrient uptake and water filtration services, nitrogen and carbon uptake in the plant tissue of submerged vegetation, or land-based practices like wetlands and forest buffers that capture and process nutrients before they enter surface waters. Maryland's commitment to this broader ecosystem management framework will help the state achieve its TMDL restoration targets while also maintaining the productivity of the Bay's living resources that strengthen local economies.

Accountability and Adaptive Management Framework

The accountability and adaptive management framework that underpins Chesapeake Bay restoration is shown in Figure 2.

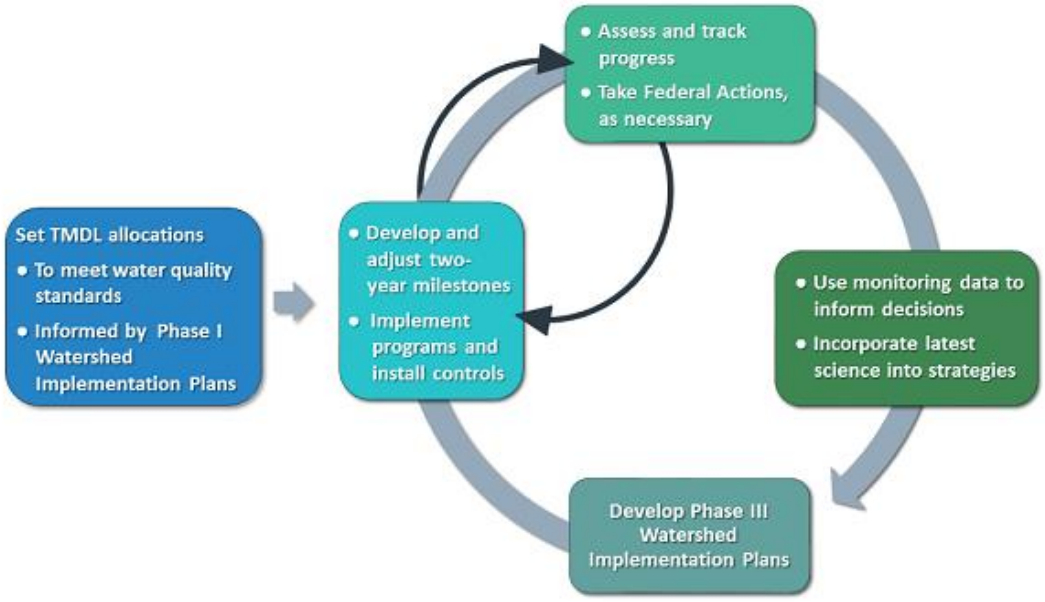


Figure 2: *Chesapeake Bay TMDL Accountability Framework. Graphic courtesy of the EPA Chesapeake Bay Program web site at epa.gov/chesapeake-bay-tmdl/ensuring-results-chesapeake-bay*

As part of this accountability framework, the Chesapeake Bay Program partners develop short term goals, called milestones, to ensure restoration progress. Milestones identify the restoration practices, programs, policies and resources that jurisdictions commit to implement over two-year periods. EPA then evaluates progress that the jurisdictions have made toward achieving their milestone commitments and takes appropriate federal actions, as necessary, to help jurisdictions remain on track.

[5] chesapeakebay.net/what/what_guides_us/watershed_agreement

Maryland submitted its 2018-2019 milestones to EPA in January 2018, and expects to submit 2020-2021 milestones in January 2020. These milestones serve as key checkpoints on the way to restoring the Bay by 2025, and include annual evaluations to gauge progress. The milestones provide Maryland the opportunity to adaptively manage the restoration process, incorporate new science on restoration practices performance, and apply key lessons learned from Phase III WIP successes or failures along the way. Chesapeake Bay water quality and living resources data are also used to ensure results are being seen in the Bay, as well as to adjust, as necessary, to new science or changing conditions.

Conclusion

There are both great challenges and great opportunities in restoring and protecting the Chesapeake Bay watershed and the rich natural heritage that defines this region. To do so, Marylanders must sustain the collective will to revive this national treasure, work to control costs and stimulate a restoration economy, leverage local and regional partnerships, and private or public partnerships, implement restoration practices that achieve multiple benefits, promote and adopt innovation, adaptively manage and build on successes. Marylanders must also acknowledge that restoration success will require full commitment from upstream states, like Pennsylvania and New York, Maryland's continued strong leadership in the CBP partnership and the EPA's maintenance of a strong restoration oversight and accountability role.

The Chesapeake Bay is a dynamic system influenced by natural ecosystem processes, as well as the multiple pressures of climate change, population growth, land use changes and invasive species. Maryland and the CBP's long term commitment to the science that informs policy and management actions, demonstrates effectiveness and communicates restoration progress must be sustained into the future. As one participant keenly observed during the state's recent local engagement process: 2025 is not the end of restoration, but rather another benchmark on the restoration journey.

Introduction

Chesapeake Bay restoration has been a priority for the State of Maryland, its citizens and Chesapeake Bay watershed jurisdictions since 1983 when the Chesapeake Bay Program (CBP) was founded, and the first watershed restoration agreement was signed. By the mid-1990s, Chesapeake Bay's water quality standards were still not being met and it was designated as impaired under the federal Clean Water Act (CWA) framework. In 2000, an updated agreement signed by leaders across the watershed including state governors, the Mayor of the District of Columbia, the EPA Administrator, and the Chair of the Chesapeake Bay Commission, committed to "correct the nutrient and sediment-related problems in the Chesapeake Bay and its tidal tributaries"[6] sufficient to remove it from the federal list of impaired waters by 2010. It was also agreed that if these voluntary commitments were not sufficient to restore the Bay by 2010, the CBP partnership would pursue the regulatory CWA approach and develop a Total Maximum Daily Load (TMDL). In the late 2000s, when it became clear that the voluntary water quality agreement had not fully restored the Bay, the CBP partnership transitioned to the regulatory CWA framework and began developing the Chesapeake Bay TMDL.

The TMDL quantifies how much pollution, specifically nitrogen, phosphorus and sediments, must be reduced to achieve Chesapeake Bay water quality standards. Water quality standards are the minimum regulatory requirements (e.g., dissolved oxygen, water clarity - see COMAR 26.08.02.03-3[7]) that Chesapeake Bay must meet to support healthy living resources like crabs, oysters and rockfish/striped bass. The TMDL is calculated using multiple computer models (watershed, estuarine, and water quality and sediment transport models) that simulate environmental conditions and are calibrated to field monitoring data. Since the TMDL does not specify how or where pollution reductions will be achieved, watershed implementation plans (WIPs) are also developed to identify to type, number and location of pollution reduction practices planned to restore water quality. The pollution reduction practices identified in those plans are then translated into scenarios that are run through the modeling framework to demonstrate that water quality standards will be achieved.

This current plan represents the third phase of the WIP to achieve Maryland's 2025 TMDL pollution targets and incorporates lessons learned from the Phase I and II WIPs. The Phase I WIP identified and accelerated the strategies and deadlines for practices to achieve 70 percent of the pollution reductions by 2017. This Phase I WIP was finalized in December 2010 commensurate with the development of the 2010 TMDL and during a time when EPA's scientific modeling framework was being updated. The Phase I WIP demonstrated achievement of pollution targets at the major basin scale (i.e., Eastern Shore, Potomac, Susquehanna, Western Shore and Patuxent basins) and was considered a starting point for finer scale planning during the Phase II process.

Maryland's Phase II WIP provided additional geographic resolution to implementation efforts and used the 2025 restoration date consistent with the TMDL. Originally, the Phase II WIP was intended to be developed at the county geographic scale; however, EPA decided in October 2011 to scale back its expectations for geographic specificity due to data and model limitations. Although the plans were again documented at the major basin scale, most local partners provided the state information at a county scale

[6] chesapeakebay.net/documents/cbp_12081.pdf

[7] .dsd.state.md.us/comar/comarhtml/26/26.08.02.03-3.htm

to form the basis of the basin scale plans. The county analyses were supported by the state's assigning stormwater pollution reduction targets at a finer level than is available in the EPA Bay watershed model. This underlying county scale of planning provided further assurance of implementation beyond that of the Phase I WIP because many of the implementation actions are conducted by county governments and soil conservation district offices operating at that scale.

After the Phase II WIP, the CBP partnership agreed to conduct a 2017 midpoint assessment (MPA) to evaluate jurisdictions' progress in achieving 60 percent of the necessary TMDL pollution reductions. Maryland exceeded the 60 percent MPA phosphorus and sediment goals in 2017 and was 36 percent of the way towards achieving the nitrogen targets. When upgrades are completed at its 67 major WWTPs, Maryland will exceed the 60 percent nitrogen goal. As of January 2019, upgrades are complete at approximately 90 percent of these plants (59 of 67 complete), with five of the eight remaining plants anywhere from 88-98 percent complete, two still in planning or design, and work on one plant not yet started.

The MPA was also used as an opportunity to incorporate improved science and monitoring results into the Chesapeake Bay modeling framework and develop updated 2025 pollution reduction targets. Using the Phase 6 modeling suite, an updated set of state-basin targets was established to ensure the attainment of water quality standards after implementation of the States' WIPs. Nutrient targets for each of Maryland's five major basins are provided in Table 2, and the process for calculating these targets is described in Appendix F.

Table 2: *Maryland's Phase III WIP Pollution Targets by Major Basin in Million Pounds per Year.*

Major Basin	Phase III WIP Target* *(Million lbs/yr)*	
	Nitrogen	Phosphorus
Eastern Shore of Chesapeake Bay	15.6	1.29
Patuxent River Basin	3.1	0.30
Potomac River Basin	15.8	1.09
Susquehanna River Basin	1.6	0.05
Western Shore of Chesapeake Bay	9.6	0.95
Total	**45.8**	**3.68**

*****Phase III WIP reductions subject to change upon EPA review.

For the Phase I and II WIPs, Maryland used the allocation approach from the Chesapeake Bay TMDL to assign finer-scale goals for the Bay segment and county levels. This methodology was based on the portion of the load from a watershed that could theoretically be reduced, and assigning a consistent percent reduction to the reducible load from each watershed. For this Phase III WIP, and in recognition that there are varying levels of pollution reduction progress across sectors, Maryland has adopted a

feasibility approach to achieve 2025 targets. In a practical sense, this means Maryland recognizes that accelerated progress in both the wastewater and agricultural sectors will be largely responsible for Maryland achieving its 2025 restoration targets. Since wastewater and agriculture are the two highest loading sectors, these planned accelerated reductions will be sufficient to achieve current 2025 targets. The stormwater and septic sectors are then required to continue making steady reductions over a longer term (beyond 2025) and contribute their fair share of reductions to the Chesapeake Bay restoration effort while factoring in affordability. For stormwater, reductions will occur over multiple five-year MS4 permit cycles. Septic system reductions will include a menu of practices, like septic upgrades, pumpouts, sewer connections, financial incentives, and a focus on public health priorities to ensure sector progress. Slowing and reversing loss of natural lands, and increasing and restoring natural filters, are also critical to Bay restoration as well as adapting to and mitigating climate change impacts. The natural lands, conservation plus and protection chapters (Appendices B and D) include strategies to protect and restore the state's natural filters. Maryland worked closely with local jurisdictions throughout the Phase III WIP process to develop this feasibility based approach and document local strategies in county summary documents (see Appendix C).

This Phase III WIP documents all of the strategies and commitments Maryland and local jurisdictions will put in place to achieve these basin targets by 2025. EPA has also established expectations[8] for what information should be included in each jurisdiction's WIP.

These EPA Expectations include:

1. Programmatic and Numeric Implementation Commitments between 2018 and 2025
2. Comprehensive Local, Regional, and Federal Engagement Strategies and Commitments
3. Adjustments to Phase III WIP state-Basin Targets and the Phase II WIP Source Sector Goals
4. Development and Implementation of Local Planning Goals
5. PSC Decisions on Accounting for Growth
6. PSC Decisions on Conowingo Dam
7. PSC Decisions on Climate Change

Although Maryland's Phase III WIP is designed to achieve the TMDL nitrogen, phosphorus and sediment targets, and be consistent with EPA's expectations, Maryland is also strongly committed to the broader goals outlined in the current (2014) Chesapeake Bay Agreement[9]. These include sustainable fisheries, vital habitats, reduction of toxic contaminants, healthy watersheds, land conservation, stewardship, public access, environmental literacy, and climate resiliency. Maryland participates on multiple goal implementation teams to implement and track related strategies. Many of the Phase III WIP sections or strategies also contribute to achieving these broader Bay restoration goals because of their close connection to water quality.

[8] epa.gov/sites/production/files/2018-06/documents/epa-phase-iii-wip-expectations-6-19-18.pdf and "Clarification of Accounting for Growth Expectations for the Phase III Watershed Implementation Plans (WIPs), February 5, 2019.

[9] chesapeakebay.net/what/what_guides_us/watershed_agreement

Programmatic and Numeric Implementation Commitments between 2018 and 2025

This section provides an overall summary of the feasibility-based implementation commitments and associated pollutant reductions quantified using the Chesapeake Bay modeling tools. Maryland has 53 tidal subwatersheds (Figure 3) within the five major basins (Figure 4), each with specific water quality standards that must be achieved. The following Phase III WIP pollution reduction practices (Table 3) were input into the Bay watershed model, along with their geographic location, to calculate expected reductions of nitrogen, phosphorus and sediment into Chesapeake Bay's tidal waters by 2025. The subwatershed pollution reductions were then summed up by pollutant-sector combination statewide (Tables 4-6) to determine if 2025 planning targets will be met. Maryland also projected the trajectories or pollution reduction trends after the 2025 date (Figure 5) to characterize expected future sector growth and associated increases in pollution loads. Detailed descriptions of pollution reduction programs and practices by sector are provided in Appendix B.

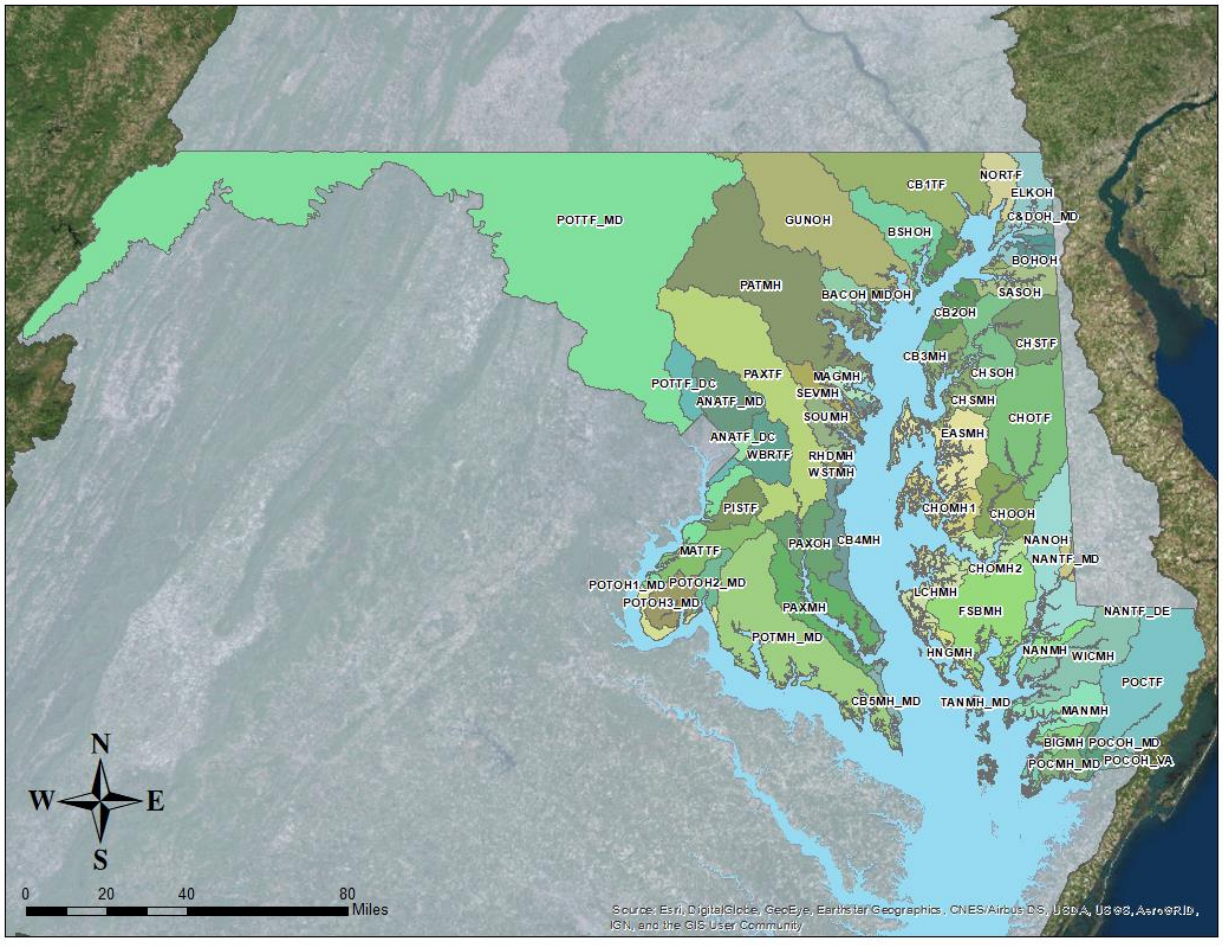


Figure 3: *Maryland's 53 tidal subwatersheds draining into Chesapeake Bay.*

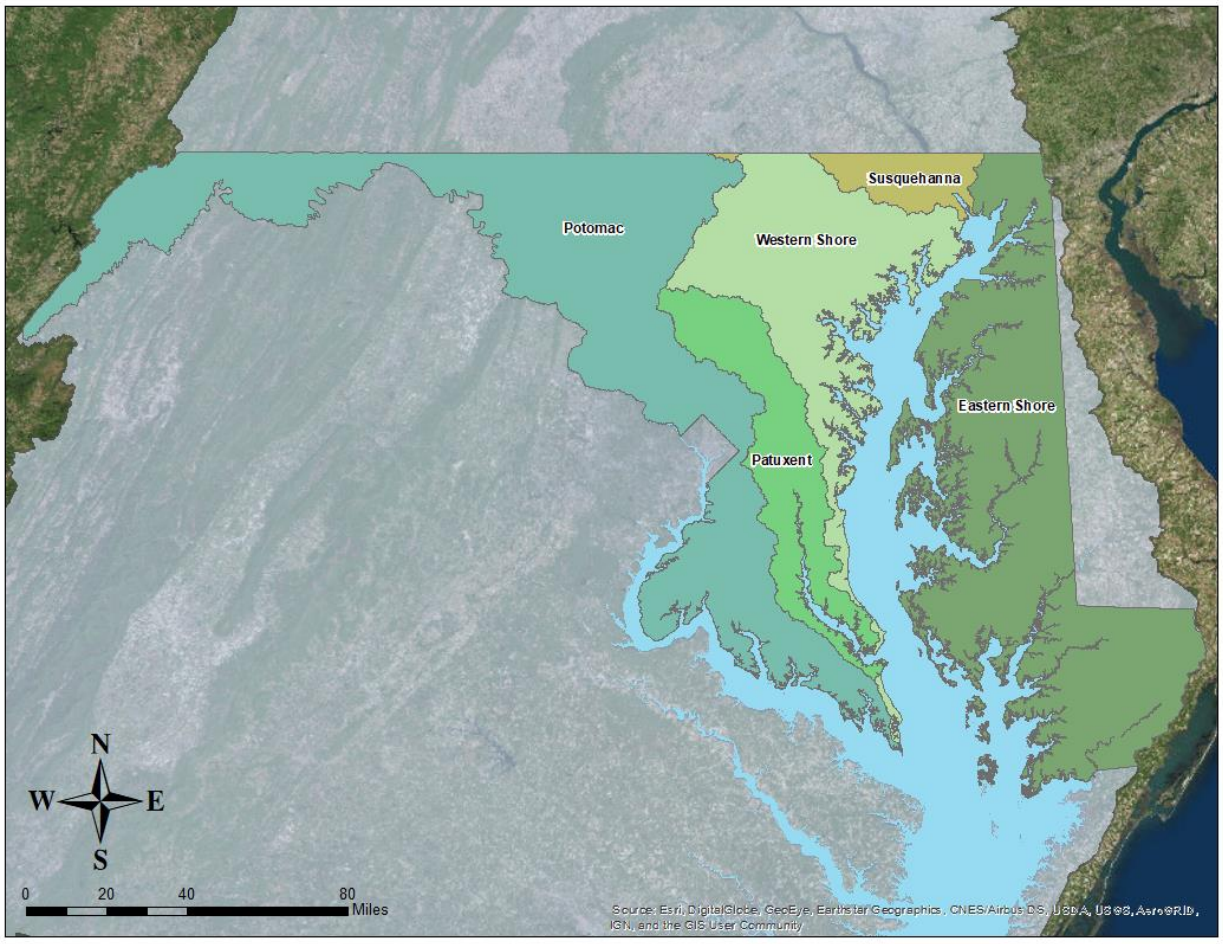


***Figure 4**: Maryland 5 Major Basins for which EPA has Assigned Pollution Targets.*

***Table 3:** Core Pollution Reduction Practices Input into the Chesapeake Bay Modeling Framework. NOTE: The table below is not intended to capture all practices, just the highlights. For details on each sector's strategies, please refer to Appendix B.*

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Agriculture	Conservation Technical Assistance (1 million acres of Conservation Plans + Design & Oversight of all BMPs implementation)	1.1 million/yr	53,000/yr	$ 13,817,000
	Nutrient Management Compliance	1.6 million/yr	76,000/yr	$ 3,100,000
	Cover Crops (470,000 acres planted annually)	2.3 million/yr	2,000/yr	$ 25,500,000

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Agriculture	Manure Transport (100,000 tons transported annually)	228,000/yr	26,000/yr	$ 2,000,000
	Verification of existing BMPs	87,500/yr	1,500/yr	$ 500,000
	Implementation of Additional BMPs (The Maryland Agricultural Water Quality Cost-Share (MACS) Program)	652,000	10,600	$ 9,275,000
Natural Lands	Upland Tree Planting and Streamside Forest Buffers (1,150 acres)	8,000	700	$1,683,920
	Wetland Restoration (175 acres)	600	50	$125,000
	Stream Restoration (6 miles)	2,500	2,250	$3,172,520
	Shoreline Management (Living Shoreline Technique) (3,000 ln ft)	150	100	$257,140
	Oyster Aquaculture (350,000 bushels)	10,000	1,000	$2,500,000
Septic	Best Available Technology (BAT) Upgrades (Based on roughly 920 BAT unit upgrades)	40,000	-	$10,100,327
	Connection to Wastewater Treatment Plants **(**WWTP) (Based on roughly 1,600 sewer connections)	16,800	-	$1,296,899
	Pumping (Not available until Septic Stewardship Plans developed by 2021)	-	-	TBD - Septic Stewardship
Stormwater	Complete current Phase 1 Municipal Separate Storm Sewer (MS4) permits restoration requirement (completion dates: 2018 and 2019) *Approximately 20,000 impervious acres*	85,000	40,000	$40,000,000
	Complete new Phase 1 MS4 restoration requirement (completion dates: 2023 and 2024) *Approximately 17,500 impervious acres*	90,000	12,500	$40,000,000

Sector	BMP Description	Lbs. TN Reduced	Lbs. TP Reduced	Annual Costs
Stormwater	Complete Current Phase 2 MS4 restoration requirement (completion date: 2025) *Approximately 3,000 impervious acres*	15,000	5,000	$5,000,000
	Miscellaneous implementation on non-MS4 counties (i.e. trading, trust fund) *Approximately 400 impervious acres*	5,000	500	$5,000,000
Wastewater	Complete Bay Restoration Fund (BRF)-Funded Enhanced Nutrient Removal (ENR) upgrades to 67 significant municipal wastewater plants	4,000,000	100,000	Fully Funded Pre-WIP III
	Continue funding ENR upgrades for non-significant municipal plants through the BRF (11 additional plants by 2025, for a total of 16)	25,000	5,000	$50,000,000
	Provide Operations and Management (O&M) Grant through the BRF for facilities achieving nitrogen discharge concentrations of 3.0 mg/L	425,000	No planned additional planned reductions	$10,000,000
	Incentivize higher treatment levels (beyond 3.0 mg/L of nitrogen) through water quality trading and the Clean Water Commerce Act (through 2021)	No estimate	No estimate	$10,000,000
	Complete upgrades to federal significant municipal plant	3,000	300	No state costs
	Continue minor industrial reductions	No estimate	No estimate	No state costs
	Maintain achievement of significant industrial Waste Load Allocations	No additional reductions	No planned additional planned reductions	No state costs
	Implement sewer projects to address combined sewer overflows (CSOs), sanitary sewer overflows (SSOs) and inflow and infiltration (I/I)	20,000	2,000	$40,000,000

Table 4: *Nitrogen: Statewide Current & Phase III WIP Loads by Source Sector.*

Source Sector: Nitrogen	2017 Progress (M lbs TN/yr)	Phase III WIP * (M lbs TN/yr)	Change in Load (M lbs TN/yr | Percent)
Agriculture	22.4	18.0	-4.4 | -20%
Natural **	8.1	8.1	0.0 | 0%
Septic	3.1	3.1	0.0 | 1%
Stormwater ***	9.4	9.2	-0.2 | -2%
Wastewater	11.3	6.6	-4.7 | -41%
Total	**54.2**	**45.0**	**-9.2 | -17%**

Table 5: *Phosphorus: Statewide Current and Phase III WIP Loads by Source Sector.*

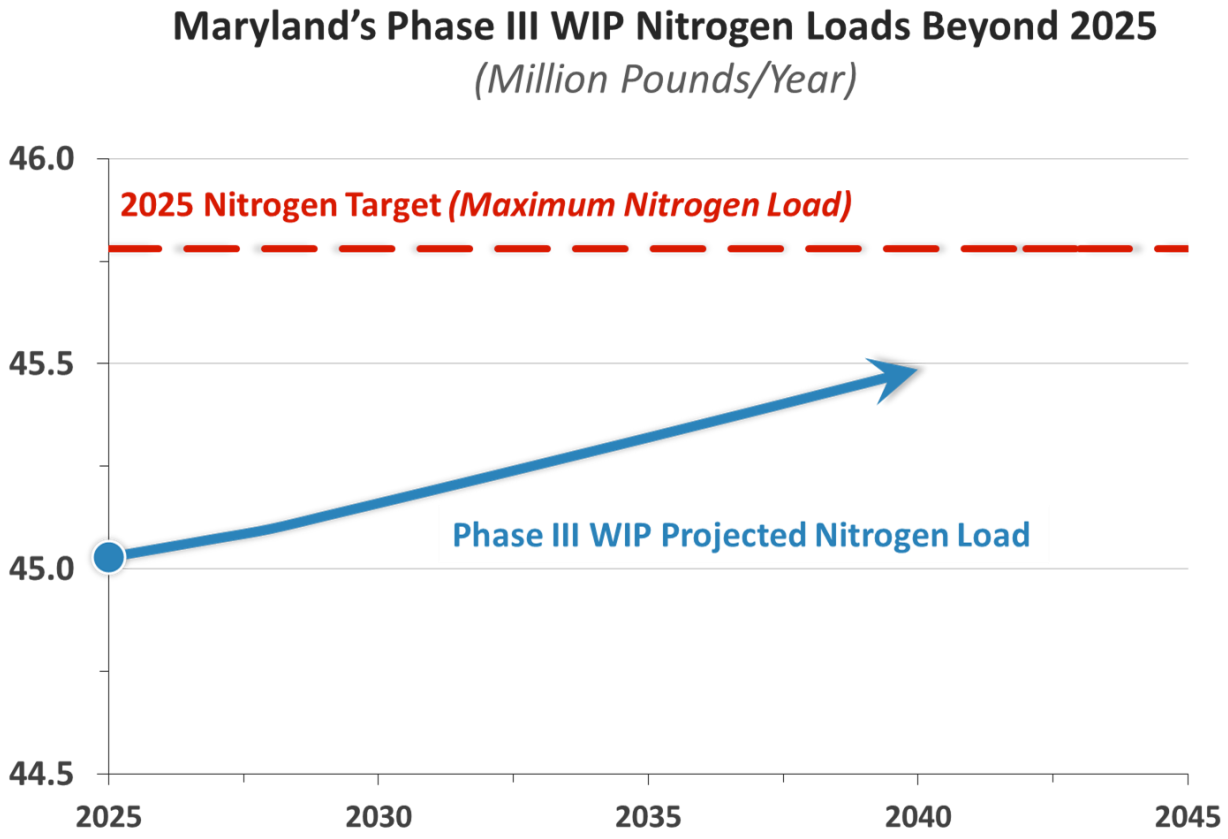
Source Sector: Phosphorus	2017 Progress (M lbs TP/yr)	Phase III WIP * (M lbs TP/yr)	Change in Load (M lbs TP /yr | Percent)
Agriculture	0.65	0.47	-0.17 | -27%
Natural	1.83	1.83	-0.00 | 0%
Stormwater ***	0.67	0.58	-0.09 | -13%
Wastewater	0.51	0.39	-0.12 | -24%
Total	**3.66**	**3.28**	**-0.39 | -11%**

Table 6: *Sediment: Statewide Current and Phase III WIP Loads by Source Sector.*

Source Sector: Sediment	2017 Progress (M lbs TSS/yr)	Phase III WIP * (M lbs TSS/yr)	Change in Load (M lbs TSS/yr | Percent)
Agriculture	259	185	-75 | -29%
Natural	6,903	6,903	0 | 0%
Stormwater ***	405	230	-175 | -43%
Wastewater	7	9	+2 | +26%
Total	**7,575**	**7,328**	**-239 | -3%**

* Phase III WIP reductions subject to change upon EPA review.
** Includes atmospheric deposition of nitrogen to tidal waters.
*** Stormwater reductions include natural load reductions that are attributed to practices implemented by the stormwater sector.

These model outputs demonstrate that Maryland has sufficient practices across sectors to achieve its 2025 pollution targets. In fact, per Figure 5 below, Maryland is expected to remain below its nitrogen target out to the year 2047. With a feasibility based approach, however, progress is not even across sectors. The wastewater and agricultural sectors achieve the largest nitrogen reductions from 2017 progress levels, 41 percent and 20 percent respectively, while stormwater achieved a 2 percent reduction and septic sector loads increase by less than 1 percent.



Source: Maryland Phase III WIP Scenario; CAST 2019

Figure 5: *Total Nitrogen projected from Phase III WIP Strategies implementation. Shown relative to total nitrogen target (red line - 45.78 M lbs).*

Comprehensive Local, Regional, and Federal Engagement Strategies and Commitments

Engagement During WIP Implementation

Due to their central implementation roles, county, municipal, federal, and soil conservation district (SCD) staff who conduct implementation activities will be the primary stakeholders involved in Maryland's Phase III WIP implementation. Approaches to practitioner engagement will vary by pollution source sector. Appendix A lists specific engagement activities during WIP development.

The Maryland Department of Agriculture (MDA) held a meeting in each county, facilitated by the local SCD, to develop a revised county level plan that was ultimately incorporated into Maryland's Phase III WIP.

The Maryland Department of the Environment (MDE) held individual meetings with each county's public works staff to discuss county goals and Maryland's Phase III WIP. Engagement with Phase I MS4s occurred, and continues to occur, during permit renewal, as well as during review of required biennial financial assurance plans and annual progress reports. MDE staff continue to engage Phase II jurisdictions and facilities one-on-one and in small groups to discuss permit requirements and financial assistance. MDE engaged federal facilities through participation in the Federal Facilities Workgroup. A summary of U.S. Department of Defense implementation can be found in Appendix E. MDE, Maryland Sea Grant Extension, and NGOs engage non-MS4 communities.

MDE met with environmental health directors from all counties to discuss local onsite disposal goals and Maryland's Phase III WIP. Engagement with permitted wastewater facilities continues through the permitting process. Communication with this sector is also facilitated by the Maryland Association of Municipal Wastewater Agencies.

Engagement and Communication Goals

It is critical that local government, the agricultural community, and other local partners were involved in developing the WIP to ensure the plans will be realistic, reflect local priorities, benefit local communities and clearly identify the resources (e.g., funding, technical support) needed to get the job done. To facilitate effective local engagement in the Phase III WIP process, EPA expected[10] the states to devise a strategy for engaging local, regional and federal partners in the development and implementation of the Phase III WIPs.

Key expected products from Maryland's continued local engagement will vary by sector, permit status and local needs. Specific types of engagement will be customized according to local needs and capacities. Engagement will primarily target partner groups most directly involved in implementation, including soil conservation districts, local governments and state agencies.

[10] U.S. Environmental Protection Agency's Expectations for the Phase III Watershed Implementation Plans, June 2018.

Discussion of implementation funding will continue to be an important component of engagement activities. State and local partners will continue to refine funding strategies for achieving the Bay restoration goals and making further reductions after 2025.

Strategies

Target Audiences

Maryland's Phase III WIP will succeed only with policymaking and commitments that are coordinated with local leaders. Local elected officials and agricultural community leaders, (e.g., district managers and Maryland Association of Soil Conservation Districts boards), have particularly important roles. Engagement of local leaders will continue through correspondence from the governor's Chesapeake Bay Cabinet. MDE will continue to participate in Maryland Association of Counties and Maryland Municipal League conferences to keep local government leaders engaged and informed.

MDE staff will maintain key technical contacts knowledgeable in disciplines that inform WIP implementation, such as tree planting, climate change and urban source sector management. These technical partners will continue to share their experiences and identify model programs that have been successful.

Practitioners will continue to be the primary stakeholders involved in Maryland's Phase III WIP implementation. Broadly speaking, practitioners are county, municipal, SCD, Watershed Assistance Collaborative and National Fish and Wildlife Foundation staff who conduct implementation activities. Approaches to practitioner engagement will vary by pollution source sector, as described below.

MDA will continue to lead agriculture sector engagement, primarily through listening sessions and meetings, to identify barriers and opportunities in implementation and to track progress toward meeting WIP goals.

MDE will maintain contact with each county's public works staff to discuss local progress on stormwater. Additional sub-sector engagement will take place as described below.

Phase I permits in Maryland require the restoration of a percentage of a jurisdiction's impervious surface area. Nutrient reductions resulting from restoration and other permit requirements were incorporated into Maryland's Phase III WIP. Engagement will continue to occur during permit renewal, as well as during review of required biennial financial assurance plans and annual progress reports. In addition to regular phone calls and emails with stormwater managers, MDE staff will continue to participate in stormwater meetings organized by Maryland Association of Counties (MACo) to discuss Bay restoration and local water quality improvement.

MDE staff will continue to engage Phase II jurisdictions and facilities one-on-one and in small groups to discuss permit requirements and financial assistance. Nutrient reductions resulting from permit requirements were incorporated into Maryland's Phase III WIP. Permittees are also routinely engaged during their annual report reviews, which include constructive feedback from MDE staff.

Maryland Sea Grant Extension's watershed restoration specialists are trusted messengers for WIP implementation, especially for non-MS4 stormwater. Extension specialists assist communities with identifying funding, implementing restoration projects, BMP tracking, engaging community leaders and

more. In addition, several NGOs facilitate communication about the WIP with local partners. MDE will continue to collaborate with these messengers on local engagement.

Engagement with environmental health directors will continue to identify barriers and opportunities in implementation and to track progress toward meeting WIP goals for onsite wastewater systems.

Engagement with permitted wastewater facilities continues through the permitting process. Communication with this sector is also facilitated by the Maryland Association of Municipal Wastewater Agencies.

Key Local Challenges and Opportunities

Maintenance and Verification

Much of the on-the-ground implementation to achieve Maryland's restoration targets occurs at the local government level. These local government partners are installing physical infrastructure, whether larger capital projects like upgrading wastewater plants or smaller scale stormwater retrofits designed to reduce pollution at its source. Like all infrastructure projects, pollution reduction practices must be properly installed and maintained to achieve their intended function. Maryland has approved verification protocols to ensure pollution reduction practices are working properly and can continue to be counted towards Bay restoration credit. [11] Local jurisdictions, soil conservation districts, and other partners who are implementing these projects on the ground have identified maintenance, verification, funding, programs and accounting as resource challenges that could impact restoration progress.

Restoration Capacity

Local partners also need continued resources to build restoration capacity, whether in the form of permitting assistance, technical assistance, knowledge transfer, more dedicated staff, and/or financial incentives. These needs vary regionally, by sector, as well as within individual jurisdictions. Since there is no one-size-fits-all solution to local implementation challenges, ongoing local engagement and capacity building will be necessary throughout the implementation process to ensure restoration progress.

Key Messages

Messages will be continuously re-evaluated based on new information on barriers, opportunities and progress. The following general messages are likely to remain important throughout WIP implementation.

- Continue to work with upwind states through key programs and partnerships, like the Regional Greenhouse Gas Initiative (RGGI), as well as through appropriate legal actions.
- Continue to work with upstream states and ensure EPA is holding all jurisdictions accountable.
- Make sure all watershed states do their part and are held accountable.

[11] Maryland BMP verification protocols are available at .mde.state.md.us/programs/Water/TMDL/TMDLImplementation/Documents/BMP%20Verification/MD_Verification%20Protocols_Master_Doc.pdf

- Maintain a strong commitment to restoration and resiliency.
- Invest in restoration practices that reduce increased pollution resulting from climate change, and consider their placement on the landscape so they can be maintained over time.
- Continue to support full funding at the federal, state and local levels for Bay and local waterway restoration and prevention of degradation.
- Make funding go further by using market-based and other innovative finance approaches to create a restoration economy.
- Implement the Clean Water Commerce Act and other mechanisms to fund cost effective nutrient reduction practices.
- Continue to support addressing pollution loads from Conowingo Dam through the CWIP and other strategies, including holding Exelon accountable.
- Continue steady restoration progress in the stormwater sector through ongoing MS4 restoration requirements over current and future permit cycles.
- Plan for continued implementation beyond 2025.

Key Messengers

Key messengers are those entities that the state relies on to assist with delivering communications and engaging local governments around the Phase III WIP. In addition to the Departments of Environment and Agriculture, other important messengers and sources include the Maryland Department of Planning, Maryland Department of Natural Resources and numerous NGOs.

MDE's Office of Communications, working with its sister state agencies, the Chesapeake Bay Trust, and various other NGOs, will continue to support outreach efforts to the general public to raise public awareness of WIP implementation.

Tools and Resources

Engagement will take place in the form of webinars, meetings, fact sheets, phone calls, written correspondence and training. Table 7 (right) lists the target audiences along with example activities for each. For more examples of engagement activities, see the section on WIP development engagement and communication. In addition, MDE will continue to update its Chesapeake Bay webpages[12] to ensure that WIP information is readily available to a broad audience at all times.

Table 7: *Key Target Audiences and Associated Outreach Activities.*

Target Audience	Activities
Local leaders	• Letters • Workshops • Conferences • Meetings
Practitioners	• Workshops • Webinars • Surveys • Meetings • Emails
Technical partners	• Phone calls
Other stakeholders	• Meetings • Emails

[12] MDE's Chesapeake Cleanup Center: https://mde.maryland.gov/programs/water/TMDL/TMDLImplementation/Pages/cb_tmdl.aspx

Adjustments to Phase III WIP State-Basin Targets and the Phase II WIP Source Sector Goals

In July 2018, the Chesapeake Bay Program Partnership agreed on nitrogen and phosphorus planning targets for the jurisdictions. The targets were established at a major basin scale so that Maryland received targets for the Eastern Shore, the Patuxent River Basin, the Potomac River Basin, the Susquehanna River Basin and the Western Shore. As part of its WIP development process, working with local jurisdictions to assess the feasibility of achieving reductions in different regions, Maryland adjusted the targets geographically. The adjustments followed a set of exchange rules established by the partnership in order to ensure that each of the jurisdictions' WIPs achieves a minimum water quality benefit. Maryland's Phase III WIP Targets are shown in Table 8. Appendix F provides a detailed description of the process used in establishing the final targets.

Table 8: *Maryland's Phase III WIP Pollution Targets by Major Basin in Million Pounds per Year.*

Major Basin	Phase III WIP Target* *(Million lbs/yr)*	
	Nitrogen	Phosphorus
Eastern Shore of Chesapeake Bay	15.6	1.29
Patuxent River Basin	3.1	0.30
Potomac River Basin	15.8	1.09
Susquehanna River Basin	1.6	0.05
Western Shore of Chesapeake Bay	9.6	0.95
Total	**45.8**	**3.68**

***** Phase III WIP reductions subject to change upon EPA review.

Development and Implementation of Local Planning Goals

Throughout the development of each phase of the state's WIP, there has been significant interest in providing local planning goals for each jurisdiction by sector. There are many ways to do this, and the section below describes previous and current approaches to developing these goals.

In the Phase II WIP, Maryland used an equity based approach to setting local targets whereby each jurisdiction and pollution source sector was given a goal expected to achieve a similar percentage of pollution reductions. Through this approach, it was assumed that similar pollution reductions in each sector would require a similar level of effort. As Maryland implemented the Phase II equity approach, it became clear that different sectors have greater challenges implementing pollution reductions. Upgrades to stormwater and septic systems often require greater resources and include more roadblocks to implementation than other sectors, including private landowner permission, long planning horizons, preparation and approval of engineering plans and permits. Once in the ground, these practices achieve modest reductions relative to large capital projects like wastewater upgrades and will need to build up over time and long sustained efforts to make significant reductions.

Understanding these challenges, the state took a different approach in Phase III to setting local goals. The state met with local implementers like county governments and SCDs to understand their planned implementation efforts between now and 2025, as well as identify challenges and strategies that could increase the amount of work done in this timeframe. These local BMP planning scenarios were then given to the state to run through the Chesapeake Assessment Scenario Tool (CAST) model to determine the loads generated by the scenarios and set goals for each jurisdiction and sector for 2025.

This information was then brought together in county summary sheets (See Appendix C) that describe anticipated implementation across sectors planned to be met between now and 2025, and provide estimates of numeric nitrogen goals by sector for each county. The county summaries are components of the statewide strategy. It was also recognized that there would be an additional level of effort required beyond 2025 in order to achieve some sector goals and maintain others.

Maryland will use these goals as the basis for tracking local implementation progress through two-year milestones and the annual progress evaluations process. The primary mechanism for tracking Maryland's overall progress will be the sector and basin targets. It is important to realize that although the primary goal of the WIP is to meet nitrogen, phosphorus and sediment goals, there are other benefits to implementation in these sectors. These conversations also focused on the important co-benefits that nitrogen, phosphorus and sediment reduction practices can provide to Maryland's citizens. Such benefits include flood control, new public recreational spaces, sustainable infrastructure, climate mitigation, and aquatic resource improvements to local streams and waterways.

Accounting for Growth

Background

The EPA's expectations for the Phase III WIP states that to be consistent with the 2010 TMDL, jurisdictions should describe how they are going to offset any increases in nutrient and sediment loads resulting from growth through 2025. EPA also expects jurisdictions to consider using NPDES regulations to offset or adjust source sector goals for new or increased loads, and to describe the programs and regulations that jurisdictions intend to implement to maintain existing beneficial land covers. EPA also gives jurisdictions the opportunity to factor updated future growth projections into their milestone commitments.

After completing the final Phase II WIP, an Accounting for Growth (AfG) Workgroup was established in 2013 to find common ground, clarify areas of disagreement and make recommendations for an AfG policy in advance of formally proposing regulations. The 2013 AfG workgroup achieved consensus on all but two key policy issues: (1) calculating allocation of loads for new development and determining associated offset requirements and (2) establishing the geographical boundaries for pollution trading. Nutrient trading regulations have been developed to address trading geographies while specific nitrogen offset requirements from growth have not been determined. The ultimate goal is to create a fair AfG program that is not unwieldy, expensive to administer, or difficult to explain.

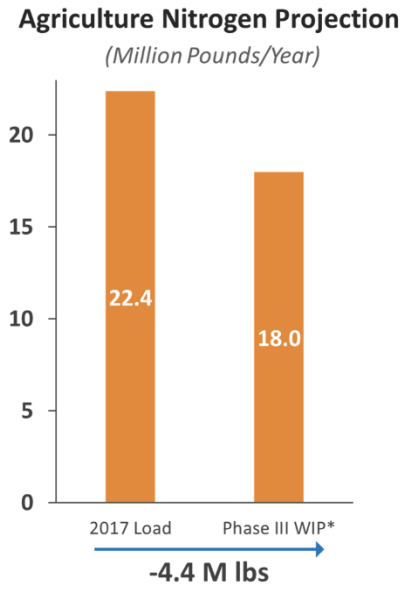
Since Maryland does not have regulations in place to offset increased loads from new sector growth, the state is currently offsetting loads through accelerated pollution reductions in the wastewater and agricultural sectors. Maryland also has many land conservation, preservation and growth management programs that limit the impacts of growth to the natural environment. To sustain Chesapeake Bay restoration over the long term and accommodate projected growth, Maryland will need to implement an adaptive growth policy through the accountability and adaptive management framework that regularly revisits sector-loading trends and provides sufficient offsets to stay under the state's pollution reduction targets.

Trends

Maryland is expected to grow by approximately 15,000 households per year through 2045, resulting in additional nutrient pollution (Maryland Department of Planning, Projections and state Data Center, August 2017). The following sections discuss the pollution reduction and growth trends in each sector, as well as the programs in place to curtail growth in loads. Overall, Maryland currently projects that expected load reductions under the Phase III WIP will outweigh the growth in loads from development and agriculture past 2025 until 2047.

Agriculture

According to SDAT, which tracks acres subject to the agricultural transfer tax, about 5,103 acres of farmland were lost in 2018. The annual loss of farmland has been historically low in Maryland since the Great Recession in 2008. During the housing boom of the early 2000s, annual loss was much higher. For example, in 2004, according to SDAT, 22,451 acres of farmland were lost. The Bay Program has projected continued loss of farmland through 2025.



**Phase III WIP reductions subject to change upon EPA review*

Figure 6: *Current and projected nitrogen loads to Chesapeake Bay from agriculture.*

Forest Loss

Current projections (CAST "current zoning" scenario for Maryland) estimate 3,000-acres of forest loss annually. Since forest is the lowest nutrient loading land use to the Chesapeake Bay and provides many co-benefits like carbon sequestration, shading/cooling of streams, and wildlife habitat; slowing and ideally reversing forest loss is critical to sustaining the health and restoration of Chesapeake Bay and Maryland's local waters over the long term.

To minimize the loss of Maryland's forest resources during land development, the 1991 Forest Conservation Act (FCA) was enacted. Any activity requiring an application for a subdivision, grading permit or sediment control permit on areas 40,000 square feet (approximately 1 acre) or greater is subject to the Forest Conservation Act and will require a Forest Conservation Plan. During the first fifteen years of implementation FCA has been responsible for the review of 199,925 acres of forest on projects scheduled for development. Of those, 120,638 acres were retained, 71,885 acres were cleared, and 21,461 acres were planted with new forest. In other words, at least twice as many acres were protected or planted as were cleared.

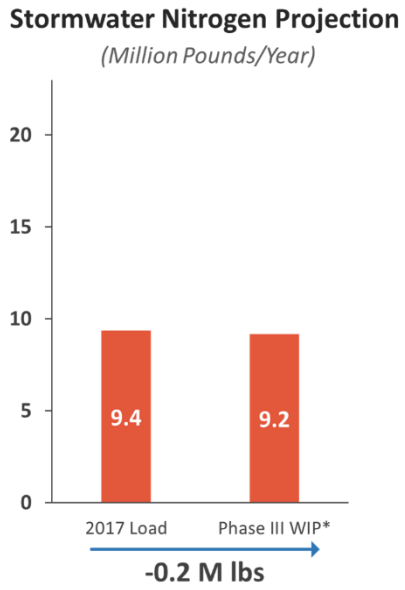
The 2014 Chesapeake Bay Watershed Agreement has Vital Habitats goals that commit to both reforestation targets and a 2025 conservation goal focusing on forested lands to "protect an additional two million acres of lands throughout the watershed—currently identified as high conservation priorities at the federal, state, or local level—including 225,000 acres of wetlands and 695,000 acres of forest land of highest value for maintaining water quality." Additional information about Maryland's land conservation programs is provided in the Conservation Plus section, Appendix D. The natural lands section of the WIP (Appendix B) also identifies tree planting and riparian buffers goals to help meet Bay agreement goals.

Stormwater

Current projections (CAST "current zoning" scenario for Maryland) to 2025 estimate 900-acres of new impervious surfaces created annually as a result of new development. This results in an approximately 2 percent reduction in stormwater loads of nitrogen by 2025 (Figure 7). After agriculture and wastewater,

stormwater is the third highest nutrient loading sector to the Bay at approximately 17 percent of the total nitrogen load. By 2025, nitrogen pollution from stormwater is estimated to comprise 20 percent of the total nitrogen loads to Chesapeake Bay.

To help address stormwater impacts from new development, the "Stormwater Management Act of 2007" (Act) became effective on October 1, 2007. Prior to this Act, environmental site design (ESD) was encouraged through a series of credits found in Maryland's Stormwater Design Manual. The Act requires that ESD, through the use of nonstructural best management practices and other better site design techniques, be implemented to the maximum extent practicable. ESD practices are designed to promote infiltration of stormwater into natural vegetation and soils, which helps reduce nitrogen discharges associated with new development.

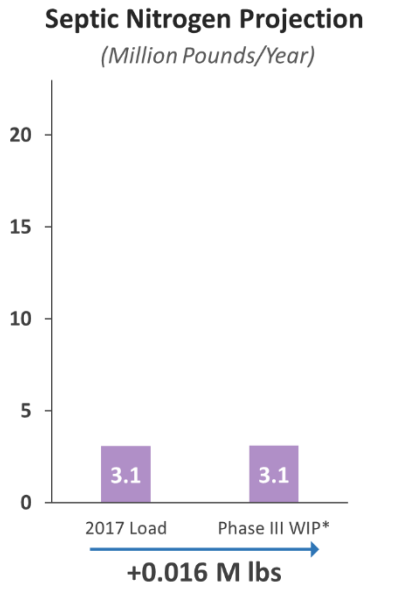


*Phase III WIP reductions subject to change upon EPA review

Figure 7: *Current and projected nitrogen loads to Chesapeake Bay from stormwater.*

On-Site Disposal Systems

Current projections (CAST "current zoning" scenario for Maryland) estimate approximately 1,700 new on-site disposal systems (septic systems) annually. On average, approximately 1,200 septic systems annually are upgraded from conventional to best available technology (Maryland BAT database). This results in an increase of 16,000 lbs. of septic loads of nitrogen by 2025 (Figure 8). Although the septic sector is Maryland's smallest nutrient loading sector to the Bay at approximately 6 percent of the state's total nitrogen load, the septic sector is also the only sector with increasing pollution loads over time in Maryland's Phase III WIP; however, this increase is minimal. By 2025, Maryland's septic loads are expected to comprise approximately 7 percent of the overall nitrogen load to the Chesapeake Bay.



*Phase III WIP reductions subject to change upon EPA review

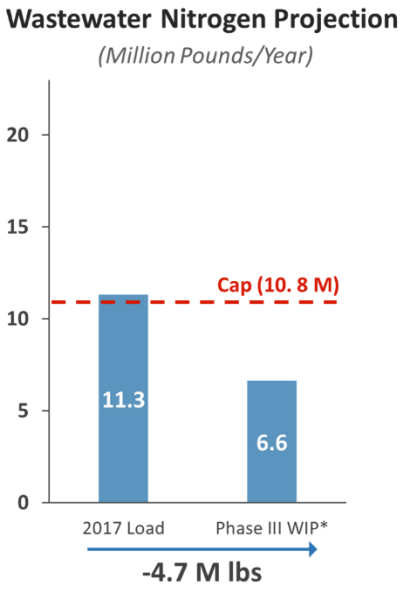
Figure 8: *Current and projected nitrogen loads to Chesapeake Bay from septic.*

Centralized Wastewater

Maryland's 67 major wastewater treatment plants have NPDES total nitrogen, total phosphorus, and suspended solids permit limits to control the effluent concentration and volume of daily flow discharged from those facilities. The approved design capacities in Table 9 below are used as the basis for the loading limits. Since these major plants are not at full design flows and will all be upgraded to "best available technology," they are

projected to be below their pollution cap in 2025 by approximately 4.1 million pounds (Figure 9). This projection also accounts for the assumption that wastewater flows will continue to grow by approximately 0.6 percent each year[13].

In short, over performance in the wastewater sector more than offsets anticipated growth in the urban sector. As Figure 9 shows, wastewater loads will be approximately 4.1 million pounds below its loading cap through a combination of better treatment performance (3.25 mg/L total nitrogen) than required under permit and operating below full design flows.



*Phase III WIP reductions subject to change upon EPA review

Figure 9: *Current and projected nitrogen loads to Chesapeake Bay from wastewater.*

Table 9: *Design capacity and average daily flows for Maryland's major wastewater treatment plants.*

WWTP	Approved Design Capacity (MGD)	Average Flow (MGD)*
Aberdeen	4.000	1.774
Annapolis	13.000	7.160
APG - Aberdeen	2.800	1.670
Back River	180.000	167.824
Ballenger/Mckinney	6.000	5.167
Blue Plains (MD Share)	169.600	169.600
Bowie	3.300	1.978

[13] This estimate is based off of MDP's population projections published in August 2017. The percent increase is calculated assuming a constant percent growth over ten years, from 2015 to 2025, from 5.99M to 6.34M people. While the growth is presented as a statewide number, plant flow increases were based on county-specific projections from the same MDP analysis.

WWTP	Approved Design Capacity (MGD)	Average Flow (MGD)*
Broadneck	6.000	5.141
Broadwater	2.000	1.147
Brunswick	1.400	0.639
Cambridge	8.100	3.951
Celanese	2.000	1.239
Centreville	0.500	0.322
Chesapeake Beach	1.500	0.751
Chestertown	1.500	0.687
Conococheague	4.100	2.422
Cox Creek	15.000	11.986
Crisfield	1.000	0.711
Cumberland	15.000	14.317
Damascus	1.500	0.839
Delmar	0.850	0.506
Denton	0.800	0.422
Dorsey Run	2.000	1.500
Easton	4.000	1.946
Elkton	3.050	1.768
Emmitsburg	0.750	0.492
Federalsburg	0.750	0.381
Frederick	8.000	7.178
Freedom District	3.500	2.378
Fruitland	0.800	0.517
Georges Creek	0.600	0.712
Hagerstown	8.000	8.722
Hampstead	0.900	0.671
Havre de Grace	2.275	1.606
Hurlock	1.650	0.981

WWTP	Approved Design Capacity (MGD)	Average Flow (MGD)*
Indian Head	0.500	0.387
Joppatowne	0.950	0.789
Kent Island	3.000	1.436
La Plata	1.500	1.040
Leonardtown	0.680	0.392
Little Patuxent	25.000	19.131
Marley-Taylor	6.000	3.774
Maryland City	2.500	0.992
Mattawoman	20.000	8.527
Mayo Large Communal	0.820	0.534
MCI	1.600	0.950
Mount Airy	1.200	0.773
Northeast River	2.000	0.773
Parkway	7.500	6.062
Patapsco	73.000	56.089
Patuxent	7.500	5.110
Perryville	1.650	1.103
Piscataway	30.000	21.848
Pocomoke City	1.470	0.623
Poolesville	0.750	0.713
Princess Anne's	1.260	0.510
Salisbury	8.500	5.039
Seneca	20.000	8.628
Snow Hill	0.500	0.425
Sod Run	20.000	12.453
Swan Point	0.600	0.057
Talbot Region II	0.660	0.411
Taneytown	1.100	0.803

WWTP	Approved Design Capacity (MGD)	Average Flow (MGD)*
Thurmont	1.000	1.015
Western Branch	30.000	19.742
Westminster	5.000	4.049
Winebrenner	1.000	0.193
Total Volume	**753.465**	**613.476**

*Based on 2002-2004 data

Strategies

Accounting for Growth Strategy in the Phase III Watershed Implementation Plan

Maryland has a four-pronged strategy to account for growth in the Phase III WIP. These strategies consider growth impacts not only out to the 2025 restoration deadline, but also those strategies that will address growth in loads beyond 2025. The following sections describe each of these four strategies.

1. *Projected 2025 Conditions Have Been Built into the 2025 Pollution Reduction Targets*

In developing the Phase III WIP to meet 2025 pollution reduction targets, the CBP's Principals Staff Committee (PSC) agreed in December 2017 to use 2025 projected conditions to account for growth impacts on land use and populations. What this means is that Maryland's Phase III WIP strategies have already accounted for projected 2025 growth in calculating each sector's load reduction. The CBP modeling team will confirm each jurisdiction's Phase III WIP pollution reduction practices on their 2025 forecasted conditions to ensure practices achieve restoration targets while accounting for growth.

2. *Maryland's Current Land Use Policy BMPs Conservation and Protection Plans Have Been Incorporated in the 2025 Land Use*

The CBP gave the states the opportunity to modify the future land use scenarios for projecting 2025 growth conditions to reflect existing and/or proposed conservation and protection efforts, such as agricultural and forest conservation, and growth management (e.g., local zoning). Since Maryland and local governments have many existing land use preservation and protection programs in place, these programs were included in a Conservation Plus scenario that was incorporated into the Bay model. This process allowed Maryland to take credit for the nutrient load reductions resulting from these programs. This credit helps to account for a certain portion of future projected growth in loads. More details on Maryland's Conservation Plus efforts can be found in Appendix D.

At this time, Maryland has worked to get load reduction credit for existing state and local Land Use Policy BMPs. Also, the possibility exists of getting additional credit for new Land Use Policy BMPs proposed to be implemented through 2025; however, Maryland has not yet determined the load reduction effect of new Land Use Policy BMPs, such as expanded and targeted land preservation programs.

3. *Maryland's Resource Protection Programs and Associated Strategies for Increasing Those Protections are Being Incorporated into the Phase III WIP*

In Appendix D, Maryland describes current natural and aquatic resource protection and conservation programs, as well as the strategies for programmatic improvement. While this represents more of a qualitative approach to dealing with growth and land change (because it is not quantified in the model), Maryland recognizes that protecting and conserving ecologically high functioning systems and the lands they depend is very cost effective relative to restoration.

4. *Adaptive Management to Address Growth in Loads Post-2025*

Overall, Maryland currently projects that expected load reductions under the Phase III WIP will outweigh the growth in loads from development and agriculture past 2025 until 2047. Through two-year milestones and associated progress evaluations, Maryland use an adaptive management process to ensure any growth in loads does not exceed restoration targets.

Key Challenges and Opportunities

Once achieved, Maryland will need to maintain the Bay TMDL post-2025. When the anticipated load increases from both climate change and Conowingo Dam are considered in addition to growth, it becomes increasingly necessary to ensure that Maryland has a proactive and adaptive policy to address growth in loads. Maintaining the Bay TMDL after 2025 means that Maryland will need to continue to achieve sufficient load reductions to offset any increases in loads due to growth. Post-2025 load reductions can contain a variety of measures, including continued MS4 permit implementation, innovative WWTP technology improvements, land use policy BMPs (defined below, i.e., Conservation Plus) and accounting for growth policies. The types of post-2025 load reductions needed will depend on specific growth patterns and trends, and implementation of the adaptive management framework can help ensure that appropriate offsets are established.

Maryland's Holistic Approach to Addressing Conowingo Dam's Pollution Impacts

Scientific analysis shows an additional reduction of six million pounds of nitrogen and 260,000 pounds of phosphorus is needed to mitigate the water quality impacts of the Conowingo Dam's lost trapping capacity. Science has demonstrated that this lost trapping capacity threatens the ability of both the state and the region to meet Chesapeake Bay clean up goals.

Maryland has made significant progress toward solving environmental problems stemming from the Conowingo Dam on the Susquehanna River. This progress includes recognition by the EPA of the CWIP multi-state strategy, including hiring a third-party fundraiser and project coordinator, and Maryland's selection of a winning bidder to carry out a pilot project for dredging, beneficial reuse and characterization of sediments behind the dam. These steps, along with a comprehensive set of environmental protection requirements issued by the Hogan administration to Exelon Corporation as conditions for dam relicensing encompass Maryland's multi-pronged, multi-state, and public/private strategy to address water pollution impacts associated with the Conowingo Dam.

Last year, the CBP partnership unanimously agreed on the need to develop an additional plan, known as the Conowingo Watershed Implementation Plan (CWIP), to specifically reduce pollution associated with the loss of the Conowingo Dam's capacity to trap sediment in the reservoir behind the dam. A key step was taken when the EPA issued a Request for Applications (RFA) for work on the CWIP. The EPA plans to award one to three cooperative agreements for work that will support the efforts of the watershed jurisdictions, along with other partners, to help restore the Bay. The work proposed by the RFA includes facilitating the development and implementation of a Conowingo WIP, the development of a comprehensive financing strategy and implementation plan, and the development of a system for tracking, verifying and reporting results. The CWIP timeline is still under development by the CBP partnership and will be released for public comment sometime after the jurisdictions' WIPs.

More recently, the Maryland Environmental Service (MES), in coordination with MDE and the Governor's Bay Cabinet, has selected the joint venture Northgate Dutra to carry out a pilot project to test the quality of sediment throughout the Conowingo reservoir, as well as dredge and beneficially repurpose a small portion of it to create a market for the cost effective recovery of potentially useful material that now threatens water quality in the river and Bay. The proposed pilot project schedule provides for the work to be substantially complete in 2019.

At the same time Exelon is seeking a 50-year federal license renewal for the dam's operation. Under federal law, and as part of the Federal Energy Regulatory Commission's relicensing process, Exelon is required to obtain a Clean Water Act, Section 401 Water Quality Certification from the state for the continued operation of the dam. The certificate enforces the requirement that the facility's operation comply with state water quality standards.

In 2018, the Hogan administration issued a comprehensive environmental plan for the Conowingo Dam, Susquehanna River and the Chesapeake Bay to drive major restoration and pollution prevention efforts upstream and downstream of the dam. The plan, contained in a Water Quality Certification issued by MDE, includes special conditions for the proposed dam relicensing and requires the applicant, Exelon Generation Company LLC, to reduce water pollution that flows from the dam to the river and, eventually, the Bay. The certification requires Exelon to improve conditions for aquatic life, including changes in its control of water flow from the dam and installation of equipment to improve migration of fish to upstream spawning areas. It also requires Exelon to improve its management of debris that collects at the dam, including conducting a feasibility study on a solar-powered trash collection wheel.

This multi-pronged, multi-state, public/private strategy to address impacts to Chesapeake Bay from Conowingo Dam ensures all appropriate partners are working together to solve this challenging pollution problem. More information regarding progress on these fronts will be provided to the public, as available.

Climate Change

Background: PSC Three-Part Strategy

The Chesapeake Bay region is projected to experience changes in temperature, sea level and precipitation as a result of climate change (Najjar, et al. 2010; Johnson et al., 2016). These changes are expected to affect nutrient and sediment loads to the Chesapeake Bay and, in turn, affect the Bay's health (Sinha et al., 2017, Wang et al., 2017; Irby, et al. 2018; Herman, et al. 2018; Linker, et al., 2018). Preliminary estimates of the additional Bay wide load reductions needed in response to climate change, on top of current reduction goals, are about 9 million pounds of nitrogen and 0.5 million pounds of phosphorus. Approximately 2.2 million pounds of the watershed-wide nitrogen loads are estimated for Maryland. The CBP Partnership is still refining these preliminary estimates, as described below.

In March 2018, members of the PSC, who represent the Bay-state governors, agreed to a three-part adaptive management process. This process recognizes that further information is needed to refine estimates of future changes in nutrient and sediment loads and their impact on Bay water quality. Similarly, additional information is needed to quantify changes in the effectiveness of many pollution control BMPs resulting from climate change.

Briefly, the PSC's three-part strategy going forward includes:

1. **Incorporate Climate Change into Phase III WIPs:** Include a narrative strategy in the Phase III WIPs that describes state and local jurisdictions' current action plans and strategies to address climate change.
2. **Understand Climate Change Science:** The CBP Partnership will sharpen the understanding of the impacts of climate change on the Bay and identify research needs, improve the understanding of BMPs, and refine nutrient and sediment load estimates for each jurisdiction in March 2021.
3. **Incorporate Climate Change into Milestones:** Bay states will account for additional nutrient and sediment loads, as well as improved understanding of BMPs, beginning in September 2021. These will be reflected in a Phase III WIP addendum and/or 2022-2023 two-year milestones.

Although climate adaptation is the primary climate-change-related directive for the Bay WIP, mitigation of greenhouse gases is also of pressing importance. Consequently, in developing Maryland's Phase III WIP, MDE staff sought to identify nutrient and sediment control strategies that can both help mitigate the increase in greenhouse gases and help adapt to anticipated climate impacts where possible.

Trends

Climate Science: Historic Trends & Projections

Greenhouse gasses, like carbon dioxide (CO2) and methane (CH4), trap the sun's heat in Earth's atmosphere (Wogan, 2013). This increased thermal energy is leading to gradual long term changes, or trends in the climate, such as increased air temperatures and dryer or wetter seasons, depending on the particular region. This greenhouse effect also is expected to cause more variable and extreme day-to-day weather like more intense storms, as witnessed in the one-in-a-thousand-year amounts of rainfall that occurred twice in old town Ellicott City, Maryland in 2016 and 2018. Maryland can also expect to experience periodic, intense dry spells and heat waves.

On the land, increased precipitation volume and intensity are expected to result in more nutrient and sediment runoff. For example, as of 2017, average annual precipitation in parts of Maryland have already increased as much as 10 percent compared to the first half of the 1900s (Easterling et al.). Maryland's average annual precipitation is projected to increase an additional 10 percent from current amounts by 2100 (Easterling et al.). In addition the effectiveness of BMPs to control pollution in runoff is expected to change due, in part, to more intense rainstorms. Watershed computer models are used by the CBP Partnership to estimate future changes like these on the landscape.

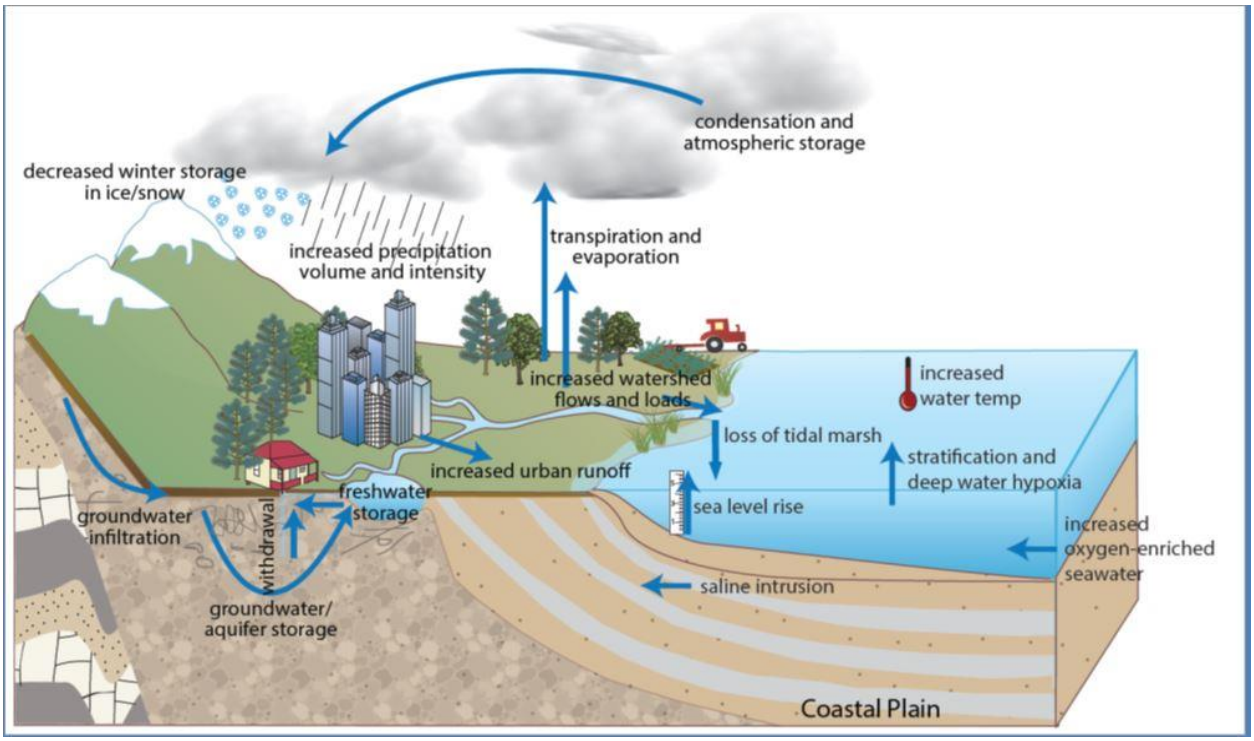


Figure 10: *Key changes on the land and in the water that are expected to impact the Chesapeake Bay. (Source: CBP modified, Univ. MD IAN 2011).*

In Chesapeake Bay, more pollution runoff from the land, increased water temperatures, changes in salinity and sea level rise,[14] and changes in pH, among other things, are expected to interact in complex ways to change water quality (Figure 10, above). These changes will impact algal growth, water clarity and dissolved oxygen levels, all of which affect fish, crabs, oysters, and other living resources. Hydrodynamic and water quality modeling tools are used to estimate some of these changes in the Bay.

The costs to the economy and to human life and livelihood from climate-induced extreme weather are severe and increasing. Figure 11, below, sometimes called a Haywood Plot, and depicts by month and year, the accumulated number of weather-related disaster events costing more than $1 billion. Six of the last 10 years exceeded the average number of storms costing more than $1 billion. Years 2011 and 2017 tied for the national record of 16 $1 billion storms, with 2017 setting record overall storm costs of $306.2 billion, shattering the previous record of $214.8 billion (CPI-adjusted) in 2005 from the impacts of Hurricanes Dennis, Katrina, Rita and Wilma[15].

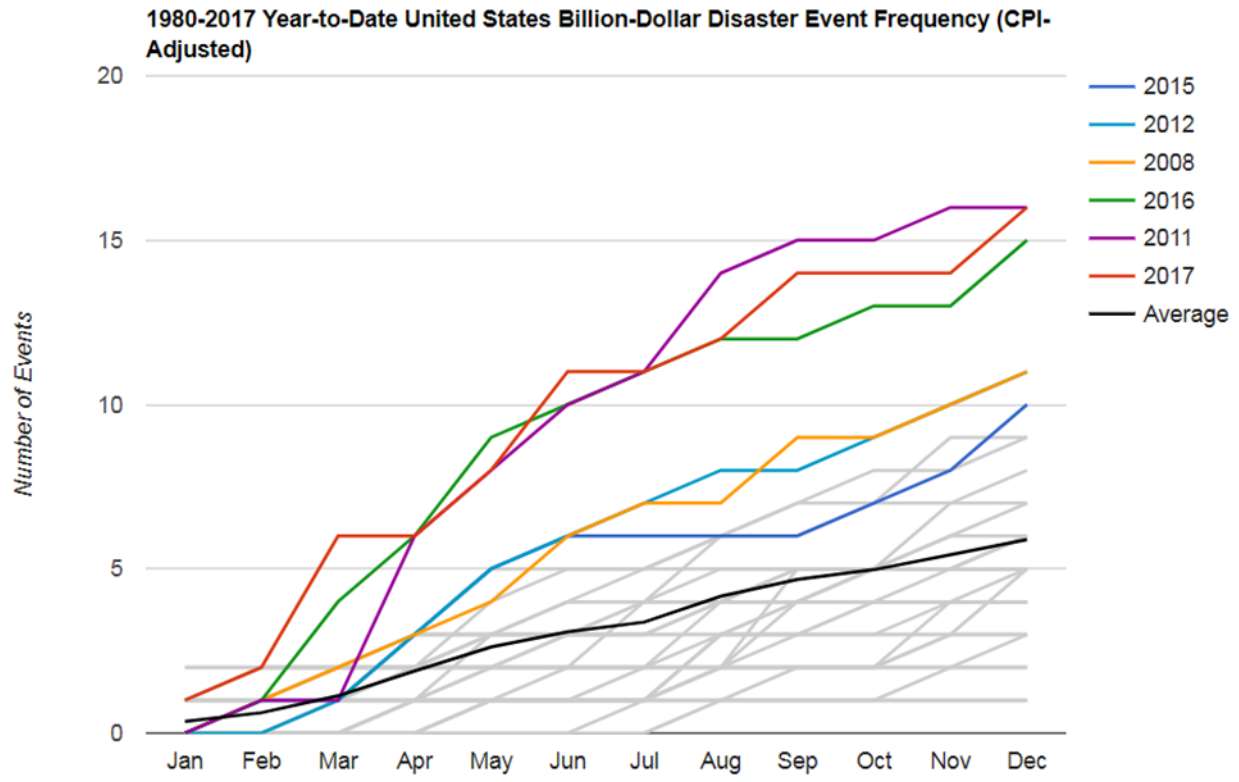


Figure 11: *Cumulative Number of Disaster Events, in a given year, that Exceed a Billion Dollars in Damage. Source: Figure 14 and paragraph above from Smith, A B, NOAA Climate.gov.*

[14] For planning purposes, the likely range (66% probability) of the relative rise of mean sea level expected in Maryland between 2000 and 2050 is 0.8 to 1.6 feet, with about a one-in-twenty chance it could exceed 2 feet and about a one-in one hundred chance it could exceed 2.3 feet. Later this century, rates of sea level rise increasingly depend on the future pathway of global emissions of greenhouse gases during the next sixty years. (mde.maryland.gov/programs/Air/ClimateChange/MCCC/Documents/sea levelRiseProjectionsMaryland2018.pdf)

[15] **Smith, A B, NOAA Climate.gov**

These enormous costs are raising questions nationally and in Maryland about whether to build or rebuild in areas with repeat catastrophic weather events. As investments are made in BMPs to restore the Chesapeake Bay, the state must also be asking not only how individual practices function to reduce any increased nutrient loading resulting from climate change, but also where to locate them on the landscape so they persist over time.

In October 2018 the United Nation's International Panel on Climate Change (IPCC) issued a special report on a 1.5° degree centigrade (1.5°C) temperature increase from pre-industrial levels. It highlighted the devastating impacts that could be avoided by limiting the temperature rise to 1.5°C rather than 2.0°C. Limiting the rise to 1.5°C would require a 45 percent reduction of anthropogenic greenhouse gas (GHG) emissions from the 2010 baseline by 2030 and achievement of zero net emissions[16] by 2050 (UN IPCC 2018).

The urgency of this scientific finding has driven Maryland to elevate the importance of GHG mitigation in the Bay restoration strategy. Fortunately, broadening the lens to consider the intersection of climate mitigation, climate adaptation and nutrient reduction offers new management efficiencies and financing opportunities elaborated below.

Strategies

This section identifies strategies that address both climate change management and Bay restoration. It also highlights Maryland's existing foundation of climate change plans, action strategies, legal authorities and governance structures. This extensive foundation will help assure integration of climate change management with Chesapeake Bay WIP implementation. The section closes with implementation guidance.

1. WIP Strategies that Address Climate Change

Maryland's Phase III WIP includes numerous actions that have the primary goal of reducing nutrients and sediments while also either mitigating or adapting to a changing climate. These state actions will also provide Maryland with the information to develop BMP implementation scenarios to more effectively address nutrient and sediment loads resulting from climate change. This section is organized to first identify general strategies that are widely applicable, then to highlight strategies that are specific to particular pollution source sectors.

General Climate Strategies

Several strategies apply widely, such as developing new science and several aspects of funding the Phase III WIP. These general strategies are highlighted below.

[16] According to the IPCC definition, net zero emissions are achieved when anthropogenic emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals over a specified period.

Strategy 1: Climate Science & Research

Maryland is committed to adopting improved climate science by including refined nutrient reduction goals in 2021, and BMP efficiencies into a future WIP addendum and/or two-year milestone commitments in 2022. In order to meet future load requirements, research may be needed to understand how future conditions may affect the state's ability to meet its targets. Below is a list of research topics that the state will pursue:

- **BMP site selection and design:** Maryland is committed to designing and siting BMPs that are expected to persist and perform in a changing climate. This commitment is reflected in early efforts, including 2013 guidance, *Best Management Practices: Preserving Clean Water in a Changing Climate*. Part of Maryland's strategy is to engage with the CBP partnership in ongoing BMP design and siting research[17] .

- **Trends Analyses:** Review current climate data and trends that may affect load targets; including sea level, precipitation patterns, temperature and ecosystem response.

- **Saltwater Intrusion:** Maryland will investigate the impact of saltwater intrusion on soil composition and the potential for nutrient leaching from soils. Maryland will investigate adaptation options, like salt-tolerant plants that soak or take up nutrients.

- **Beyond 2025:** Maryland acknowledges that climate conditions will continue to change after 2025, and anticipates that 2050 climate projections will be used to inform future Bay restoration strategy considerations.

Strategy 2: Local Engagement and Education

Maryland is committed to advancing the capacity of state and local government agencies, infrastructure organizations and businesses to develop and implement sound climate change initiatives, thus ensuring current and future public health, security and economic prosperity. To achieve this vision, the state, in partnership with the Association of Climate Change Officers, has established the Maryland Climate Leadership Academy.

The Maryland Commission on Climate Change (MCCC) workgroup on Education, Communication and Outreach (ECO) is another institutionalized avenue for local engagement. The MCCC Adaptation and Response Workgroup coordinates closely with Maryland's Bay restoration process and includes local engagement in its annual work plan.

[17] In 2017 a Chesapeake Bay Program Science and Technology Advisory Committee (STAC) Workshop Report, *Monitoring and Assessing Impacts of Changes in Weather Patterns and Extreme Events on BMP Siting and Design*, was released. Although it was inconclusive about the quantitative impacts of climate change on BMPs, it laid the foundation for continued evaluation of this subject.

Strategy 3: Incentives and Funding

Costs are anticipated to rise for at least four reasons. First, more frequent and severe extreme weather events will damage BMPs and necessitate more inspections and maintenance or replacement. Second, more BMPs will need to be installed to make up for an anticipated loss of BMP pollution reduction efficiency. Third, more BMPs will likely be needed to address increased future loads. Fourth, restoration actions will entail more complex multidisciplinary considerations, as exemplified in the *Climate Smart Framework and Decision Support Tool*, developed by the Chesapeake Bay Program. (Johnson, Z. 2018)

The following are strategies that Maryland is committed to implementing:

- **Existing Restoration Funding Sources:** Maryland is refining restoration and resource conservation grant prioritization criteria to favor projects that include climate co-benefits. This includes review criteria for state land conservation and preservation purchases.

- **Volkswagen Settlement Funding:** Maryland received $75.7 million in settlement funds from Volkswagen's illegal pollution emissions. Much of this money will be used to electrify transportation in Maryland, which will reduce CO_2 emissions while reducing nitrogen deposition to the Chesapeake Bay.

- **Coast Smart Construction Criteria:** The Coast Smart Construction Infrastructure and Design Guidelines were developed in 2014 to increase the resilience of state capital investments to sea level rise and coastal flooding. In 2018, legislation expanded the application of criteria to other projects and may create additional opportunity to implement resilient design. Coast Smart practices include identifying, protecting, and maintaining ecological features that may serve to buffer a project from the impacts of future sea level rise, coastal flooding, or storm surge. Protecting and maintaining these ecological features is a co-benefit to Bay restoration.

- **Innovative Technology Fund:** Maryland is committed to expanding the scope of eligible techniques and technologies to include consideration of climate aspects of projects that are proposed to the Innovative Technology Fund. Investment in the research, development and commercialization of various solutions that address climate mitigation will be investigated to help accelerate the adoption of climate resiliency and GHG mitigation solutions.

- **Climate Mitigation and Adaptation Synergies:** Many Bay restoration actions result in large amounts of GHG sequestration. These include protection and restoration of tidal wetlands and seagrass ecosystems (coastal blue carbon), forest conservation, forest management practices, conversion of non-forest to forest, riparian forest buffers and a variety of healthy soils practices (collectively called terrestrial carbon removal). Maryland commits to aligning its GHG reduction strategy (i.e., the Greenhouse Gas Reduction Act (GGRA) plan) with its Bay restoration strategy to generate mutually beneficial results that are greater than the sum of their parts:

    - Better alignment of management resources used to implement and track mutually beneficial practices can result in cost efficiencies and better outcomes.

- Recognizing that the same action generates monetary value associated with both nutrient and carbon reductions should translate to greater public and private financing opportunities and incentive frameworks.

The following are preliminary ideas that Maryland will consider:

- **Water Quality and Climate Change Resiliency Portfolio:** The state is currently actively engaged in a variety of efforts to restore the Chesapeake Bay and improve Maryland's environmental and economic resilience to a changing climate. Many of the actions to achieve these two objectives are similar, yet are not coordinated to the degree they could or should be to maximize benefits to both. This effort will identify a long term portfolio of natural infrastructure projects that optimize water quality, living resources, GHG reduction and other environmental benefits while also reducing the risk posed by a changing climate to the commercial economies and recreational opportunities essential to Maryland's working coast. Having a pipeline of identified projects will better prepare Maryland and its communities to take advantage of existing and emerging funding opportunities that promote the use of natural infrastructure to build resilience to climate impacts. Some potential new funding opportunities are described below.

- **Climate Funding Sources:** There are climate and hazard mitigation oriented grants that have not traditionally been targeted for Bay restoration outcomes or for complementary water quality and climate benefits. These fund sources could be explored for their potential to achieve restoration co-benefits, similar to the Community Resilience Grant Program that funds climate resiliency projects with water quality benefits and the new Federal Emergency Management Administration job aid that will allow hazard mitigation grant funding to be used for restoration projects that build resilience.

- **Expansion of Maryland's Building Resiliency through Restoration Initiative:** Maryland could explore opportunities for expanding incentives for projects that will build resilience and reduce the vulnerability of communities and infrastructure from the impacts of extreme weather events, climate hazards and flooding.

- **Strategic Energy Investment Fund (SEIF)**: Sales of CO2 credits generate funds that are used for investments in energy efficiency and clean and renewable energy. These investments reduce air emissions and associated land deposition, contributing to the state's climate and water quality goals. Administered by the Maryland Energy Administration, the potential exists for SEIF energy investments to potentially provide further co-benefits by leveraging energy efficiency grants with water quality financing (e.g., funding energy efficiency grants for wastewater treatment plants to increase their financial capacity to afford pollution controls).

- **Climate Cost Estimate and Funding Options:** Maryland could investigate options for achieving additional load reductions and identifying associated costs due to climate change. Then, as needed, options for generating additional revenue to cover any additional public sector costs could be explored. If any additional public sector costs are identified, options for funding would be outlined in September 2021 when Maryland submits its implementation strategy to reduce climate change loads in the Phase III WIP addendum and/or 2022-2023 two-year milestones.

- **Carbon Markets for Nutrient Reduction Practices:** The reduction of GHG emissions is being accomplished through Maryland's GGRA plan, which includes participation in the RGGI, a cap-and-invest framework for large fossil-fuel-fired electric power generators. Maryland could consider exploring the development of a carbon market that credits nutrient reduction practices with GHG co-benefits. This would augment programs that incentivize the implementation of BMPs associated with Bay restoration. Practices, such as cover crops, riparian buffers and conservation tillage not only provide water quality benefits, but also improve soil health and sequester carbon.

Strategy 4: Accountability

To ensure that Bay restoration planning and implementation integrates climate resilience co-benefits, Maryland is including the following accountability strategy elements:

- **Two-Year Milestones:** Maryland will document its commitment to adapting its Chesapeake Bay nutrient reduction strategies to climate change through specific actions in the state's two-year milestone framework.

- **Emerging (Long-Term) Strategies:** Maryland will identify incremental research and development steps in future two-year milestone commitments to ensure that emerging reduction strategy options remain on track.

- **Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change (Phase I & II):** This comprehensive strategy sets implementation targets for each adaptation action. The Adaptation and Response Workgroup of the MCCC oversees a review of progress on these implementation targets. WIP commitments will be aligned with this comprehensive strategy and its accountability tracking framework.

- **BMP Verification:** Maryland's BMP verification protocols provide the foundation for the likely increased frequency of inspection and maintenance that will be necessitated by the stresses of more extreme weather due to climate change (MDE 2016).

Climate Change Strategy Highlights by Source Sector

Agriculture Climate Strategies

- **Current WIP Strategies:**

    - Many traditional agricultural BMPs provide environmental benefits beyond water quality. Practices such as residue and tillage management, cover crops, crop rotations, composting, riparian buffers and biomass plantings, and rotational grazing, among others, support and enhance soil health. These practices have been shown to increase organic matter and sequester carbon in the soil, reduce soil erosion, promote nutrient cycling, improve water retention, and reduce competition from weeds and pests.

- **Contingency and Long-Term Strategies:**

  - Various innovative animal waste management technologies offer energy savings and GHG emissions reductions that are climate co-benefits.
  - Agricultural Wetland Incentives: Maryland could explore revising state investment prioritization criteria and policies to incentivize land conservation easements that promote conversion of flooded or salt-impacted agricultural lands to wetlands, where desired. The process could explore use of wetlands mitigation funds and public-private partnership opportunities with stakeholders that value diverse habitat for birds and other wildlife. Where appropriate, the introduction of salt-tolerant crops could be explored. Similar partnerships have helped accelerate trout habitat restoration and conservation in the state.
  - Cropland irrigation with wastewater effluent has the potential to reduce nutrients to the Bay while creating climate resiliency by assuring a reliable supply of water for crops. Although some degree of crop irrigation is currently occurring in Maryland, it is not currently being done as an explicit agricultural nutrient management practice.

- **Programmatic and Educational Outreach Strategies:**

  - In collaboration with conservation partners, MDA is currently developing a Healthy Soils Program focused on accelerating educational outreach and promotion of a wide variety of agricultural and climate management co-benefits.

Wastewater Treatment Plant Climate Strategies

- **Current WIP Strategies:**

  - Land application of wastewater treatment plant bio solids increase organic content of sandy soils, thereby increasing carbon and water retention.
  - Energy-saving pumps lower WIP wastewater treatment implementation costs in the long-run and reduce GHG emissions.

- **Contingency and Long-Term Strategies:**

  - Anaerobic digestion of food waste at WWTPs utilizes existing centralized facilities, provides an energy source, reduces a large waste stream to landfills, reduces GHG emissions, and offers a number of cost savings. For more information see https://archive.epa.gov/region9/waterinfrastructure/web/pdf/why-anaerobic-digestion.pdf.

Septic System Climate Strategies

- **Current WIP Strategies:**

  - Mounting solar panels on OSDS
  - Setbacks of OSDS to prevent flooding
  - Bermed infiltration pond removal in response to sea level rise

Urban and Suburban Stormwater Climate Strategies, Including Erosion and Sediment Control

- **Current WIP Strategies:** In addition to reducing nutrient and sediment pollution, the base mission of stormwater management provides climate resilience in the form of erosion control, groundwater recharge, flood control, and stream channel protection. Maryland is committed to adapting its stormwater program to climate change by maintaining and repairing critical stormwater management infrastructure and dams by establishing an emergency dam repair fund and a revolving loan dam fund.

- **Contingency and Long-Term Strategies:**

    - The state could explore establishing an emergency dam repair fund and revolving loan fund to be used for fortifying Maryland's stormwater management infrastructure for increased precipitation events. Fortifying these structures would also ensure continued nutrient processing and uptake that occurs in impoundments.
    - Stormwater BMP Siting and Design: Based on the outcome of research into how precipitation changes will affect stormwater design storms, Maryland is considering changes to its erosion and sediment control and stormwater programs.

- **Programmatic and Educational Outreach Strategies:**
    - Maryland will continue leveraging its funding to support projects that will inform how climate impacts will interact with stormwater management practices. The state could consider additional funding or other strategies that facilitate ongoing academic research into stormwater design guidelines for increased precipitation events.

Conservation and Natural and Working Lands Climate Strategies

- **Current WIP Strategies:** Conservation and management of natural and working lands reduce nutrient loading to the Bay and promotes climate resilience. Several intentional strategies include:

    - Forest harvesting on state lands utilize wider buffers; leaving half of the land out of active management zones; and variable-density harvesting, where some trees are left to provide habitat and seed source, and often is a combination of single trees (e.g., future snag or desired seed source) and some clumped leave-tree areas (e.g., a wetter area or clump of mast-bearing trees like oaks, hickory, or beech), as ways to sequester carbon.
    - Adaptive Silviculture for Climate Change collaborates with partners, including Baltimore City, to work on a regional effort to develop locally appropriate techniques. These current and future efforts create more diversity on the landscape providing enhanced resiliency.
    - The Sustainable Forestry Initiative, forestry boards and Forestry Stewardship Council are all evaluating sustainable forestry certification programs for opportunities to enhance climate resiliency. MDA, U.S. Forest Service, forestry stewardship councils and University of Maryland-Cooperative Extension are developing new conservation easement mechanisms to promote adaptation stewardship activities on private lands.
    - Program Open Space (POS) directs its funding towards GreenPrint Targeted Ecological Areas. Wetlands important for coastal resilience and climate change adaptation areas for future wetlands are noted as key ecological benefits.

- The Accounting for Maryland's Ecosystem Services framework provides economic values for seven non-market ecosystem services, including carbon sequestration, nitrogen removal, groundwater recharge, and stormwater mitigation/flood prevention, which have climate resilience value.
- Encouraging wider riparian buffers along stream corridors to allow for channel migration resulting from increased precipitation.

- **Contingency and Long-Term Strategies:**

  - Maryland could enhance shoreline suitability analyses and conduct property owner and marine contractor social marketing research to increase the rate of adoption of living shoreline erosion techniques. Living shorelines provide coastal communities resilience to sea level rise while reducing erosion and ecosystem benefits.
  - Maryland could evaluate the reuse of dredged material for living shorelines and other beneficial uses like marsh elevation enhancement (i.e., thin layer placement) that help communities respond to rising sea levels, sequester carbon and provide for possible commercial or recreational uses.

- **Programmatic and Educational Outreach Strategies:**

  - Modified programmatic operating procedures and outreach approaches based on findings of suitability analyses and social marketing research.
  - Development and implementation of climate and ecologically friendly maintenance plans for natural lands. Whether county/municipal/state parks, grass medians along state or county roads, or older stormwater management pond infrastructure, a certain level of vegetation maintenance is required to facilitate multiple uses, control invasives species, or preserve lines of sight for vehicular traffic and structural function. However, there are opportunities for certain portions of our natural lands to revert back toward forest lands or other lower nutrient loading land uses by no longer mowing them. This has multiple benefits of growing Bay friendly vegetation, sequestering more carbon in the vegetation matrix, while also reducing carbon emissions associated with mowing equipment. Cities, counties, state agencies and transportation agencies should develop and implement more robust natural land maintenance plans that are sensitive to lowering nutrient loads to the Bay, while also reducing climate emissions and saving maintenance dollars.

Protection Climate Strategies

- **Current WIP Strategies:** Protection and management of high quality and value non-tidal stream resources and those natural assets supporting such resources such as watershed forest cover, riparian buffers and wetland gains promote climate resilience while resulting in some of the lowest nutrient delivery to the Bay. BMP strategies include:

  - Moderate stream temperatures by protecting expanded forested riparian buffers in Tier II watersheds on state regulated streams.

- Prioritize forest conservation, mitigation and restoration requirements, as well as quantify non-regulatory wetland gains, to increase carbon sequestration capacity. This includes working to conserve priority Conservation Reserve Enhancement Program (CREP) buffers in perpetuity, and restricting the conversion of virgin forest while incentivizing the redevelopment of existing commercial or industrial properties for energy projects such as solar farms.
- Cross jurisdictional credit for joint projects have the capacity to increase the amount of headwaters restoration and reforestation projects, which in turn will increase carbon sequestration capacity as forests mature.

- **Contingency and Long-Term Strategies:**

  - Maryland could develop further justification for protection based on natural resource-based economics.
  - The state could recommend new or modifications of existing legislation, regulation, policy, ordinances, etc. based on the results of a gap/strength analysis.

- **Programmatic and Educational Outreach Strategies:**

  - Continue with existing regulatory requirements and non-regulatory initiatives.
  - Develop a methodology to identify existing and new opportunities to make outreach more efficient, and provide a consistent, consolidated message from state agencies.

Accounting for Growth Climate Strategies

- **Current WIP Strategies:** By establishing a framework to track the growth in loads and verify the functionality of BMPs, the current WIP strategy establishes a necessary foundation to account for and reduce the growth in loads associated with climate change.

2. Supporting state and Local Legislative, Governance and Strategic Climate Frameworks

For over a decade, Maryland has developed an extensive set of plans, action strategies, legal authorities and governance frameworks to mitigate and adapt to climate change. This foundational framework will enable more rapid progress on WIP implementation than would otherwise be possible. Elements of this framework are highlighted below.

A. Legislative and Executive Actions

Maryland has historically been at the forefront of states taking action to address both the drivers and consequences of climate change, demonstrated by the state's policy record. The state has consistently advanced efforts to combat climate change with legislation and policy initiatives over the past decades. These include, but are not limited to the following brief history:

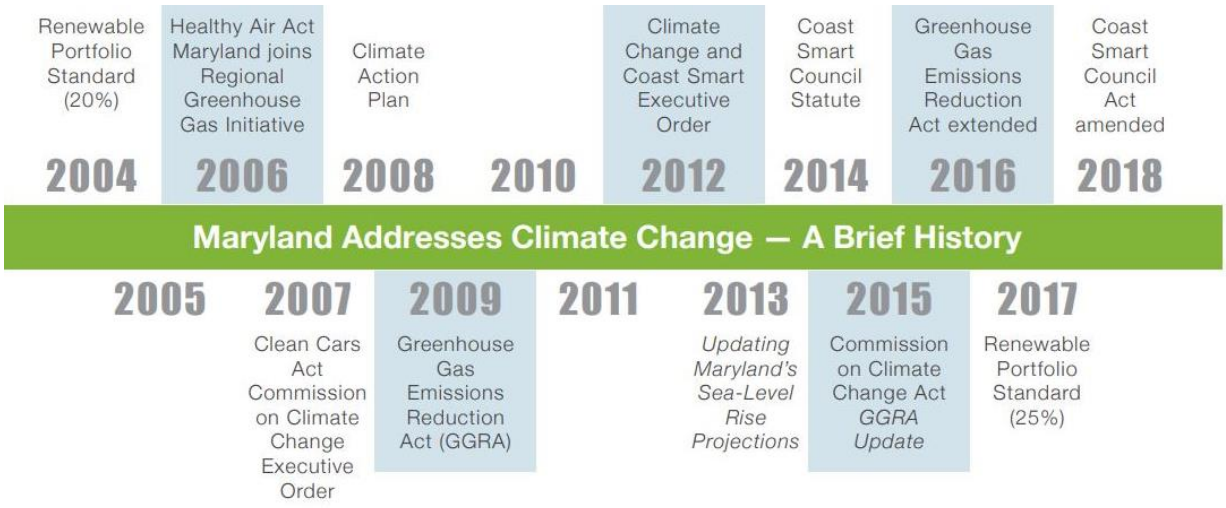


Figure 12: *Brief History of Maryland's Climate Actions. Source: University of Maryland Center for Environmental Science (UMCES) Sea Level Rise Projections for Maryland 2018.*

B. Governance Structures for Managing Climate Change

Maryland's commitment to addressing climate change is institutionalized in a variety of governance structures that span state, regional, national and international levels.

State Level

At the state level, the MCCC is charged with advising the governor and General Assembly "on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change". The MCCC was initially established by executive order in 2007 and codified into state law in 2015.

The MCCC consists of 26 members with wide representation, including state agency cabinet members, and is led by a steering committee. Maryland is aligning the climate aspects of it Bay restoration strategy with the four workgroups of the MCCC: the Adaptation and Response Working Group; the Education, Communication, Outreach Working Group; the Mitigation Working Group; and the Scientific and Technical Working Group. The MCCC, in concert with the governor's Chesapeake Bay Cabinet, is expected to play a central role in advancing Maryland's Chesapeake Bay climate adaptation actions.

The MCCC and its work groups annually put forth a set of recommendations and strategies, which will be aligned with the Bay restoration two-year milestones that address climate change. Details of the meetings and activities of the MCCC and its workgroups can be found at:
mde.maryland.gov/programs/Marylander/Pages/mccc.aspx

Regional Level

Regionally, Maryland is a signatory to the 2014 Chesapeake Bay Watershed Agreement, which includes a Climate Resiliency Goal. Maryland is committed to this goal and the associated monitoring and assessment outcome and adaptation outcome.

Maryland is also a member of the RGGI, a cooperative effort among the states of Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New York, Rhode Island and Vermont to cap and reduce power-sector CO2 emissions.

National & International Levels

Nationally, and internationally, Maryland is a member of the U.S. Climate Alliance of 17 states and the territory of Puerto Rico, which is committed to doing their share towards meeting international climate agreements. These governance structures not only institutionalize leadership processes and coordination, they provide avenues for accelerated learning, technology transfer and adoption of best practices. They also support a framework of accountability.

C. State and Local Climate Change Plans and Strategies

Maryland's commitment to addressing climate change is reflected, in part, by a variety of plans and strategies. Maryland's foundational adaptation strategies, which were developed by the Adaptation and Response Workgroup of the MCCC, are found within the *Comprehensive Strategy for Reducing Maryland's Vulnerability to Climate Change*:

- *Phase I: Sea Level Rise and Coastal Storms* (Johnson, 2008).
- *Phase II: Building Societal, Economic and Ecological Resilience* (Boicourt, 2010).

The Adaptation and Response Workgroup is tracking progress on the actions outlined in the comprehensive strategy. Many of these strategies relate to BMP implementation that reduce nutrient and sediment loads or slow the growth in loads by preserving natural lands.

Local Plans: In addition to state plans, six local government plans have been developed between 2008 and 2018 that either directly or indirectly address climate change impacts. In addition, 15 of Maryland's counties and Baltimore City have specifically mentioned climate change and/or the effects of climate change in their comprehensive plans (Maryland Department of Planning, 2018).

3. Implementation Guidance

Providing implementation guidance is part of Maryland's strategy for aligning Bay restoration and climate change management. Although technical materials and tools have been developed to guide restoration in the context of climate change, the field is new and rapidly evolving. Some of the latest information can be found at the following websites:

Maryland Commission on Climate Change: The commission coordinates climate change activities for the state including mitigation, adaptation, science and education, communication and public outreach.

Maryland Department of Environment: The Air and Radiation Administration leads the state's efforts on greenhouse gas mitigation.

Maryland Department of Natural Resources: DNR plays a significant role in climate adaptation, with an emphasis on mitigating coastal hazards and protecting and restoring the resilience of natural resources.

Chesapeake Bay Program Climate Resiliency Workgroup: The workgroup coordinates climate-related efforts to address climate resilience for the CBP Partnership as deemed a priority of the Chesapeake Bay watershed.

Key Challenges and Opportunities

Climate change poses many significant challenges for achieving Bay restoration goals. However, given the circumstances, many opportunities exist to leverage commonalities between managing climate change and Bay restoration.

- **Chesapeake Bay Water Quality will be Affected by Climate Change:** Climate change is predicted to increase nutrient and sediment loads to the Chesapeake Bay, and will change water quality characteristics like water temperature, dissolved oxygen and clarity. The CBP partnership is committed to develop refined quantified estimates of these pollution loads and water quality impacts in 2021.

- **Pollution Control Practices will be Affected by Climate Change:** The BMPs used to control water pollution will likely become less effective at controlling extreme storm events and be subject to damaging stresses of climate change. The CBP partnership is committed to better understanding these impacts and making adjustments to management practices in 2022 via two-year milestone commitments.

- **The Cost of Achieving and Maintaining Chesapeake Bay Water Quality Goals will be Affected by Climate Change:** If the water quality impacts of increased nutrient and sediment loads are not offset by increased flushing of the Bay, as a result of climate change, then more restoration practices will be necessary. This, in addition to BMPs becoming less effective and requiring more maintenance, could result in an increase in the cost of restoring the Bay. In anticipation of this, Maryland is committed to investigating ways of funding the incremental increase in cost.

- **Bay Restoration Mitigates Greenhouse Gases in Addition to Adapting to Climate Change:** The main interest in accounting for climate change in the Bay WIP is to adapt to impending shocks of climate change. However, many restoration practices that sequester carbon in soil and plant matter have significant GHG mitigation benefits. Aligning Maryland's GHG reduction actions with Bay restoration actions offers the prospect of powerful financing synergies borne out the recognition of increased value for the same action.

- **Quantifying Maryland Specific Air Reductions:** Maryland has evaluated reductions in nutrient deposition from state-specific regulations and/or facilities, beyond federally mandated requirements. Although the particular reductions evaluated are modest, this line of inquiry has the potential to mutually benefit climate change and Bay restoration management goals.

  The evaluation revealed that delivered nitrogen loads to the tidal Chesapeake Bay from air emissions are a relatively small fraction of Maryland's total nitrogen emissions. For example, only about 4 percent of Maryland's oxidized nitrogen emissions end up in the tidal Chesapeake. Many physical and biological processes such as movement of airborne nitrogen outside the

watershed, biological uptake and denitrification account for this low transport rate. These relatively minor delivered loads will have obvious management implications when it comes to targeting reductions in NOx emissions for the Phase III WIP. However, emission reductions of GHG will occur simultaneously with NOx emission reductions and by reducing GHG we reduce the future climate impact of increased nutrient loading. Thus air emission reduction strategies have a two-fold impact by slightly reducing land deposition of NOx and by combating future nutrient loading resulting from climate change.

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Reasonable Assurance and Accountability Framework

Section 303(d) of the CWA requires that a TMDL be "established at a level necessary to implement the applicable water quality standard (WQS)." Federal regulations [40 CFR 130.2(i)] also define a TMDL as "the sum of the individual wasteload allocations (WLAs) for point sources and load allocations (LAs) for nonpoint sources and natural background". Section 7 of the 2010 Chesapeake Bay TMDL requires jurisdictions to provide reasonable assurance that the nonpoint source component of the TMDL, the LA, will be achieved. EPA does this to ensure that the voluntary nonpoint source reductions expected to occur are realistic and achievable and that the regulatory WLA is set at the appropriate level to achieve WQS.

Balanced Approach of Regulations and Incentives

Maryland uses a balanced approach of regulations and incentives to ensure that WQS will be met and that the TMDL allocations are achievable. On the regulatory side, Maryland has many tools under both the federal CWA or state law that set numeric permit limits and restoration or other requirements for the regulated community. Some examples across sectors include: federal NPDES permit limits on WWTP pollution discharges; federal and state restoration requirements for areas under municipal separate storm sewer permits (MS4s), which require stormwater management retrofit practices; state requirements for agricultural nutrient management plans; and state BAT requirements for onsite (septic) systems in the Critical Area (within 1,000 feet of tidal shorelines). These regulatory tools are backed by effective compliance and enforcement programs that, where necessary, can implement legal backstops to ensure restoration progress.

At the same time Maryland has pollution sources that do not currently have regulatory clean up requirements, such as small communities with no Bay restoration requirements for pre-law stormwater discharges (non-MS4s), that play an important role in helping achieve Bay restoration targets and where financial incentives are critical to drive restoration progress. Some examples of incentive programs to drive restoration progress through voluntary efforts include: Maryland's cover crop program supported through the BRF; local stormwater remediation projects funded through the Trust Fund; operations and maintenance incentives to improve wastewater treatment performance beyond regulatory requirements; and, BRF to upgrade failing septic systems outside of the Critical Area.

It is also important to recognize that restoration progress, whether driven through regulations or incentives, is not even across sectors. Accelerated pollution reductions through wise use of enhanced technology and capacity at WWTPs as well as on farms are largely driving Maryland's success in meeting the 2025 Bay restoration targets. Challenges in the stormwater and septic sector, such as numerous distributed systems over large areas, many private property interests, longer implementation horizons, and required engineering plans and approvals, to name a few, limit restoration pace in these sectors. Therefore continued steady progress in both the stormwater and septic sectors is necessary to ensure that ongoing pollution reductions keep pace with any increased loads due to climate change and growth. Phase 1 and 2 MS4 permits now cover greater than 90 percent of Maryland's developed landscape and are legally enforceable mechanisms to ensure steady restoration progress in that sector over the longer term.

Continued steady progress in the septic sector will be assured through upgrades, sewer hookups and the recent septic stewardship law that helps local jurisdictions with septic maintenance through pumpouts.

Locally-Driven Restoration and Leveraging Co-benefits

Chesapeake Bay restoration will not be assured without sufficient capacity and close collaboration with local partners. County governments, municipalities, SCDs, farmers, citizens, and nongovernmental organizations are the boots on the ground implementing restoration practices through permits or grant/incentive programs. To ensure the continued progress of our local partners, restoration practices must not only be cost effective and achievable, but also provide benefits to local communities and address local challenges like flooding. Maryland will also work closely with local partners to identify strategies that address barriers through the adaptive implementation process of two-year milestones, progress evaluations, accelerating strategies that are cost effective and meet local needs, while embracing a continuous improvement philosophy to build on successes and learn from shortcomings. Maryland is already forming a workgroup to improve technical assistance delivery to local partners, as well as working with those partners to develop a strategic implementation plan for addressing challenges.

Financial Assurance, Creating a Restoration Economy and Driving Innovation

In FY00–18, the state spent about $8.4 billion on Chesapeake Bay restoration activities (Table 10), $3 billion of which has been appropriated within the last three years. This amount includes funding for activities that directly reduce nutrient and sediment inputs to the Bay (e.g., cover crops and WWTp upgrades), activities that indirectly support Bay restoration (e.g., monitoring, education, outreach), and activities that prevent or minimize future degradation of the Bay (e.g., land conservation). Recent actions that are important to highlight are 1) the full funding of the Trust Fund; 2) an increased focus on cost efficiency in both the BRF and Trust Fund; 3) the efforts toward the development of an operational Water Quality Trading Program; 4) the passage of the Clean Water Commerce Act, and; 5) progress on addressing the impacts of the pond behind the Conowingo Dam reaching its long term sediment and nutrient trapping capacity.

Table 10: *Fiscal Year 2000 - Fiscal Year 2018 Maryland Bay Restoration Funding Summary.*

Category	Total Fiscal Year 00 - Fiscal Year 18 Funding Amount (millions)*
Bay Cabinet Agencies (DNR,MDE,MDA,MDP,) Bay Restoration Funds	$4,774 M
Land Conservation(POS and Rural Legacy)	$615 M
Agricultural Land Preservation	$487 M
GO Bonds[18]	$1,583 M
Transportation[19]	$1,534 M
Education	$101 M
Total	**$8,414 M**

Several very important caveats and approximations must be recognized in interpreting Table 10 above.

1. **Data is not consistent over time:** Records are less accessible and, therefore, reported funding amounts less reliable for the beginning of this time period than more recent years.
2. **Not all funding goes directly to reducing pollutant loads to Chesapeake Bay:** "Bay Restoration" involves a diversity of important functions beyond simply reducing the amount of nitrogen, phosphorus and sediment entering the Bay. For example, water quality monitoring is essential to track progress and direct future actions to the most cost effective practices; education and outreach are important to providing Maryland students and citizens with access to and appreciation for a restored Bay; and smart growth and land conservation programs minimize growth impacts and protect the Bay from future degradation. All of these examples (and others) are essential aspects to restoration, but do not directly result in reductions in pollutant loadings. As a result, it is inappropriate to simply divide the total cost presented in this report by the number of pounds pollutant reduction to get a dollar amount per pound reduced.
3. **Judgment calls are necessary in identifying a program as "Bay Restoration":** Many state agency programs and budget categories contribute to restoration, as well as other non-Bay related efforts. In an effort to remain as consistent as possible, only those programs that are estimated to have more than 50 percent of their activities related to Chesapeake Bay restoration are included in this analysis.

[18] Includes Maryland Department of the Environment Revenue Bonds issued in FY 2016.

[19] Includes Maryland Department of Transportation spending from FY 2009 through FY 2018.

Although the total funding by Maryland state agencies for Bay restoration varies from year to year, the total restoration funds for the first three years of the evaluated time period (FY00–FY02) was $882,327,165 while the total for the past three years of the period (FY16– FY2018) was $2,657,862,414, an increase of 201.2 percent. This increase was driven in part by the creation and subsequent funding increases in the two primary Bay restoration Special Funds: The Bay Restoration Fund and the Chesapeake and Atlantic Coastal Bays Trust Fund.

The preliminary estimates of overall state costs for key Phase III WIP strategies by sector are presented below in Table 11. These amounts do not account for the estimated $1.6 billion that local governments will be spending through 2025 to complete the current Phase 1 and 2 MS4 permits. Phase 1 jurisdictions are required to develop financial assurance plans demonstrating fiscal capacity to achieve their stormwater permit requirements. This table also does not include federal funding sources for Chesapeake Bay restoration, such as Chesapeake Bay Restoration and Accountability Grants, Chesapeake Bay Implementation Grants, or federal funding for the Chesapeake Bay Program.

Table 11: *Preliminary estimates of annual state implementation costs by sector to achieve Bay restoration targets.*

Sector	State's Estimated Sector Costs for Key Strategies*
Wastewater	$110-million/yr
Stormwater (does not include transportation)	$90-million/yr
Septic	$11.4-million/yr
Natural Lands	$7.4-million/yr
Agriculture	$54.2-million/yr
Total	**$273-million/yr**

*Costs compiled from Table 1 WIP strategy costs

The key state funding programs for putting Chesapeake Bay restoration practices in the ground are identified below in Table 12. Comparing this funding to the costs above suggests Maryland has enough fiscal capacity to assure Chesapeake Bay's WQS will be met. However, it is important to realize these are preliminary estimates based on current year funding and estimated implementation costs. This analysis also does not factor in the substantial federal and local funding sources that also fund implementation efforts to achieve Maryland's TMDL targets. For these reasons a more in depth financial analysis is recommended in the near term to confirm Maryland's fiscal capacity to achieve 2025 TMDL targets.

Table 12: *Key state funding programs and amounts for Chesapeake Bay Restoration Projects.*

Program(s) Name	State's 2019 Program Funding Levels
Bay Restoration Fund Wastewater & Water Quality Revolving Loan Fund	$306-million/yr*
Bay Restoration Fund Septic	$15-million/yr
Clean Water Commerce Act	$6-million/yr
Chesapeake and Atlantic Coastal Bays Trust Fund	$53-million/yr
Maryland Agricultural Cost Share	$9-million/yr
Total	**$389-million/yr**

*Includes $150-million in revenue bonds. Successive years anticipated to be $22-million

In addition to traditional funding approaches, the Hogan administration is pursuing market-based strategies designed to stimulate a restoration economy and reduce costs. Nutrient trading is one such tool that allows non-mandated pollution reductions from one entity to be purchased by another entity. This creates a marketplace that will drive innovation across sectors to develop the most cost effective pollution reduction practices. At the same time, other innovative financing strategies like the Clean Water Commerce Act and the CWIP drive innovation by creating funding streams for the most cost effective practices and developing collaborative funding models like public-private partnerships to reduce public costs of restoration. Aligning Maryland's GHG reduction actions with Bay restoration actions that have significant carbon sequestration benefits can leverage and diversify financing to accelerate pollution reduction practices. Maryland is also actively pursuing water reuse technologies that help with long term water supply sustainability for our citizens, as well as reduce pollution loads to Chesapeake Bay[20].

Accounting for and Leveraging Conservation and Protection Programs

One of the best ways to assure and sustain Bay restoration is by protecting Maryland's ecologically significant lands and wildlife resources. These protections preserve the lowest pollution loading land uses from reverting to higher pollution land uses that will set Maryland further behind in its restoration goals. Maryland is making sure its land conservation programs are fully accounted for in the Bay restoration effort while fully funding land conservation programs for future acquisitions. In 2019, Maryland has $253-million in its transfer tax programs, such as Program Open Space, to protect and conserve natural lands. Maryland is also reviewing current conservation and protection program effectiveness, through monitoring results and other measures, in achieving conservation and protection goals.

[20] mde.maryland.gov/programs/Water/waterconservation/Pages/water_reuse.aspx

Holistic Ecosystem Management

Although Maryland's Phase III WIP is designed to achieve the TMDL nitrogen, phosphorus and sediment targets and be consistent with EPA's expectations, the state is also strongly committed to the broader goals outlined in the current Chesapeake Bay Agreement[21]: These include sustainable fisheries, vital habitats, reducing toxic contaminants, healthy watersheds, land conservation, stewardship, public access, environmental literacy and climate resiliency. These other watershed goals provide critical feedback loops to improve water quality, whether through restored fisheries providing nutrient uptake and water filtration services, nitrogen and carbon uptake in the plant tissue of submerged vegetation, or land-based practices like wetlands and forest buffers that capture and process nutrients before they enter surface waters. Maryland's commitment to this broader ecosystem management framework will help the state achieve its TMDL restoration targets while also maintaining the productivity of the Bay's living resources that strengthen local economies.

Accountability and Adaptive Management Framework

The accountability and adaptive management framework that underpins Chesapeake Bay restoration is shown in Figure 13.

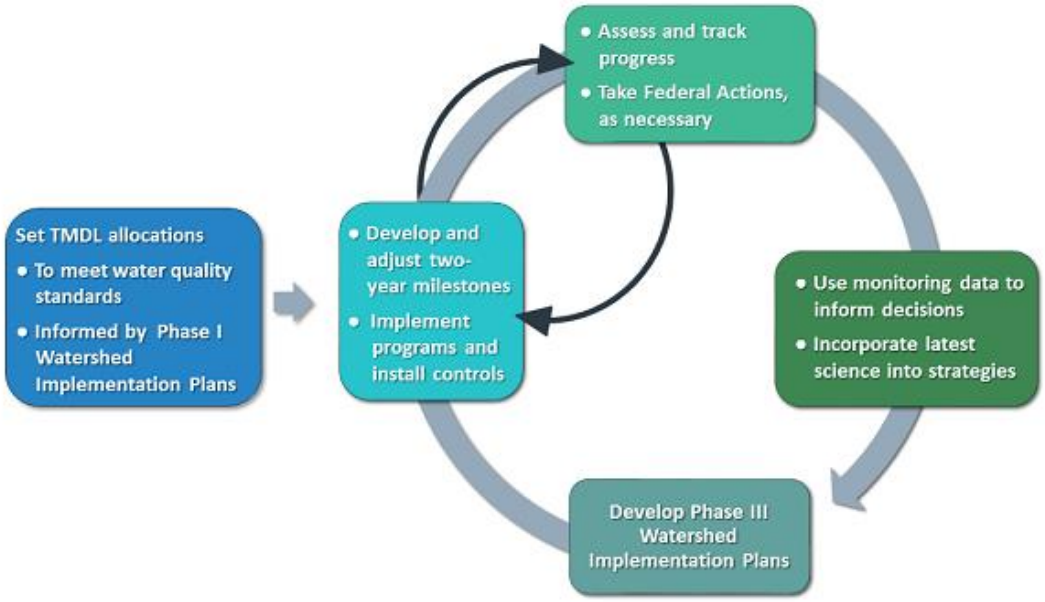


Figure 13: *Chesapeake Bay TMDL Accountability Framework. Graphic courtesy of the EPA Chesapeake Bay Program web site at epa.gov/chesapeake-bay-tmdl/ensuring-results-chesapeake-bay.*

As part of this accountability framework, the CBP partners develop short term goals, called milestones, to ensure restoration progress. Milestones identify the restoration practices, programs, policies, and resources that state jurisdictions commit to implement over two-year periods. EPA then evaluates

[21] chesapeakebay.net/what/what_guides_us/watershed_agreement

progress that the state jurisdictions have made toward achieving their milestone commitments and takes appropriate federal actions, as necessary, to help state jurisdictions remain on track.

Maryland submitted its 2018-2019 milestones to EPA in January 2018 and expects to submit 2020-2021 milestones in January 2020. These milestones serve as key checkpoints on the way to restoring the Bay by 2025 and include annual evaluations to gauge progress. The milestones provide Maryland the opportunity to adaptively manage the restoration process, incorporate new science on restoration practices performance, and apply key lessons learned from Phase III WIP successes or failures along the way. Chesapeake Bay water quality and living resources data are also used to ensure results are being seen in the Bay, as well as to adjust, as necessary, to new science or changing conditions.

Conclusion

There are both great challenges and great opportunities in restoring and protecting the Chesapeake Bay watershed and the rich natural heritage that defines the region. To do so, Marylanders must sustain the collective will to revive this national treasure, work to control costs and stimulate a restoration economy, leverage local and regional partnerships, implement restoration practices that achieve multiple benefits, promote and adopt innovation, adaptively manage and build on successes. Marylanders must also acknowledge that restoration success will require full commitment from upstream states, Maryland's continued strong leadership in the CBP partnership, and the U.S. EPA's maintenance of a strong restoration oversight and accountability role.

The Chesapeake Bay is a dynamic system influenced by natural ecosystem processes, as well as the multiple pressures of climate change, population growth, land use changes, and invasive species. Maryland and CBP's long term commitment to the science that informs policy and management actions, demonstrates effectiveness, and communicates restoration progress must be sustained into the future. As one participant keenly observed during the state's recent local engagement process: 2025 is not the end of restoration, but rather another milestone on the restoration journey.

Appendix A. Comprehensive Local, Regional and Federal Engagement Strategies and Commitments

Local Engagement in WIP Development

Key expected products from Maryland's engagement were estimates of what can reasonably be accomplished by 2025, an evaluation of expected sector shortfalls and surpluses, and an estimated pace of implementation beyond 2025. Specific types of engagement were customized according to local needs and capacities. Engagement primarily targeted partner groups most directly involved in implementation, including SCDs, local governments, and state agencies (Table A-1).

Discussion of implementation funding was also an important component of engagement activities. State and local partners considered funding strategies for achieving the Bay restoration goals and continuing to make reductions after 2025.

Target audiences, messages, messengers, tools and resources were similar to those described in the section on engagement (page 28).

Table A-1: *Phase III WIP Development Engagement and Communication Activities.*

Date	Engagement & Communication Activity
Sept. 26, 2016	Letter to local elected officials and agriculture leaders
Sept.-October 2016	Five regional WIP workshops
April 25, 2017	WIP webinar
June 15, 2017	Meeting with county Environmental Health Directors, hosted by MD Association of Counties
June 26-27, 2017	Exhibit at MD Municipal League summer conference
July 19, 2017	Meeting with Eastern Shore Blueprint Action Group (NGOs)
Aug. 16-18, 2017	Exhibit at MD Association of Counties summer conference
Aug. 18, 2017	MD Association of Counties conference panel with Secretary Grumbles: What Will We See in Phase III?
Sept.11, 2017	Presentations and Q&A with Hughes Center for Agro-Ecology Board
Sept. 12, 2017	LEAD MD class (for emerging local leaders in agriculture, natural resources, and rural communities)

Date	Engagement & Communication Activity
Sept. 15, 2017	Healthy Waters Working Group (Eastern Shore)
Sept. 20, 2017	Watershed Assistance Collaborative (state agencies, Chesapeake Bay Trust, University of Maryland Sea Grant Extension Program, University of Maryland Environmental Finance Center, NOAA, and EPA)
Oct. 20, 2017	Email "Phase III WIP Update and News" sent to WIP local contacts
Nov. 3, 2017	WIP update at quarterly Phase I MS4 meeting
Nov.15, 2017	Agriculture listening session, hosted by Hughes Center for Agro-Ecology
Nov. 16, 2017	Phase III Watershed Implementation Plan Round Table, hosted by Choose Clean Water Coalition, in partnership with the Anacostia Watershed Society, Chesapeake Bay Foundation, and Chesapeake Legal Alliance
Jan. 25, 2018	Chesapeake Stormwater Network webcast "New Year, New Model, New WIPs"
Feb. 1, 2018	Watershed Assistance Collaborative (state agencies, Chesapeake Bay Trust, University of Maryland Sea Grant Extension Program, University of Maryland Environmental Finance Center, NOAA, and EPA)
Feb. 7, 2018	MD Association of Conservation Districts
Feb. 9, 2018	WIP update at quarterly Phase I MS4 meeting
Mar. 6, 2018	Email "Phase III WIP Update and News" sent to WIP local contacts
Mar. 26, 2018	WIP update for MD Water Quality Trading Advisory Committee
Mar. 27, 2018	MD Environmental Trust Roundtable
Mar. 27, 2018	Choose Clean Water Coalition and Chesapeake Bay Foundation
Apr. 3, 2018	Choose Clean Water Coalition, Chesapeake Bay Foundation, and Chesapeake Legal Alliance
Apr. 10, 2018	Center for Watershed Protection stormwater conference
Apr. 20, 2018	CAST training for Phase I MS4s
Apr. 25, 2018	Meeting with Eastern Shore Blueprint Action Group (NGOs)
May-June 2018	Five regional meetings
Aug. –Sept.2018	MDE and MDP meetings with county public works and planning staff
Aug.-Sept. 2018	MDA meetings with Soil Conservation District staff and other agriculture stakeholders
Fall/Winter 2018-19	Webinars on WIP-related topics
Nov.-Dec. 2018	Six regional meetings

Appendix B. Sector Reports

Agriculture Sector

Background

Since the development and implementation of the Phase II Watershed Implementation Plan, Maryland farmers have made great progress towards achieving the Chesapeake Bay TMDL. Reductions achieved to date come from the successful implementation of several key conservation programs at MDA that offer assistance to the agricultural community. Voluntary locally-led conservation has been the cornerstone to Maryland agriculture reducing nutrients and sediment to the Chesapeake Bay.

The installation of additional BMPs on agricultural land was accomplished with a combination of technical assistance, provided by Maryland's SCDs and other conservation partners, coupled with state and federal financial incentives. As of FY17, approximately 924,000 acres of agricultural land is managed under a Soil Conservation and Water Quality Plan and nearly 800,000 acres of cropland is cultivated using no-till or conservation tillage practices. In addition, over 57,000 acres of riparian buffers have been planted and 9,500 acres of wetlands have been restored or created.

For over 30 years, the Maryland Agricultural Water Quality Cost-Share (MACS) Program has provided cost-share up to 87.5 percent on the installation of many structural conservation practices. Between FY09 and FY17, MACS provided $54.6 million in grant funding toward the installation of 4,435 practices. In addition, $5.8 million in state financial assistance and $3.6 million from the poultry industry was provided to transport 1.1 million tons of manure from farms with excess or for alternative uses. The state also utilizes portions of the BRF and Trust Fund to incentivize the planting of cover crops following the harvest of summer grain crops. In 2017, the Maryland Cover Crop Program provided $25.6 million in incentive payments to farmers to plant over 560,000 acres of cover crops.

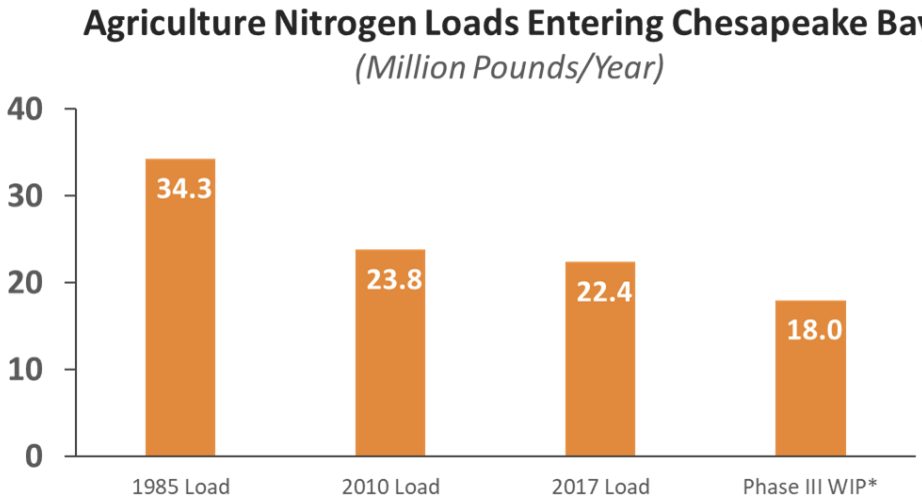
A complete list of Agricultural Best Management Practices implemented as of FY17 can be found in tables B-2 and B-3. Maryland agriculture will build on the success of these programs and our partnerships to continue achieving the remaining WIP reductions.

Programmatic Achievements

- Phosphorus Management Tool (PMT) regulations
- Animal Waste Technology Fund
- Manure Matching Services
- Soil Health and Climate Change Initiatives
- Agricultural Certainty Program
- Nutrient Trading

Trends

Agriculture has made significant strides in reducing nutrient and sediment pollution since 1985, with the 2017 Mid-Point assessment showing that it met its goals for both phosphorus and sediment. While agriculture fell short of its nitrogen goal for the Midpoint Assessment, it has nonetheless made consistent progress in reducing nitrogen and is on track to meet its Phase III WIP goals by 2025 (Figure B-1).



Source: Maryland Phase III WIP Scenario; CAST 2019

*****Phase III WIP reductions subject to change upon EPA review.

Figure B-1: *Reductions in nitrogen achieved by agriculture since 1985.*

Phase III Development Process for the Agricultural Sector

To develop the Phase III Watershed Plan for Agriculture, MDA actively engaged the agriculture community in Maryland. The department recognized and understood the importance of having a direct dialogue with stakeholders to not only provide an update on progress toward achieving the state's 2025 Chesapeake Bay restoration commitments, but also review background information regarding the accounting of agricultural conservation on the landscape and formulating a realistic plan.

Local Engagement

In cooperation with the Harry Hughes Center for Agroecology, the Maryland Department of Agriculture facilitated a kick-off meeting on July 25, 2018 with key agriculture stakeholders to begin outlining the framework for the Phase III WIP. While it was important to provide a general overview of the WIP process, discussions during this Agriculture Leadership Roundtable focused on strategies to increase the adoption of conservation measures to further reduce nutrient losses on agricultural land. A summary of recommendations include:

- Improve the collection of information regarding the implementation of existing conservation practices

- Better enforcement of existing regulations
- Reduce barriers of conservation adoption between tenants and landowners
- Streamline and align current financial incentive programs to foster increased adoption of conservation
- Leverage Pay For Performance options to further incentivize conservation
- Recognize the importance of and building stronger partnerships with agribusiness and nongovernmental organizations
- Ensure the most productive land remains in agriculture production
- Collaborate with institutes of higher education concerning additional research in the development and implementation of conservation practices
- Ensure adequate and properly trained technical resources are available to assist the agricultural community

In addition, the department facilitated a series of locally-led agricultural stakeholder meetings in the summer of 2018 within each of the 23 counties (Table B-1). These meetings were modeled after the Phase II local outreach meetings conducted in 2011, and were organized by the local Soil Conservation Districts (SCDs). The meetings were open to the general public, but a diverse group of stakeholders that represented and specialized in working with the agricultural community were invited to attend. While participation varied by county, attendees included farmers, SCD planners, engineers, technicians, USDA Natural Resources Conservation Service and Farm Services Agency, University of Maryland Extension, county agricultural coordinators, agriculture service providers, representatives from local watershed organizations, Chesapeake Bay Foundation, The Nature Conservancy, Maryland Farm Bureau, Delmarva Poultry Institute, dairy industry, county planning staff, Department of Public Works staff, and health department staff. Over 500 people participated in the meetings.

Stakeholder meetings began with information on current agricultural practices installed and discussed opportunities for further implementation with existing farm management practices and programs. The meetings also focused on local capacity to provide further reductions and commitments by participants to implement and develop a workable local strategy. Each meeting culminated with a revised implementation schedule of conservation measures that stakeholders felt were realistic and achievable by 2025. The county's plan was then assessed using the Chesapeake Bay Program's Chesapeake Assessment Scenario Tool (CAST) to ensure adequate nutrient load reductions compared to the WIP Phase II level of effort. Overall, each county was successful in reaching and/or achieving its allocation by 2025.

Table B-1: *Schedule of County WIP Meetings.*

Date	Time	County	Location
7/25/2018	8:30am - 2:40pm	Anne Arundel	Agriculture Leadership Roundtable DoubleTree 210 Holiday Court Annapolis, Maryland 21401

Date	Time	County	Location
8/7/2018	1:30-3:30 pm	Worcester	County Library Snow Hill Branch 307 North Washington Street Snow Hill, Maryland 21863
8/8/2018	9:30-11:30 am	Somerset	Somerset county Ag Building 30730 Park Drive Princess Anne, Maryland 21853
8/8/2018	1:30-3:30 pm	Wicomico	County UMD Extension Office 28647 Old Quantico Rd Salisbury, MD 21802
8/9/2018	9:30-11:30 am	Dorchester	Dorchester county Office Building 501 Court Lane Cambridge, MD 21613
8/9/2018	1:30-3:30 pm	Talbot	Hog Neck Community Center 10028 Ocean Gateway Easton, MD 21601
8/21/2018	9:30-11:30 am	Caroline	4H Park 8230 Detour Rd Denton, MD 21629
8/21/2018	1:30-3:30 pm	Queen Anne's	County Planning & Zoning 110 Vincit Street, Suite 104 Centreville, MD 21617
8/22/2018	9:30-11:30 am	Cecil	County Admin Building 200 Chesapeake Blvd, Suite 2100 Elkton, MD 21921
8/22/2018	1:30-3:30 pm	Kent	UMD Extension 709 Morgnec Rd #202 Chestertown, MD 21620
8/23/2018	9:30-11:30 am	Harford	Harford SCD 3525 Conowingo Rd Street, MD 21154
8/23/2018	1:30-3:30 pm	Baltimore Co.	Baltimore county Ag Center 1114 Shawan Road # 4 Cockeysville, MD 21030
8/28/2018	9:30-11:30 am	Carroll	Maryland Cooperative Extension 700 Agricultural Center Dr. Westminster, MD 21157
8/28/2018	1:30-3:30 pm	Frederick	Frederick county Extension Office 300 Montevue Ln. Frederick, MD 21701

Date	Time	County	Location
8/29/2018	9:30-11:30 am	Howard	Lisbon Fire Hall 1330 Woodbine Rd Woodbine, MD 21797
8/29/2018	1:30-3:30 pm	Montgomery	Montgomery Co. SCD 18410 Muncaster Road Derwood, MD 20855-1421
8/30/2018	9:30-11:30 am	Prince George's	Prince George's Soil Conservation District 5301 Marlboro Race Track Road, Suite 100 Upper Marlboro, MD 20772
8/30/2018	1:30-3:30 pm	Anne Arundel	Maryland Department of Agriculture 50 Harry S. Truman Parkway Annapolis, MD 21401
9/5/2018	1:30-3:30 pm	Garrett	UMD Extension 1916 MD Highway Mt. Lake Park, MD 21550
9/6/2018	9:30-11:30 am	Allegany	Allegany College of Maryland 12401 Willowbrook Road Cumberland, MD 21502
9/6/2018	1:30-3:30 pm	Washington Co.	Washington county Division of Emergency Services 16232 Elliott Parkway Williamsport, MD 21795
9/7/2018	1:30-3:30 pm	St. Mary's	St. Mary's Ag Center 26737 Radio Station Way B Leonardtown, MD 20650
9/13/2018	9:30-11:30 am	Charles	Charles Soil Conservation District 4200 Gardiner Road Waldorf, MD 20601
9/13/2018	1:30-3:30 pm	Calvert	Harriet E. Brown Center, Room 113 901 Dares Beach Road Prince Frederick, MD 20678

Coordinating Federal Resources in Agriculture

MDA is coordinating with USDA's Natural Resources Conservation Service (NRCS) to maximize the application of federal resources toward WIP achievement. Beginning in FY11, NRCS approached MDA to request a list of practices that were part of the existing two-year milestones. Through this effort, NRCS committed to focus programmatic resources available to Maryland farmers, providing prioritized funding to those practices that were part of the goals. This effort continues through the Environmental Quality Incentive Program and the Chesapeake Bay Watershed Initiative. The MACS Program leverages state

funding by cost sharing the implementation of individual BMPs funded through federal programs.

In addition, the CREP, first instituted in Maryland 1997, seeks to treat 100,000 acres of sensitive agricultural land in the state. Currently, approximately 59,000 acres are under CREP agreements in Maryland. CREP will play an integral role incentivizing the implementation of forest and grass buffers, wetland restoration and treating Highly Erodible Land acres. These correlations of effort with USDA will enhance Maryland's ability to meet WIP targets.

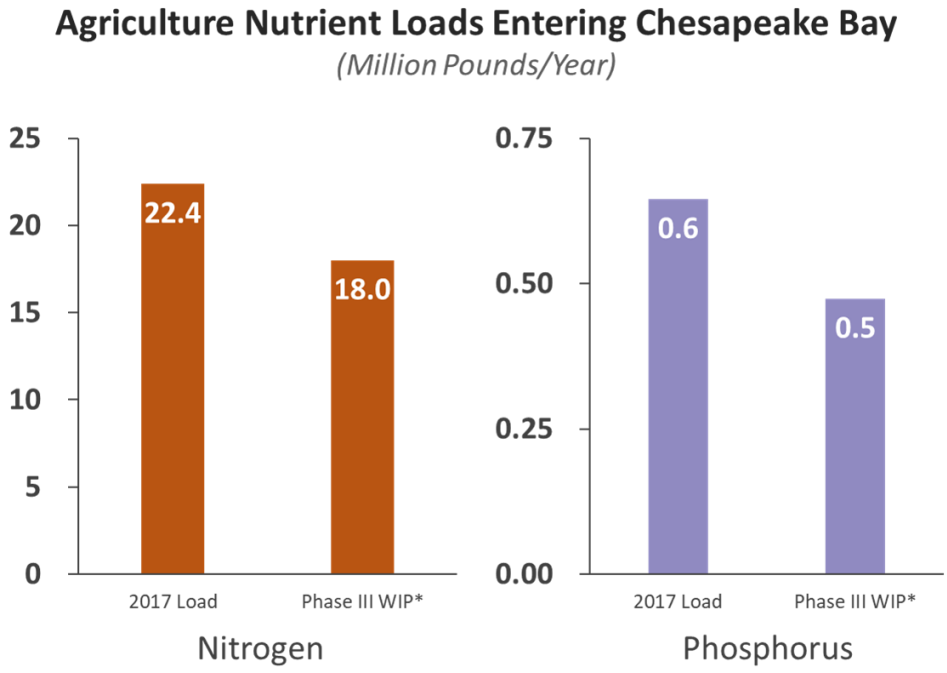
Phase III WIP Agriculture Strategies

Table B-2: *Annual Phase III WIP Agriculture BMP Practices.*

BMPs to be Implemented Annually	Unit	2017 Progress w/Verification	2025 Goal
Conservation Tillage	Acres/Year	194,122	242,876
Cover Crops - Commodity	Acres/Year	81,983	76,998
Cover Crops - Traditional	Acres/Year	476,815	470,891
Cropland Irrigation Management	Acres/Year	118,586	142,374
High Residue Tillage	Acres/Year	647,072	626,233
Manure Incorporation	Acres/Year	133,718	132,416
Manure Injection	Acres/Year	7,931	7,226
Manure Transport	Tons/Year	77,758	97,400
NM Placement	% Acres/Year	<10%	20%
NM Rate N/P	% Acres/Year	<10%	35%/10%
NM Timing	% Acres/Year	<10%	10%
Nutrient Management	% Compliance	61%	70%
Poultry Litter Treatment	% Operations/Year	-	75%
Soil Conservation and Water Quality Plans	Acres/Year	923,896	1,022,256

Table B-3: *Structural Phase III WIP Agriculture BMP Practices.*

Additional Structural Practices to be Implemented	Unit	2017 Progress w/Verification	2025 Goal
Agricultural Drainage Management	Acres Treated	4,836	23,292
Agricultural Stormwater - Poultry	% Operations		65%
Alternative Crops	Acres	14	100
Animal Waste Storage - Dairy	% Animal Units	>75%	90%
Animal Waste Storage - Other Livestock	% Animal Units	<20%	50%
Animal Waste Storage - Poultry	% Animal Units	100%	100%
Barnyard Runoff Control	Acres	1,045	1,210
Cropland Conversion to Pasture	Acres	6,971	9,448
Dairy Precision Feed Management	% Animal Units		90%
Forest Buffers	Acres	18,725	19,913
Grass Buffers	Acres	38,863	43,256
Horse Pasture Management	Acres	2,015	2,652
Land Retirement - Open Space	Acres	17,235	22,453
Livestock Exclusion	% Animal Units		90%
Loafing Lot Management	Acres		64
Mortality Composters	% Animal Units	100%	100%
Non-Urban Stream Restoration	Linear Feet	74,301	135,601
Nursery and Greenhouse Runoff Capture and Reuse	Acres		1,691
Off Stream Watering without Fencing	% Animal Units	<10%	10%
Phosphorus Sorbing Materials in Ag Ditches	Acres	100	100
Prescribed Grazing	Acres	11,857	18,783
Shoreline Management	Linear Feet		30,000
Tree Planting	Acres	3,865	4,111
Wetland Restoration	Acres	9,487	13,594



Source: Maryland Phase III WIP Scenario; CAST 2019

*****Phase III WIP reductions subject to change upon EPA review.

Figure B-2: *Current and projected agriculture total nitrogen and phosphorus loads entering Chesapeake Bay relative to Phase III WIP goals.*

Phase III WIP Implementation

As originally committed in the Phase II Watershed Implementation Plan, MDA will continue to promote and account for the implementation of conservation on agricultural land in Maryland to meet Bay restoration efforts. MDA will rely heavily on the existing conservation partnership between USDA NRCS and FSA, local SCDs, and other state agencies and institutions to deliver the necessary conservation programs to meet goals outlined above. In addition, the Department is excited to partner with many non-governmental organizations to promote the adoption of voluntary conservation on Maryland farms.

To accomplish the Phase III WIP for agriculture, MDA intents to employ a multi-faceted approach. Foremost, it is critical that all existing conservation measures have been properly accounted and credited before additional implementation is considered. Identifying and developing solutions to overcome barriers associated with conservation adoption as well as leveraging new opportunities to enhance and/or develop new programs are also vital.

Accounting for Current Conservation

Better Data

Throughout the county stakeholder meetings, concerns were raised regarding the characterization of agriculture in the Chesapeake Bay Model. Baseline assumptions, such as acres in production, number and type of animals, and manure being generated in each county, have all been questioned. To help better inform the Chesapeake Bay Model, MDA, working through the Chesapeake Bay Program's Agriculture Workgroup, will explore opportunities to more accurately quantify agricultural production. Specifically, the Department will explore the expansion of data being collected on the Nutrient Management Annual Implementation Report, consider the development of industry-specific surveys, and collaborate with industry related to nutrient applications and animal production.

Resource Improvements

In looking forward to Phase III, MDA has recognized the importance of documenting the efforts of the agricultural community to install practices without the technical or financial assistance of the department and its partners. With the certification process of Resource Improvements, MDA has placed an emphasis on utilizing its many programs to document those practices that, while not meeting NRCS standard criteria, are still providing a water quality benefit. Resource improvements are found through the following processes:

- During the development or when updating a conservation plan.
- During BMP verification of other WIP-eligible BMPs.
- During MACS spot checks or quality assurance reviews.
- During nutrient trading evaluations.
- During agricultural certainty evaluations.
- During Farm Stewardship Certification and Assessment Program Evaluations.

Finalized in 2015, MDA developed the Non Cost-Shared Best Management Practice and Resource Improvement Practice Verification Procedures Manual. In it, soil conservation planners, technicians, and other MDA staff are provided certification forms that can be filled out and incorporated into a conservation plan to document farmer-installed conservation efforts. Like many processes, this requires investigative work, including an interview with the cooperator or landowner to determine eligibility and to record WIP-specific data required to pass a certification. Each of the 18 resource improvements has a dedicated one-page description and certification form that details the mandatory visual indicators required for eligibility.

In 2016, MDA held trainings with personnel to educate on identification of resource improvements. This process will continue to be highlighted going forward. To date, a total of 430 individual resource improvement practices have been identified in Maryland. A challenge going forward will be to identify those practices that have been installed on operations that have yet to form a relationship with MDA or its partners.

BMP Verification

Beginning in the fall of 2016, and in response to the mandate that all states and sectors strengthen the accountability and transparency of reported BMP practices, MDA established the BMP Verification Task Force. This group, currently comprised of five individuals, is charged with verifying that installed BMPs that are eligible for nitrogen and phosphorus reduction within the Bay model are functioning as intended and are achieving a water quality benefit. To fulfill this obligation, task force members work regionally and within each SCD to provide a third-party analysis of the data provided within Soil Conservation and Water Quality Plans and MDA's Conservation Tracker database. Working on three-week intervals in each SCD, task force members (verifiers), compare information for installed BMPs that was inputted into conservation tracker with the information provided in each respective conservation plan. After noting any discrepancies in data and mapping BMPs within ArcGIS, verifiers collaborate with SCD personnel to visit farm operations and assess the water quality functionality of each reported BMP.

Each BMP is verified as it relates to its NRCS standard or resource improvement definition as provided by the CBP verification framework. After assessment, BMPs receive one of the following status determinations: Meets Standard, Does Not Meet Standard, No Longer Present or Does Not Exist, or Meets Standard but No Animals Present (Figure B-3). Each of these determinations can be accompanied with an administrative flag, prompting the SCD to provide or correct data during a bi-monthly reconciliation process. For BMPs that do not meet standard, the SCD is given one year to work with the cooperator to bring the BMP back into water quality functionality.

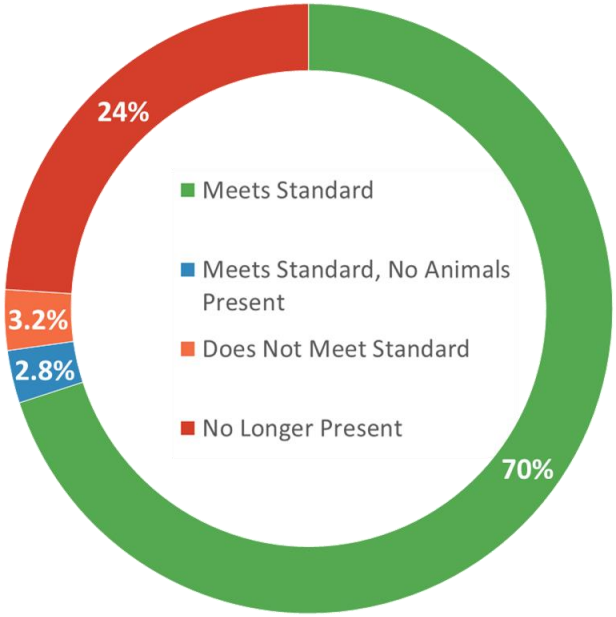


Figure B-3: *Maryland BMP Status Determinations.*

To date, the BMP Verification Task Force has verified over 35 percent of the total WIP-eligible BMPs installed in Maryland, totaling approximately 11,500 BMPs. In doing so, the task force has evolved a rigorous logic for handling and documenting field assessment data. Using this logic, the task force remains in constant contact with each SCD, requesting reconciliation data such as retirement dates for

historical BMPs, as well as the documentation of new BMP data discovered by verifiers upon completion of a farm assessment.

Key Challenges and Opportunities

Enforcing Regulatory Compliance

The Department's Nutrient Management Program is responsible for regulatory oversight of nutrient applications and proper animal waste management on agricultural land. Regulatory compliance has dropped the last few years, but there are several reasons for the decline. Several years ago the program began targeting farms for inspection based on information provided on the Annual Implementation Report (AIR) that seemed suspect based on the initial review. When the program collected soils data as a result of PMT requirements, those farms that did not submit soil data were specifically targeted for review. In addition, traditional targeted reviews continued for various other reasons. The program believes the concept of targeting farms instead of complete random sampling has had a positive impact, but it has lowered the compliance rate. We believe the compliance rate will naturally improve due to this process. Many of those out of compliance are for expired or incomplete plans, which means they are technically out of compliance but not necessarily creating water quality issues. In fact we have encountered many farms with expired plans that were following the old plan, but were found to be out of compliance.

Compliance with nutrient management requires more than having a current plan and properly implementing that plan. While on farm for reviews, the specialists also inspect the property to determine if animals are excluded from streams, and if stream buffers are in place. The program also monitors compliance with winter spreading restrictions, temporary stockpile of organics, and the progress of enhanced nutrient management practices such as split applications of nitrogen. If it is determined that setbacks or buffers have not been provided, a notice of violation is given to the operator along with a date for completion and a scheduled re-inspection. The program has been successful in getting farmers to install stream fencing as well as waste storage structures needed to meet the state's winter spreading prohibition. Planning also promotes no-tillage and minimum tillage leading to nutrient reductions.

Maryland Agricultural Water Quality Cost-Share Program (MACS)

MACS grants allow farmers to install highly valued BMPs on their farms that help Maryland meet nutrient and sediment goals outlined in its federally approved WIP to restore the Bay. All of the practices adopted by MACS that meet water quality criteria for controlling soil loss or animal waste are eligible to receive state funding when installed by farmers. Subsequently implementation of most of the practices automatically aligns with the WIP.

Any one or combination of MACS adopted practices allows a farm operation to address or prevent control of agriculturally related nonpoint water pollution specific to that operation's needs, which in turn supports meeting the 2025 WIP goals. While the MACS program contributes up to 87.5 percent of the eligible cost-share dollars, conversely the farm operation may contribute more than 12.5 percent, providing the

operation the latitude by which to select a desired BMP for the operation. Provided farmers continue to install new practices between now and 2025 the remaining gap will continually be addressed.

Farmers' future participation in the MACS program will be warranted by 1) their ability to choose BMPs that align with not only water quality goals but also their operations management and sustainability, 2) their needs to meet regulatory requirements associated with water quality, and, 3) their desire to support WIP goals.

As the WIP is more aggressively promoted it may be necessary to make administrative changes to the MACS Program to enhance program delivery while remaining consistent with program regulations.

Animal Waste Technology Fund

Reauthorized in 2013, MDA's Animal Waste Technology Fund provides grants to companies that demonstrate innovative technologies on farms and alternative strategies for managing animal manure. These technologies may generate energy from animal manure, reduce on-farm waste streams, or repurpose manure by creating marketable fertilizer and other products and by-products. To date, the program has issued $5.85 million in grants to six companies. A full list of current grant recipients is available at mda.maryland.gov/resource_conservation/Pages/innovative_technology.aspx.

As these technologies become fully operational, the manure may experience transformation in the nutrient content of the raw manure, stabilizing the material for improved uses, or both. MDA will also be evaluating grantee's projects as they relate to a new conservation practice approved by the CBP - Manure Treatment Technologies. Beginning in 2014, the following manure treatment technologies were evaluated for nutrient reduction benefits:

- Thermochemical conversion,
- Composting,
- Anaerobic Digestion,
- Settling,
- Mechanical Solid-Liquid Separation, and
- Wet Chemical Treatment.

After academic evaluation of the technologies, including available literature, nutrient removal credit was approved for thermochemical and composting technologies, or any technology with direct monitoring of nutrient removal. The remaining manure treatment technologies are presumed to alter the moisture content of the manure making it easier to transport. MDA anticipates as knowledge of treatment technologies increases within the agricultural community, it may offer viable options for some operations to better utilize the benefits of their manure source. MDA will track and report these outcomes consistent with the CBP protocols.

Maryland Agricultural Certainty Program

The Maryland Agricultural Certainty Program was established to accelerate the implementation of conservation practices to meet local, state, and Chesapeake Bay pollution reduction targets while rewarding farmers for being environmental stewards and showing leadership in preventing and controlling soil erosion and nutrient runoff. In addition, it allows farmers to make the long-term commitments and business decisions necessary in planning for the future by giving them assurance of regulatory predictability during the ten-year enrollment period.

Since inception, MDA has promoted the benefits associated with the program, but has had limited success. Although the program's growth has been slow, MDA continues to respond to inquiries and assess farms. The Department is evaluating potential regulatory changes to not only allow both owners and operators to participate in the program, but also reduce the paperwork burden on applicants.

MDA is currently evaluating vacancies within the Oversight Committee and seeks to address these concerns with the Committee once re-established.

Healthy Soils Initiative

In 2017, the Maryland General Assembly established the Maryland Healthy Soils Program to promote practices that improve the health, yield and profitability of soils in the state of Maryland. While these practices aim to increase biological activity in the soil and sequester carbon, many of these practices also prevent soil erosion and reduce nutrient loss on agricultural land. As the program is established and promoted, the department will identify and develop methods to quantify the soil health co-benefits associated with the implementation of the WIP.

Workforce Development

Since the establishment of the first SCD in Maryland, conservation professionals have been the cornerstone in evaluating and recommending solutions to address resource concerns on working lands. Farmers rely on the technical expertise provided by these dedicated conservationists to not only ensure resource concerns are being addressed, but also assist them in navigating through various state and federal programs.

As the role of the conservationist has evolved over time, so has the knowledge and skills to recommend and implement practices on agricultural land. As identified during the local WIP meetings, additional technical resources will be needed to accomplish the Phase III WIP by 2025. Further, as recommended in the Chesapeake Bay Commission's report Boots on the Ground, it is necessary to increase technical assistance capacity to address the complexity and delivery of services. To " Enhance the Job Climate for Governmental Conservation Professionals Providing Technical Assistance," as recommended in the report, MDA is committed to work with the institutions of higher education to expand educational opportunities to encourage the development of a conservation workforce.

The NRCS has established essential knowledge, skills, and abilities leading to conservation planning certification. Training and proficiency levels must be achieved to obtain conservation planner certification. A similar curriculum is in development for technician that will be administered through NRCS.

Recruitment and retention for positions funded with the Trust Fund grant are seen by employees as short term grant positions. Until recently, few of these entry level positions included benefits which has caused retention to be challenging in some districts. Experienced district staff have spent countless hours training these Trust Fund-supported positions only to see them leave before they are achieving meaningful production levels and in the process lowering the production level of the staff doing the training. Permanent state positions will offer long term stability and improve retention and development of experienced staff.

Natural Lands Sector

Background

Natural filters practices improve both water quality and habitat by protecting, enhancing and restoring riparian buffers, wetlands, streams and living shorelines. "Natural filters on Other Public Lands" was developed as a separate strategy in the Phase II WIP due to these practices' important ability to provide co-benefits, many of which contribute to the goals and outcomes of the 2014 Chesapeake Bay Watershed Agreement. One of the key co-benefits provided by these practices is increased climate resilience, which will be integral to help the state prepare for, and respond to, the impacts of climate change. This strategy is being expanded for the Phase III WIP to incorporate additional practices and define new goals for implementation by 2025. Public lands were defined in Phase II as those managed by the Maryland Department of Natural Resources (DNR), other state agencies, the federal government and local governments. The definition of public lands for Phase III will not include federal government property because it will be accounted for as part of a separate WIP. As with the Phase II strategy, natural filters implementation on private agricultural lands is captured in the agricultural section of the WIP.

Trends

The Phase II natural filters strategy was focused on four main practices: tree planting, wetland restoration, streamside forest buffers and natural filters on other public lands. Specific performance metrics for 2010-2018 are provided in the "Phase III Strategy" section below. The most successful practice to date has been wetland restoration, in which most of the progress was achieved through the implementation of two large-scale projects. The wetland goal for Phase 3, presented below, was developed with the assumption that no large scale projects will be implemented. A significant acreage of tree planting was implemented through the Million Trees Initiative (MTI), also known as the Forest Brigade; however, less than half of the ambitious Phase II goal was achieved.

Strategies

The Phase III natural filters strategy is composed of the practices detailed below. The first four practices were also part of the previous strategy; their Phase II goals and progress are provided along with updated goals for Phase III. In general, many of the opportunities for natural filters practices on public lands have already been implemented during the first and second phases of the WIP. The opportunities that remain may pose obstacles or be less cost effective than the projects implemented to date. Although the goals set for tree planting, wetland restoration, and buffers are modest due to these challenges, three new practices are being added to expand the strategy for Phase III. This strategy is also very closely connected to Conservation Plus (Land Use Policy BMP), which is described in the Accounting For Growth section (see section PSC Decisions on Accounting for Growth) of this report. Conserved lands may provide additional opportunities for the practices within this natural filters strategy to be implemented.

There are several additional considerations that should be kept in mind when implementing this strategy. The first is that stable funding is imperative to support construction as well as ongoing maintenance and monitoring, which are crucial to ensure long term project success. Climate impacts, such as changes to precipitation patterns, need to be considered as a part of project design and maintenance. Adaptive management should be incorporated into the project timeline, when possible, so that project performance can be maximized by making adjustments post-construction.

A) Tree planting

Forests are our most strategically important natural resource. Trees protect water quality, clean our air and provide wildlife habitat. One large tree can eliminate 5,000 gallons of stormwater runoff each year, and well placed trees can help reduce energy costs by 15 to 35 percent. This strategy focuses on upland tree planting; urban tree planting is accounted for in the stormwater strategy.

Phase II goal: Plant trees for a total of 3,450 acres by 2017
2010 - 2018 progress: 1,356 acres
This acreage is composed of trees planted through the MTI, Trust Fund grants and MS4 permit compliance projects as reported to the MDE. As such, it is likely not a full accounting of tree plantings on public lands implemented across the state.

Phase III goal: 800 acres
Estimated cost: $8,200,000
This goal was developed to reflect the fact that the opportunities identified for tree planting on state owned lands, as assessed through the MTI, have already been planted during the previous phases of the WIP; and reflects planting implementation supported by the Trust Fund and without consideration of MS4 plantings as they are captured in the stormwater strategy. This estimated cost is based on the assumption that the trees will be planted by a contractor and will include site preparation as necessary, installation of tree protection, and some maintenance costs during the maintenance period, which may include replacement of dead trees.

B) Wetland restoration

Wetlands are highly valuable lands in terms of their abilities to improve water quality and provide important habitat for many species.

Phase II goal: Restore 555 acres to meet the 2011 milestone commitment, and 100 acres annually through 2017 (for a total of 1,155 acres)
2010 - 2018 progress: 4,601 acres
This total reflects wetland restoration supported by Trust Fund grants and wetland acreage gains reported to MDE's Wetlands and Waterways Program.

Phase III goal: 175 acres
Estimated cost: $875,000
Wetland restoration will also be achieved through stream restoration (see section E below). The 175-acre wetland goal is independent of any wetland restoration implemented through stream restoration projects.

C) Streamside forest buffers

Streamside forest buffers are linear wooded areas along rivers and streams that help filter nutrients, sediments and other pollutants from runoff. These buffers remove nutrients from groundwater and also provide both terrestrial and aquatic habitat.

Phase II goal: Increase streamside forest buffers by 645 acres by 2017
2010 - 2018 progress: 617 acres
This total is composed of buffer plantings from the MTI, plantings supported by Trust Fund grants and plantings reported to MDE for MS4 permit compliance.

Phase III goal: 350 acres
Estimated cost: $3,587,500
This goal was developed to reflect the fact that the opportunities identified for buffer planting on state owned lands, as assessed through the MTI, have already been planted during the previous phases of the WIP. The width of the streamside forest buffer is critical to its function. Where possible, larger buffers (100 feet) should be prioritized to provide maximum water quality benefits, as well as other ecosystem services. Stream migration is likely to increase with the incidence of large storms; larger buffers provide additional room for changes in channel course. Forest buffers will also be achieved through stream restoration (see section E below). The 350-acre buffer goal is independent of any buffer plantings implemented through stream restoration projects.

D) Natural filters on other public lands

Phase II goal: Increase partnerships with state agencies, nonprofits, universities, local governments and the federal government to explore potential for natural filter implementation on their lands.
2010 - 2018 progress: An inventory of natural filters opportunities on state lands was performed in support of the Phase I WIP. The opportunities identified were further investigated and those that were able to be implemented were completed. Examples of programs involving multiple state agencies include the MTI, in which DNR partnered with the State Highway Administration (SHA) and the Maryland Department of Public Safety and Correctional Services (MDPSCS) to plant trees on land owned or managed by DNR. DNR has also supported tree planting on county-owned lands through Trust Fund grants. All acreage planted on public lands through these programs is reported as part of sections A and C above.

Phase III goal: Continue working with state and local land managers to build partnerships for natural filter implementation.

E) Stream restoration

Stream restoration refers to a suite of practices used to improve the function of degraded streams, including natural channel design, regenerative stormwater conveyance (RSC), and legacy sediment removal. The water quality benefits attained through a stream restoration project depend on the project design and may be credited through prevented sediment, instream denitrification, floodplain reconnection and dry channel RSC as a retrofit. Stream restoration has become a popular technique to improve water quality and make progress towards MS4 permits and county WIP goals; the Trust Fund supported 6 miles of stream restoration on public lands between 2010 and 2018, the majority of which was on county lands. In addition, approximately 3 miles of stream restoration along Piney Run is being implemented through a partnership between DNR, SHA, and the Maryland Department of Health (the land owner) as part of the first phase of a multi-phase restoration initiative.

Phase III goal: 6 miles
Estimated cost: $22,207,680

F) Living shorelines (Shoreline Management)

The living shoreline technique used to protect, restore, enhance or create natural shoreline habitat through the application of erosion control measures. Living shorelines may include the use of fiber coir logs, sills, groins, breakwaters or other natural components in combination with soil substrate (such as sand) and marsh plantings. Shoreline erosion is a natural process, and living shoreline practices should only be pursued if they will maintain sand movement, nutrient cycling and natural shoreline dynamics as opposed to solely armoring against erosion.

Phase III goal: 3,000 linear feet
Estimated cost: $1,800,000

G) Oyster aquaculture

An adult oyster can filter up to 50 gallons of water daily. In doing so, it helps to improve water quality by assimilating nutrients into its tissue and shell, removing sediment particles from the water column, increasing the availability of bioavailable nitrogen to bacteria and depositing particles that may become buried on the bottom. Oyster aquaculture (shellfish farming) will be pursued through this strategy on state-owned bottom.

Phase III goal: 350,000 total bushels with a per year implementation (Table B-4).

Table B-4: *Recommended harvest of oysters from 2019 to 2025.*

Year	Recommended Harvest (Bushels)
2019	5,000
2020	25,000
2021	30,000
2022	45,000
2023	65,000
2024	85,000
2025	95,000

Estimated cost: $17,500,000
The cost for oyster aquaculture reductions will be distributed among public and private entities. For example, the Oyster Recovery Partnership has received a Trust Fund grant to develop an oyster cooperative to create and implement a revolving fund to support sustainable oyster harvest and reduce nutrients in the Chesapeake Bay. The revolving fund will create a self-sustaining and long term structure linkage between economic development, sustainable management and water quality restoration.

Key Challenges and Opportunities

Natural filters practices have many co-benefits or "ecosystem services." Forests and wetlands are home to a variety of flora and fauna and restoring forests, wetlands, and streams can create new habitat for these species, or improve upon existing habitat. Outdoor recreation is a significant economic driver in Maryland, with this industry contributing $14.4 billion per year in spending to the state's economy (Outdoor Industry Association 2018 report). A significant benefit of using natural filters is the impact they have on the local hydrology. Natural filters in watersheds surrounding drinking water reservoirs improve local water quality, decreasing the cost of treating the water that over 60 percent of Marylanders rely on for drinking water. Natural filters also increase groundwater recharge, helping to ensure streams do not go dry during low flow seasons or periods of drought, and store rainfall in soils, lessening the need for human-made stormwater infrastructure. In estimated quantities, the natural filters practices

implemented between 2010 and 2018 reduce 6.7 billion gallons of surface runoff and allow for 1.4 billion gallons of groundwater recharge every year. They also take up nearly 3,000 tons of carbon per year, helping Maryland meet its GHG reduction goals.

Funding and partnerships

There are a number of funding programs and partnerships that will help to make progress towards the Phase III strategy goals:

- Trust Fund - Managed by DNR on behalf of the State of Maryland, the Trust Fund issues an annual solicitation for efficient and cost effective projects that reduce nonpoint source pollution. Some of the projects funded each year are natural filters practices on local public land. In addition, a portion of the annual Trust Fund budget is specifically focused on natural filters projects. When reviewing proposed projects they are evaluated on their ability to be credited and reported for annual progress implementation.
- DNR and SHA Memorandum of Understanding (MOU) - These two state agencies initiated a MOU in October 2016 to facilitate the implementation of water quality projects on state lands owned or managed by DNR that SHA can use towards its permits. A MOU that extends to all Maryland Department of Transportation units is being developed.
- DNR Land Acquisition and Planning (LAP) Programs - LAP uses a targeting approach for the Program Open Space program that considers restoration opportunities. Opportunities for natural filters identified could be implemented on parcels that are purchased. A similar approach could be applied to the Rural Legacy Program.
- Community Resilience Grant Program (CRGP) - Managed by DNR, the CRGP provides funding support to Maryland communities to help them become more resilient to climate hazards related to flooding. A portion of the funding made available through this program is for the design of nature-based projects, including living shorelines.
- Regional Greenhouse Gas Initiative - Proceeds from emission allowances sold at quarterly options could be partially invested in land based carbon sequestration practices like tree planting or agricultural practices, as is done in some other states that participate in RGGI. However, this is not currently done in Maryland and would likely require amendment of the current laws governing the fund allocation.

There are also opportunities to further explore the science around restoring healthy aquatic communities or keystone species and how that can help increase nutrient uptake and reduce delivered loads. Calculating nutrient reductions from oyster aquaculture is the first foray into this arena, but many living resources in Chesapeake Bay (e.g., submerged aquatic vegetation, menhaden) and its freshwater tributaries (e.g., mussels, benthic macroinvertebrates) have the ability to consume and sequester nutrients directly or indirectly. Developing science-based methods to account for and quantify these nutrient co-benefits of healthy aquatic systems may offer additional cost effective solutions to Bay restoration.

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- DNR Parcel Evaluation Tool: geodata.md.gov/greenprint/
- Fielddoc: fielddoc.org/
- Watershed Resources Registry: watershedresourcesregistry.org/

Phase III WIP Septic Strategies

Septic Upgrades

Maryland has two main programs for implementing BAT septic upgrades. First, upgrades are funded through the state's BRF Septic Fund, and second, BAT treatment is required on all new systems in the Critical Area. It is important to note that a portion of the BRF Fee paid by households on septic systems is used to pay for cover crops.

The department will continue to pay for BAT upgrades through the BRF Septic Fund. Funding priority is ranked based on six categories: (1) failing OSDS in the Critical Area, (2) failing OSDS outside the Critical Area, (3) non-conforming[22] OSDS in the Critical Area, (4) non-conforming OSDS outside the Critical Area 5) other OSDS in Critical Area, including new construction 6) other OSDS outside Critical Area, including new construction. All installations and subsequent operation and maintenance of nitrogen reducing units are tracked by MDE's WSA Wastewater Permits Program in a secure database.

Regulations mandate any new construction of a septic system or repair of a septic system within the Critical Area must utilize BAT. Within the Chesapeake Bay watershed, the Critical Area covers land located within 1,000 feet of the tidal waters. This land is deemed to be of crucial importance to the health of the Bay, and due to its proximity the delivery of nitrogen from OSDSs has been estimated to be much greater than from systems located higher up in the watershed. Septic systems located outside the Critical Area are not required to install BAT units, however a significant level of BAT implementation is still being done in these areas through the BRF Septic Fund.

Maryland's BAT Technical Review Committee (TRC) currently lists a variety of pre-approved manufacturer units capable of reducing nitrogen discharged into a septic system by 50 percent or greater. The BAT TRC continues to review newer technologies to include in the pre-approved categories. In addition, the TRC has approved additional reduction by utilizing BAT units in concert with particular OSDS that are capable of reducing nitrogen effluent by 30 percent, hence increasing the total nitrogen reduction to 80 percent or greater.

From 2016-2018 Maryland spent roughly $10.1 million annually for roughly 1,000 BAT units installed (BRF 2018). Maryland's Water Quality Trading Program allows non-required septic upgrades to be

[22] systems that do not conform with current regulations

installed to generate nitrogen credits. It is intended that this will act as an additional driver of septic implementation.

Septic Strategy 1: Provide incentives for OSDS upgrades to BAT

Maryland will continue to implement septic upgrades through its BRF Septic Fund. This strategy estimates implementation of 1,000 upgrades per year and assumes an average reduction of 5.5 pounds per year per household, yielding an annual reduction of 5,500 pounds of nitrogen per year delivered to the Bay. Over a seven-year period, 2019 to 2025, this will result in a reduction of 40,000 pounds of nitrogen.

Septic Strategy 2: Require BAT for systems installed in the critical area

Maryland will continue to require that new OSDSs in the Critical Area use BAT treatment. It is estimated that on average approximately 200 systems are installed per year, yielding average per household reductions of 7.5 pounds per year. Cumulatively this results in 10,000 pounds per year prevented by 2025.

Septic Strategy 3: Accelerate BAT through WQ trading

Maryland will promote using septic upgrades as a mechanism for generating credit to meet NPDES permit requirements. We acknowledge that there will be a reduction; however, that reduction will be used to meet NPDES permit requirements so no estimate figure is provided here.

Septic Connections

Maryland has invested over $1.2 billion in ENR upgrades for wastewater treatment plants, and by 2022, around 98 percent of the state's wastewater treatment capacity will be operating at this high treatment level. In order to maximize the benefit from this investment, the state must continue to pursue opportunities to connect additional septic systems to sewers. On average, from 2016 to 2018, 100 onsite sewage disposal systems were connected annually to sewer (BRF Advisory Committee 2018). And from 2016-2018 Maryland spent roughly $1.3 million annually per roughly 100 septic connections (BRF 2018). The anticipated annual load reduction per household connected to sewer is a slightly over 8 pounds of nitrogen delivered to the Bay, with an average cost below $100 per pound[23] (CBP 2017, MDE 2016). Accelerating the pace of connections is a priority in this phase of the WIP, and Maryland is pursuing several options to achieve this. For example, the funding and approval process has been streamlined, which is anticipated to generate increased interest for public sewer connections for areas with problem sewage disposal systems. One project of note is on southern Kent Island, where 1,500 systems are being connected to sewer.

The state is specifically pursuing sewer connection opportunities for campgrounds, mobile home parks and Bermed Infiltration Ponds (BIPs). BIPs are above-ground facilities that typically serve multiple

[23] mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Documents/Data_and_Tools/BMP_Unit_Cost_Estimates_Phase_5-3-2.xlsx

homes. Beyond connections to existing sewer systems, the management action may involve replacing the existing treatment facility with a different treatment system such as a package plant[24].

The state will continue working directly with county governments and officials to increase the number of connections statewide. Implementation of this strategy is time consuming, as it requires extensive local planning and significant funding allocations. There are also many communities that cannot be connected to sewer due to local zoning and "no growth" sewer lines. Annual reductions will continue to be modest at a statewide scale, but on a finer scale these projects can provide significant nitrogen reductions in rural watersheds with few other nutrient sources. Perhaps more importantly, the public health impact at this level can be substantial.

Septic Strategy 4: Connect households on OSDSs to sewer

This strategy assumes that septic connections to sewer will occur at a pace of 300 systems per year. This equates to reductions of 2,400 pounds per year, or 16,800 pounds by 2025. These connections will be funded through a combination of funding sources, including the BRF Wastewater Fund and state Revolving Loan Fund. There is expected to be a small phosphorus increase of less than 100 pounds associated with this work. Maryland will look for opportunities to accelerate this work, and update projections in its two-year milestones accordingly.

Septic Strategy 5: Pursue higher-level treatments systems

Maryland will continue to investigate the use of *in situ* and *ex situ* treatment, as described in the 2014 report, Recommendations of the Onsite Wastewater Treatment Systems Nitrogen Reduction Technology Expert Review Panel, including elevated sand mounds and shallow-placed pressure-dosed dispersal. Where possible, the state will develop crediting mechanisms through its permits or trading program to incentivize these practices.

Septic Strategy 6: Pursue additional reduction strategies for "high-benefit" reductions

Maryland will continue to investigate additional septic strategies for addressing septic loads that provide a maximum benefit, either in terms of cost effectiveness for nitrogen removal or non-nutrient impacts, including public health and drinking water quality. Examples of potential opportunities include focusing on BIPs, mobile home parks and campgrounds, as opportunities to fund sewer connections or construct package plants or other small wastewater treatment facilities. The state is not projecting load reductions for this strategy in this document; however, a review of alternatives will be conducted and an adaptive management approach will be conducted through the two-year milestone process.

Septic Stewardship Plans and Septic Pumping

Recent legislation (HB1765 2018) makes funding available to county governments that adopt Septic Stewardship Plans. Septic Stewardship Plans must describe jurisdictions' goals, consistent with the WIP

[24] Package plants are pre-manufactured treatment facilities used to treat wastewater in small communities or on individual properties. According to manufacturers, package plants can be designed to treat flows as low as 0.002 MGD or as high as 0.5 MGD, although they more commonly treat flows between 0.01 and 0.25 MGD (Metcalf and Eddy, 1991).

nitrogen reduction goal and describe funding mechanisms to support the plan. To get credit for septic pumping under this plan, OSDS tanks must be pumped on a routine cycle. Based on numbers from P6 CAST, the anticipated annual load reduction for pumping an OSDS is about 0.4 pounds of nitrogen per household. The law also allows for financial assistance to homeowners for the cost of pumping out a septic system. Currently, county-based programs are too varied to provide an estimate of the annual cost of pumping across the state. The Septic Stewardship Plans provide a mechanism for local jurisdictions to develop plans that incorporate local priorities targeted toward goals beyond nitrogen reductions. For example, at the jurisdiction's discretion, a plan could be written to focus on subsurface source water protection zones.

Several counties already have voluntary rebate incentive programs to encourage OSDS pumping. Through the adoption in local codes one county (Queen Anne's County) already requires OSDS pumping every five years and that compliance documentation be provided to local officials.

Septic Strategy 7: Incentivize Septic Pumpouts

Maryland will continue to offer credit to incentivize septic pumpouts. It is anticipated that the state will credit 10,000 pumpouts per year. Estimating a household reduction of 0.4 pounds per system, the total reduction is 4,000 pounds.

Key Challenges and Opportunities

Currently MDE has programs with individual databases pertaining to septic discharges, groundwater discharge permits and BAT OSDS systems. Development of one integrated database could ensure that information is represented in the intended manner.

Staffing at the state and local level continues to be a challenge for septic implementation. The process of evaluation of OSDS requires education, experience and a unique crossover of science, engineering and public health, generally by Licensed or Registered Environmental Health Specialists. The industry standards exist for this career path, however lack of outreach and financial incentives limit interest in this field of work. MDE operates the OSDS/BAT program with personnel trained in identifying problems with individual systems but also relies on county government officials with the same background to implement septic regulations in the same manner. Expanding the awareness of the employment series through outreach would improve the staffing issues and the counties to the benefit of the entire program.

Long-term strategy

The 2008 Final Report of the Advisory Committee on the Management and Protection of the state's Water Resources, known as the Wolman Report (Wolman, 2008)[25], provides a bedrock synthesis related to protecting water supplies, and many of these ideas are brought forward in this section. The state must continue to pursue the implementation of recommendations from this document particularly those with the potential to drive nitrogen reductions in the OSDS sector. At a glance, the Wolman Report provides guidance on prioritizing issues related to funding, climate change and growth; and more specifically on issues such as long term monitoring, public health initiatives and infrastructure resilience.

[25] mde.maryland.gov/programs/Water/water_supply/Documents/WolmanReport_Vol1.pdf

MDE programs that currently intersect with the management of the OSDS sector include: (1) permitting, (2) compliance of installation and repair data, (3) stormwater, (4) wetlands, (5) water supply and (6) TMDL planning. A cooperative outlook on management will also serve to support other fact finding ventures. Concurrent to the development of the Phase III Chesapeake Bay WIP, the Integrated Water Planning Program at MDE is developing a technical directive with Tetra Tech to assess elements that influence the impact of OSDS on nitrogen loading and co-benefits. While the WIP accounting is based on nutrient load reductions, resulting in nitrogen reductions driving the implementation in the OSDS sector, it is becoming increasingly apparent that only focusing on nitrogen reductions from the OSDS sector (at the exclusion of co-benefits) is not a cost effective process for reducing nutrients to the Chesapeake Bay. These co-benefits include: (1) protecting public health, (2) improved source water quality, (3) reduced water treatment costs in rural Maryland, (4) critical infrastructure resilience, (5) MS4 permit and trading credit and (6) improved property values.

Strategies for co-benefits

Existing federal groundwater protection programs are spread across roughly eight distinct parts of Title 40 of the Code of Federal Regulations (EPA Groundwater Issues). These programs provide a network of mechanisms for data collection on the activities impacting groundwater and the subsurface environment. Through the Groundwater Protection Program under the Safe Drinking Water Act, the Water Supply Program at MDE has emphasized preventative measures to avoid public health issues (MDE 2013). These data collection activities authorized by the Safe Drinking Water Act need to be refined and refocused, so that they can be functional in an increasingly real-time planning environment.

Groundwater management driven by source water protection requires monitoring data. In the state of Maryland, there have already been a series of documents that have called for additional monitoring resources to be developed to effectively and sustainably manage groundwater supplies (MDE 2013). In order to support these data collection efforts, there could be innovative fee structures based on water appropriation (MDE 2013). Regardless of how a monitoring program is supported, it is becoming increasingly evident that this type of data collection is critical to protecting public health. Examples of why this is critical are: (1) the expansion of groundwater recharge zones for community groundwater supplies and (2) the increasing uncertainty as to whether new and emerging contaminants of concern (potentially mobilized in septage) could be materializing in water withdrawals due to wider subsurface cones of depression (MDE 2013).

One near-term possibility to begin to focus data collection activities on protecting public health is to encourage subsurface source water protection zones be written into septic stewardship plans (MDE 2013). This should include a jurisdictional analysis of the cost of water treatment at community and private groundwater wells. Including source water protection zones in septic stewardship plans would lead to local jurisdictions managing their resources with higher resolution data, with guidance and data compilation being provided at the state level by MDE.

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Stormwater Sector

Background

Streams in Maryland's urban areas are consistently found to have degraded biology due to stressors driven by impervious surfaces, such as altered hydrology, morphology, and water chemistry, as well as increased water temperature and sedimentation. Unsightly trash and debris, and fecal bacteria pollution can also make urban streams unsuitable for recreation and other uses. Because these problems are linked to stormwater and the urban landscape, a healthy aquatic ecosystem cannot be restored without specifically mitigating the impacts of legacy impervious surface areas.

Local jurisdictions, including counties and municipalities, have developed ordinances and enforcement programs to implement and approve stormwater practices for new development and redevelopment, and the Maryland Department of the Environment (MDE) reviews these local programs to ensure consistency with state law and regulations. Stormwater practices implemented for new development and redevelopment on state or federal lands are approved by MDE. Older developments (pre-2000) generally do not have water quality practices in place to control stormwater runoff and mitigate associated pollution impacts. To address stormwater from these older developments, Maryland's NPDES Municipal Separate Storm Sewer System (MS4) permits require that stormwater restoration practices be applied to impervious surfaces (roads, parking lots, roof tops, etc.) that have not been treated to the maximum extent practicable. The MS4 permit restoration requirement represents Maryland's key strategy for addressing nutrients and sediment pollution associated with stormwater runoff that impacts both Chesapeake Bay and non-tidal waters.

Trends

According to EPA's Chesapeake Bay watershed model estimates (Phase 6 CAST), nutrient loads from impervious surfaces and lawns—collectively referred to as urban stormwater loads—accounted for 17.4% of Maryland's 2017 nitrogen loads to the Bay and 18.3% of phosphorus loads. Compared with the nutrient reductions from the state's farms and wastewater treatment plants, the pace of progress in reducing urban stormwater loads is slower. While controls to address stormwater pollution cannot be rapidly deployed, they are a critical piece of Maryland's long-term plan for restoring the Bay and its non-tidal waters.

Several factors limit the pace of implementation in the urban sector. First, management practices that address stormwater pollution generated by impervious surfaces must be dispersed throughout the watershed instead of building a single facility at one centralized location as in the case of a wastewater treatment plant. Second, most stormwater restoration practices must be designed and permitted, so a significant planning effort is needed for each individual practice. Further, land for these practices must be identified and potentially acquired. This can impose significant costs, or require private landowner

permission, in addition to any construction expenses. These planning requirements and capital costs mean that staffing and municipal budgets limit the rate of progress.

Another challenge is the heterogeneity of urban nutrient sources, which include air deposition, lawn fertilizer, erosion, and leaking sanitary pipes. The result is that no single source control initiative can fully address all sources. Therefore, the restoration activities for the urban sector are not limited to traditional stormwater practices, like bioretention and wet ponds, but also cover alternative practices[26] such as street sweeping, reforestation on urban land, stream restoration, and shoreline management.

Recognizing the multiple water quality impacts from stormwater means that care should be taken to select specific restoration practices that provide both a nutrient reduction benefit for the Bay as well as address other important local stressors. This is a departure from previous planning exercises where cost-benefit was optimized by finding the least expensive approach for reducing only nutrients and sediment. A different way to maximize the impact of money spent on stormwater management is to expand the benefit across multiple water quality objectives. When assessing the cost-benefit of a stormwater strategy, selecting and placing practices that maximize the number of pollutants treated becomes more important. Most of this watershed-scale and site-level planning is done at the county or municipal level, not by the state. One of the state's key roles is building broad flexibility into the MS4 permits so that jurisdictions can select the most appropriate suite of stormwater management practices to address local problems.

Furthermore, with increased intensity and frequency of rainstorm events, sea level rising, and flooding occurring on a more regular basis, climate change impacts and how they affect stormwater quantity and quality must also be considered in this restoration process. When upgrading infrastructure to handle today's environmental concerns, consideration must also be given to how these practices will operate in the future, and whether they make the state more resilient to climate change.

Maryland is committed to adapting its stormwater program in response to climate change by establishing an emergency dam repair fund and a revolving loan dam fund for maintaining critical stormwater management infrastructure and dams. By maintaining these structures, the state is also preventing further loss of nutrients and sediments that would continue to occur if these facilities were left unmaintained or failed. Maryland is also committed to making programmatic changes in the future to its erosion and sediment control and stormwater programs by funding academic research into the latest climate science that can inform design guidelines for increased precipitation events. Maryland has begun this work by engaging with the state university system to perform downscaled precipitation modeling, the results of which may help to inform design guidelines.

The slower pace of restoration progress in the urban stormwater sector relative to wastewater and agriculture means that stormwater discharges will make up a larger proportion of the state's nutrient loads by 2025 - approximately 20% and 19% of the nitrogen and phosphorus loads, respectively. Reduction opportunities outside the stormwater sector will concurrently decrease, and stormwater management will become a more important part of Maryland's nutrient reduction portfolio. The result is that maintaining the statewide target pollution levels after 2025 will require continuing stormwater management implementation. The long lead time for putting practices in the ground means that a stormwater

[26] Alternative practices from MDE's Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated Guidance document (MDE, 2014)

management program cannot be quickly ramped up, and in order to provide regulatory certainty beyond a five-year planning horizon, it is important for this WIP to establish a long-term pace of implementation.

Phase III WIP Stormwater Strategies

The stormwater strategies described in this section rely on a sustained pace of implementation, recognizing that the arc of restoration will need to continue well beyond 2025 and a single permit cycle. The practices that are installed today may remain on the landscape for decades or more, and the importance of choosing the right options cannot be overstated. This means an even greater focus on the quality of practices, in terms of the full environmental benefit they provide, in terms of how they enable Maryland's communities to adapt to a changing climate and in terms of limiting the annual maintenance they will require.

Maryland's NPDES Stormwater Permits and Other Stormwater Management Programs

Impacts from flow-driven stressors (e.g., sediment, bacteria) in urban watersheds are required to be mitigated under the state's MS4 permits. Maryland has developed dozens of TMDLs for nutrients, sediment, and other pollutants in its streams and lakes that assign waste load allocations (WLAs) to permitted stormwater dischargers. According to the CWA, permitted discharges must be consistent with the assumptions and requirements of available WLAs. Maryland's MS4 permits accomplish this by requiring restoration plans for impervious surface areas and TMDL WLAs, with the former establishing a pace of restoration and the latter establishing a water quality based framework for measuring progress. Since many of the practices that improve stream health also reduce the load of nutrients reaching the Bay, stormwater controls for nontidal TMDLs are essential components of Maryland's WIP. More information on stormwater restoration practices can be found in Maryland's Accounting for Stormwater Wasteload Allocations and Impervious Acres Treated guidance document.

Individual MS4 Permits

The previous (fourth-generation) Phase I MS4 permits established a rate of restoration equivalent to twenty percent of the untreated impervious area within the jurisdiction. To support the development of the next generation (fifth-generation) Phase I MS4 permits (see figure SW-1) the Department considered what pace of implementation can reasonably be expected in each five-year permit term, including limitations on the physical capacity to complete this level of work, i.e., staff, contractors, land availability, permitting delays. Additionally, as the inventory of stormwater management practices for each county increases, a greater share of its annual budget will need to be dedicated to operations and maintenance. This approach corresponds with the idea of local feasibility, or in the context of the CWA, the maximum extent practicable (MEP), instead of defining a restoration pace to meet specific allocations by 2025.

Recent MS4 implementation and trend analysis indicates that permittees (nine counties, Baltimore City and the State Highway Administration) should be capable of annually restoring two percent of their impervious surface areas that currently have little or no stormwater treatment. While this level of implementation will be used in the Phase III WIP analysis for estimating load reductions, the Department will continue to work with permittees on an MEP analysis that will indicate what is feasible. This MEP

analysis will take into consideration the physical and financial capacity of a jurisdiction to perform restoration, and the need for making significant and continual progress toward Bay and local water quality improvements. Permittees will also have the flexibility to meet a portion of their restoration requirements through water quality trading. It is anticipated that significant restoration requirements will be maintained in the sixth- and seventh-generation permits through subsequent MEP analysis that will be conducted at the outset of each permit term to update the pace based on the latest information available. Figure B-4 below depicts Maryland's MS4 permitted areas.

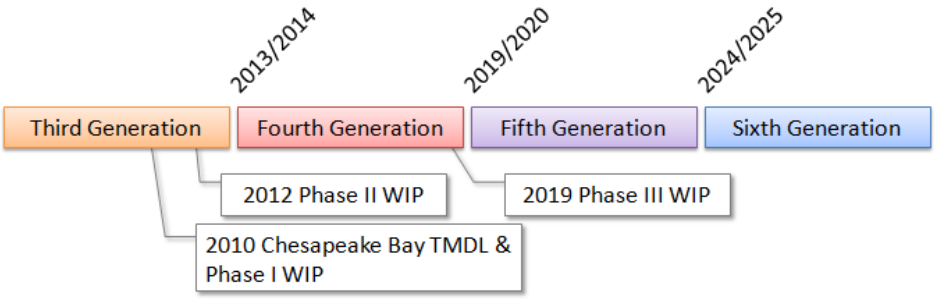


Figure B-4: *Chronology of Maryland's Phase I MS4 Permits.*

Maryland's eleven Phase I MS4 permittees include the State Highway Administration, Baltimore City and the state's nine most populous counties—Anne Arundel, Baltimore, Carroll, Charles, Frederick, Harford, Howard, Montgomery, and Prince George's. SHA's current (fourth-generation) permit covers discharges from storm sewers that the agency owns or operates in the state's Phase I and Phase II MS4 jurisdictions (Figure B-5).

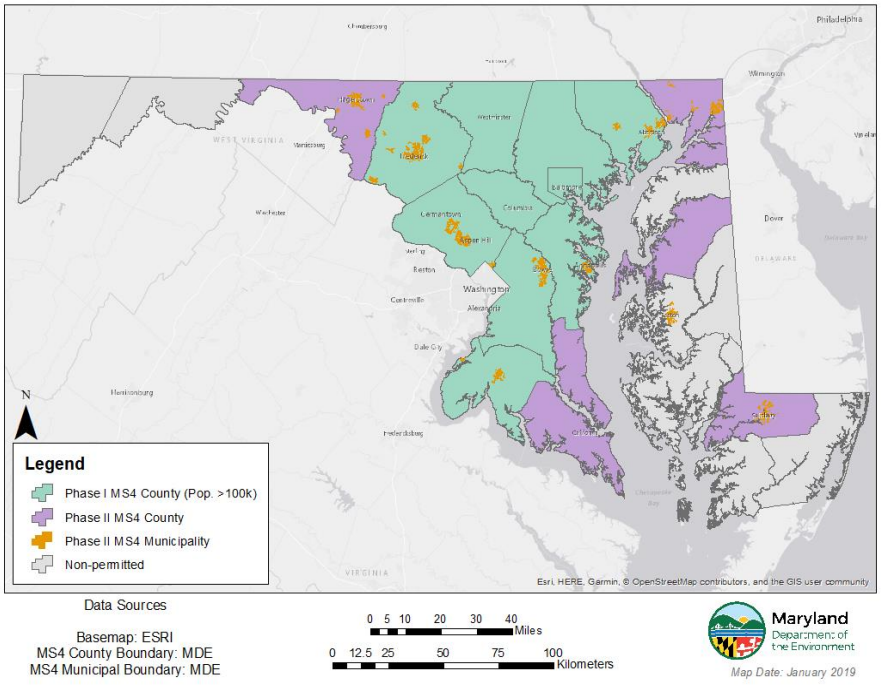


Figure B-5: *Phase I and Phase II MS4 permitted areas in Maryland.*

SW Strategy 1: Complete any remaining retrofit requirement from fourth-generation Phase I MS4 permits that was achieved through water quality trading

The fourth-generation Phase I MS4 permits required restoration of twenty percent of the untreated impervious area within the jurisdiction. Any MS4 jurisdiction that meets its fourth-generation permit restoration requirements through water quality trading will need to complete its twenty percent restoration requirement through stormwater practices in its subsequent MS4 permit, anticipated to expire in 2024. These practices include those listed in the 2014 Accounting Document (or subsequent updates) as Runoff Reduction (RR) practices, Stormwater Treatment (ST) practices, or Alternative Urban practices.

SW Strategy 2: Maximum Extent Practicable retrofit of untreated impervious acres in fifth-generation Phase I MS4 permit

Recent MS4 implementation and trend analysis indicates that permittees (nine counties, Baltimore City and the state Highway Administration) should be capable of annually restoring two percent of their impervious surface areas that currently have little or no stormwater treatment. Based on untreated impervious acre baselines established in the fourth-generation permits, there were 172,000 acres of untreated impervious acres. The Department will work with MS4 jurisdictions to determine what is the MEP for retrofitting impervious acres in fifth-generation permits. Permittees will also have the option of using water quality trading for meeting a portion of their restoration requirements.

SW Strategy 3: Maximum Extent Practicable retrofit of untreated impervious acres in sixth-generation Phase I MS4 permits

The sixth generation Phase I MS4 permits should maintain a similar level of effort to the fifth generation permits. This will represent additional significant impervious surfaces restoration over the permit period. Because the permit will not be issued until mid-2024, only a small fraction of the work will be completed by 2025.

General Stormwater Permits and laws

Phase II General MS4 permits

Two Phase II general MS4 permits took effect in October 2018, one covering *counties and municipalities* with a population of under 100,000 and the other covering *federal and state stormwater dischargers*, apart from SHA. The permits adopted a framework similar to the one set up for the Phase I permittees, with a twenty percent retrofit requirement of untreated impervious areas. Permittees must plan to have this restoration work in place by 2025. These two permits cover nearly 20% of the state's developed impervious land, which together with the Phase I permittees, result in almost 90% of Maryland's developed impervious acres being under an NPDES stormwater permit with a restoration requirement. Several of the Phase II permittees have already established dedicated funding mechanisms to support their restoration work, including Gaithersburg, Rockville, Salisbury, and Takoma Park.

SW Strategy 4: Twenty percent retrofit of untreated impervious acres in second- and third-generation Phase II permits for small MS4s

Maryland's second-generation NPDES General Permit for small MS4s, MDR055500, was effective on October 31, 2018. Under this permit, six counties and 29 towns and cities are to "develop planning strategies and work toward implementing water quality improvement projects" to restore twenty percent of their "existing developed lands that have little or no stormwater management" by 2025. As of the writing of this plan, the permittees have not yet submitted to MDE their impervious area estimates, but a preliminary analysis of untreated impervious areas in these municipalities estimated 55,000 acres. Twenty percent equates to 11,000 acres of restoration, or the equivalent, by 2025. A portion of these reductions may be achieved through water quality trading.

SW Strategy 5: Twenty percent retrofit of untreated impervious acres in second- and third-generation Phase II permits for state and federal MS4s

Maryland's second-generation NPDES General Permit for state and federal small MS4s, MDR055501, was effective on October 31, 2018. Under this permit, state and federal permittees are to "develop planning strategies and work toward implementing water quality improvement projects" to restore twenty percent of their "existing developed lands that have little or no stormwater management" by 2025. As of the writing of this plan, the state and federal entities have not yet estimated their impervious areas, but a rough estimate of untreated impervious acres for this permit is 20,000 acres. Twenty percent equates to 4,000 acres of restoration, or the equivalent, by 2025.

General Stormwater Permits

In addition to these two newer Phase II general MS4 permits, two other general stormwater permits have been established since the development of the Phase II WIP. These general permits also include requirements to address nutrient discharges and their impacts on the Bay. First, the *general permit for industrial stormwater dischargers*, effective 2014, created a restoration requirement for retrofitting twenty percent of the permittees' untreated impervious areas, consistent with the Phase I MS4 permits. Second, the 2014 *stormwater permit for construction activities* specifies that fertilizer applications on construction sites must comply with statutes from Maryland's Fertilizer Use Act of 2011.

Maryland's Fertilizer Use Act, described in detail in the Phase II WIP, applies not just to construction sites, but to all applicators of fertilizer to non-agricultural turf. Among other requirements, it stipulates a certification and licensing program for professional applicators and restricts commercial applications of nitrogen and phosphorus fertilizer both in quantity and seasonal timing. For fertilizer purchased by homeowners, phosphorus is banned, except in specific cases such as starter or organic fertilizer, and concentrations of nitrogen are capped. The Chesapeake Bay Program's Expert Panel on Urban Nutrient Management found decreases in phosphorus and nitrogen in lawn fertilizer sold in Bay states between 2006 and 2010, and it is expected that an analysis from USGS to be published in 2019 will show further reductions.

SW Strategy 6: Complete restoration requirement under industrial stormwater general permit

Under the 2014 and subsequent General Permits for Discharges from Stormwater Associated with Industrial Activities, permittees will complete and maintain their retrofit requirements of 20% of their untreated impervious surfaces. Any new permittees will be expected to meet these conditions.

SW Strategy 7: Continue application of erosion and sediment control and fertilizer management requirements in construction stormwater general permit, and include the option of using polymers to decrease turbidity

Under the 2014 General Permit for Stormwater Associated with Construction Activity, erosion and sediment controls (ESC) were specified that are consistent with Level 2 ESC in the Chesapeake Bay Program's 2014 report, Recommendations of the Expert Panel to Define Removal Rates from Erosion and Sediment Control Practices. The upcoming permit will include the option for permittees to use polymers to reduce turbidity.

Non-MS4 Jurisdictions

While the impact of the fertilizer law should be seen across Maryland, the installation of practices to manage stormwater continues to be a challenge outside of jurisdictions covered by stormwater permits. However, only a fraction of the state's pre-2000 developed impervious acreage—about ten percent based on an analysis of spatial data used for P6 CAST development—is not covered under an MS4 permit. Nevertheless, there are many locations in these areas with the potential for significant nutrient reductions. First, because fewer restoration projects have been installed in these jurisdictions, many common and low cost opportunities are still available. The jurisdictions are also less space limited than the more highly-developed portions of the state, meaning that land acquisition is potentially less expensive. Finally, the location of impervious areas adjacent to agricultural fields, also provides a potential to treat large nutrient loads from both land uses with the same BMPs. There is not enough urban land, however, for this to be a large driver of statewide reductions. Additionally, the budgets needed to support a large-scale effort, similar to that of the MS4s, would be difficult to fund. Accepting that overall reductions will be limited, the impetus then is to fund the projects which provide a substantial individual benefit per dollar spent, including nutrient reductions, ecosystem health, and societal benefit.

Under the Phase III WIP, projects in non-MS4s will continue to be funded by many of the same mechanisms as under Phase II. The Bay Restoration Fund (BRF) and the Chesapeake and Atlantic Coastal Bays Trust Fund will continue to offer funding for qualifying projects. Other smaller funding mechanisms, such as the 319 Nonpoint Source Grant Program and the Chesapeake Bay Trust, provide funding as well. Two new programs were recently created that could potentially fund these types of projects. The Clean Water Commerce Act (CWCA) budgets a maximum of $10 million annually in state fiscal years 2020 and 2021 to purchase low cost nutrient and sediment reductions through a reverse auction framework, where credits are purchased from the lowest-bidding seller. Maryland's Water Quality Trading Program (WQTP) currently allows MS4 jurisdictions to achieve a portion of their restoration work outside of their counties, as long as they are in contiguous Bay watershed segments. A non-MS4 county sharing a watershed with an MS4-permitted county, for example, could install a

stormwater practice and trade the reductions to the MS4 county to help them in meeting their restoration requirement.

The state of Maryland hosted its Fall 2018 WIP Regional Workshops and used those sessions as opportunities to get local feedback about WIP implementation. Non-MS4 jurisdictions consistently mentioned a lack of funding and staff as barriers to putting projects in the ground. Several programs are currently in place to address the shortfalls in staffing and technical expertise, such as the five Maryland Sea Grant Extension Watershed Specialists, and the Regional Watershed Services Manager hired under Chesapeake Bay Program's Innovative Nutrient and Sediment Reduction grants program, but the state may need to consider ways to build off of the success of these programs. In terms of money, new ways to fund projects should be pursued, including by modifying existing funding programs or using them in innovative ways, or by developing new funding streams as necessary. Roadside ditch management projects, for example, could yield cost-effective reductions by treating impervious and agricultural runoff collectively, thereby elevating urban projects in the rankings for state funding. Alternatively, expanding the geographical area to SHA road systems that are in unpermitted rural areas but in the same Bay watershed segments as MS4 permitted road systems could open opportunities to accelerate restoration progress. Finally, during the Fall 2018 WIP Workshops, some local practitioners raised concerns that are critical to the sustainability of this restoration process. For example, while counties and municipalities are required to inspect stormwater facilities owned by Homeowner Associations (HOAs) and ensure that they are being maintained, the proliferation of smaller ESD to the MEP practices is making these local administrative tasks more onerous. Advances in stormwater management design that can reduce maintenance costs will become increasingly important.

SW Strategy 8: Implementation of stormwater practices in non-MS4 jurisdictions

The state will continue to offer grants for stormwater pollution controls and will look for opportunities to improve its programs to accelerate implementation in areas not covered by stormwater permits. Improvements, like the ones described above, may include refinements to grant funding procedures, growth of the WQTP, and the provision of additional technical staff support at a local level.

In order to best serve local communities and fund projects that address water quality, community resilience and climate impacts, the state is issuing a Common Application that will leverage funds for water quality restoration through the Chesapeake and Atlantic Coastal Bays Trust Fund, with other state and federal funds available through the Resiliency Restoration Program, Coastal Zone Management Program with NOAA, and the Chesapeake Bay Implementation Grant with EPA. This Common Application will increase accessibility to state financial resources while promoting integrated projects that improve water quality and protect critical infrastructure.

SW Strategy 9: Continue to minimize impact of stormwater pollution from new development through implementation of programs such as Environmental Site Design and the Forest Conservation Act.

Through the administration of the Stormwater Management Act of 2007 and the 1991 Forest Conservation Act, Maryland will continue to minimize the increases of nutrient loadings from new development. The Stormwater Management Act requires that Environmental Site Design be

used on new development, with the objective of replicating the hydrology of woods in good condition. The Forest Conservation Act specifies that a portion of forest on new development be retained or replanted.

Stormwater Sector Challenges and Opportunities

As discussed throughout Maryland's WIP, climate change impacts and how they affect water quantity and quality must also be considered in this restoration process. One potential approach that can be used to achieve climate resilience co-benefits, until better science and technology are available to address impacts of climate change, is the use of Continuous Monitoring and Adaptive Control (CMAC) systems. To be successful, these systems need to be fully integrated in a comprehensive stormwater management retrofit that includes water quality features and dam safety considerations. CMAC technology alone does not improve water quality or quantity management.

Opportunities exist for wider application of low-cost, priority practices with high co-benefits that are most effective if widely applied across the landscape, such as tree canopy (40% goal statewide), forest buffers (70% goal Bay wide), and rain gardens. Examples of existing funded programs for tree plantings include Healthy Forests/Healthy Waters rural residential tree planting (competitive grants from the Chesapeake and Coastal Bays Trust Fund), Backyard Buffers giveaway bags of 15-30 tree seedlings (federal Chesapeake Bay Implementation Grants), Marylanders Plant Trees $25 coupons, and tree planting cost-share from the Mel Noland Woodland Incentive Program for rural residential tree planting. Challenges are expanding funding to meet continued demand as familiarity with and interest in the programs spread, expanding eligibility more broadly across the landscape, having consistent funding that builds confidence in participation, and developing partnerships that can leverage limited state staff.

Technical Assistance in the Stormwater Sector

There is broad support and need in Maryland for enhanced technical assistance delivery to low-capacity communities, especially for stormwater management. In 2018 regional meetings to gather feedback from local partners for the Phase III WIP, Maryland state agencies frequently heard that a lack of adequate technical assistance is a clear barrier to maximizing nutrient reduction potential, particularly in non-MS4 jurisdictions. Choose Clean Water Coalition (January 2019) also identified information and technical expertise deficiencies in many local jurisdictions, and recommended more assistance to local governments in identifying existing available financial resources, communicating needs to state and Federal partners, and connecting local governments with potential partners in the private and nonprofit sectors.

Maryland Sea Grant Extension's team of five watershed restoration specialists (WRS) continues to work with local governments, citizen groups, and individuals to improve water quality across Maryland. Extension recommends (January 2019) expansion of this technical assistance delivery system to help counties and communities comply with water quality goals and improve the Bay. Participants at a forum (September 2018) held by the Local Government Advisory Committee to the Chesapeake Bay Executive Council recognized the effective and successful model of Maryland's Watershed Assistance Collaborative, which includes the WRS, but acknowledged that to meet the needs of communities throughout the state, greater capability to supplement or build local capacity is needed.

Participants in the 2015 Healthy Waters Round Table (report) identified the need to support existing local staff with extra capability to accelerate WIP implementation on the Eastern Shore. A 2017 National Fish and Wildlife Foundation grant to the Chesapeake Bay Foundation (CBF), matched by MDE and six local Eastern Shore jurisdictions, began to address this need. The grant funds a pilot project to develop increased stormwater management capacity and facilitate a collaborative regional structure among cities and towns using a circuit rider model. In suggestions for Maryland's Phase III WIP (February 2019), CBF noted that investments in local planning and implementation capacity remain an unmet need that could be filled by additional effective targeted or shared technical assistance.

Maryland will continue to investigate enhanced technical assistance delivery for stormwater management implementation. In addition, MDE will look for more opportunities to directly provide specialized assistance to local partners, through the WRS and other circuit riders.

Wastewater Sector

Background

The wastewater sector of the Phase III WIP covers discharges of treated municipal wastewater and industrial process water, as well as releases of untreated effluent from sewer collection systems. Wastewater is the second-largest source of nutrient pollution in Maryland, currently accounting for approximately 21% of the nitrogen that the state contributes to the Chesapeake Bay. Although septic systems are used to treat wastewater, strategies to address the pollution contribution from septic systems are discussed separate in this report (See Septic Section on page B-20).

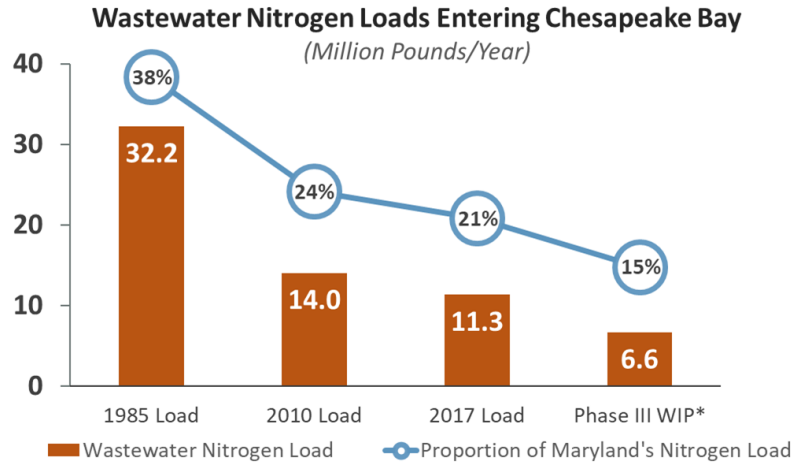
In 2005, states in the Chesapeake Bay region began to implement a new wastewater permitting process that limited the amount of nitrogen and phosphorus that significant wastewater treatment plants in the region could discharge. The term significant point sources discussed in this document means a subset of all municipal and industrial point sources located in the Chesapeake Bay watershed that have been identified by EPA and its partner jurisdictions as either discharging significant amounts of nitrogen and phosphorus. To meet the nutrient limits, and with the establishment of Maryland's Chesapeake Bay Restoration Fund in 2004, municipal facilities in the state are being upgraded with nutrient reduction technology, including biological nutrient removal (BNR) and enhanced nutrient removal (ENR).

In the Phase II WIP, the largest nitrogen load reductions from any sector, about 5.5 million pounds/year, were attributed to the point source sector. Of that amount, the greatest reductions were to be achieved by upgrading significant municipal wastewater treatment plants. These plants, defined as having discharge flows of 0.5 million gallons per day or greater, make up about 95 percent of the municipal wastewater flow.

Maryland has been a leader addressing pollution reduction in the wastewater sector and was the first state in the Chesapeake Bay region to commit to implement this state-of-the-art technology on the state's 67 largest wastewater treatment plants, accounting for 95% of our wastewater flow.

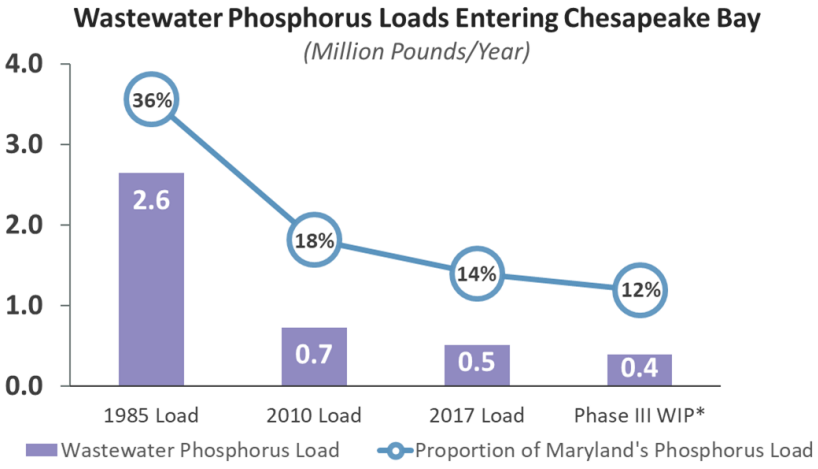
Trends

Reductions in annual nutrient loads from wastewater sources have been substantial, and between 1985 and 2017, nitrogen and phosphorus loadings dropped by over twenty million and two million pounds, respectively. The figures below show the reductions to date, as well as those projected to occur by 2025. For both nutrients, the wastewater contributions are anticipated to drop from over a third of the state's annual total load, to less than a sixth. A major future challenge for this sector is that having reduced loads so significantly to date and with the additional anticipated reductions by 2025 (Figures B-6 and B-7), opportunities for further pollution reductions will be more limited.



Source: Maryland Phase III WIP Scenario; CAST 2019

Figure B-6: *Nitrogen loading trends in Maryland since 1985.*



Source: Maryland Phase III WIP Scenario; CAST 2019

Figure B-7: *Phosphorus loading trends in Maryland since 1985.*

*****Phase III WIP reductions subject to change upon EPA review.

Phase III WIP Wastewater Strategies

For the strategies described below, the reduction estimates are calculated using a 2018 baseline year, which follows Maryland's 2018 fiscal year: July 1, 2017 to June 30, 2018.

Significant Publicly-Owned Treatment Works Upgrades

The upgrade of Maryland's largest publicly-owned treatment works (POTWs) to enhanced nutrient removal (ENR) tertiary treatment technology has been, along with agriculture, one of the main drivers of Maryland's WIP reductions. In 2004, the Bay Restoration Fund (BRF) was established as a funding mechanism for these projects, and Maryland has been able to deploy them quickly relative to the magnitude of the reductions they achieve. Upgrades are cost-effective, with per pound nitrogen reductions costing less than $100[27], and while they do not provide the broad array of ecosystem benefits that are expected to result from other sectors, such as stormwater implementation, reductions from upgrades are highly certain and immediate. End-of-pipe monitoring, reported through Discharge Monitoring Reports, assures that facilities are operating as designed. Wastewater treatment plants are a relatively small contributor of sediments to the Bay, with 2017 CAST results showing the sector accounting for one tenth of a percent of the statewide load; therefore, it is not expected that wastewater upgrades will yield a significant reduction of sediment loads with respect to Bay water quality.

ENR, as defined in Maryland Code is a technology capable of reducing nitrogen to 3 mg/L and phosphorus to 0.3 mg/L. This is lower than previous technologies in the state like secondary treatment and Biological Nutrient Removal (BNR), which are expected to achieve nitrogen concentrations of 18 mg/L and 8 mg/L, respectively. The state defines "significant" POTWs as those with design capacities of 0.5 million gallons per day or above. There are six[28] federal and 66 non-federal significant POTWs in the state discharging to the Bay, plus Blue Plains Wastewater Treatment Plant, which is located in Washington, DC but receives municipal effluent from Maryland. The BRF has budgeted $1.2 billion for the 67 non-federal POTW upgrades.

Wastewater Strategy 1: Complete remaining ENR upgrades for non-federal significant POTWs through the Bay Restoration Fund

The Phase II WIP described strategies for both the federal and non-federal POTWs. All 67 of the non-federal POTWs were planned to be upgraded with the Bay Restoration Wastewater Fund (BRF-Wastewater). Between 2006, when the first ENR upgrades went online, and the end of 2018, the state completed 59 of the BRF-funded upgrades, with over 85% of its 715 MGD capacity operating at ENR. The remaining eight BRF-funded facilities are scheduled to be

[27] .chesbay.us/Publications/cost%20effective.pdf

mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Documents/Data_and_Tools/BMP_Unit_Cost_Estimates_12.23.2016.pdf

.mde.maryland.gov/programs/Water/TMDL/TMDLImplementation/Documents/Data_and_Tools/BMP_Unit_Cost_Estimates_Phase_5-3-2.xlsx

[28] Appendix F of the Phase II WIP lists permit MD0023523, US Naval Academy (now Naval Support Activity Annapolis WWTP) as a significant federal POTW, however, the facility flow capacity was downgraded to 0.3 MGD (from 0.7 MGD) at the request of Navy during the latest permit renewal. Due to the lack of adequate size 24 hour holding pond for shellfish protection, the facility is prohibited to discharge more than 0.15 MGD until an adequate holding pond is built. As for the commitment for ENR upgrade, Navy had signed a consent decree issued by EPA in late 2018 (document attached) agreeing to build an ENR facility to meet the nutrient requirements in the current discharge permit.

complete by the end of 2022 —The City of Westminster WWTP, Conococheague WWTP, Frederick City WWTP, Freedom District WWTP, Hampstead WWTP, Maryland Correctional Institution WWTP, Patapsco WWTP and Princess Anne WWTP. These plants account for around 100 MGD of the state's total capacity and should provide a nitrogen load reduction of around 4 million pounds per year and a phosphorus reduction of 100,000 pounds per year. The majority of the reductions—above 95 percent—will come from the upgrade of Patapsco WWTP which is scheduled to be complete in 2019. Funding for these projects has already been allocated through the BRF.

Wastewater Strategy 2: Complete the remaining federal significant POTW ENR upgrade

Maryland had also issued permits to the significant federal POTWs requiring them to meet ENR permit limits, and to date, five of the six have completed their upgrades. The five facilities that have been upgraded are: Naval Support Facility Indian Head, APG, APG Edgewood Area, Fort Detrick, and Fort Meade.

The remaining federal ENR upgrade is for the USDA East Side WWTP, which is currently under construction and the treatment process is expected to be complete before 2025. The anticipated nitrogen and phosphorus reductions are 3,000 pounds per year and 300 pounds per year, respectively.

Non-Significant POTW Upgrades

While the upgrades to larger POTWs are scheduled to be complete by 2022, Maryland continues to fund upgrades to POTWs with design capacities below 0.5 million gallons per day, called non-significant municipal facilities. At the end of 2018, five BRF-funded minor POTWs were in operation in the Bay watershed, with eleven more planned for completion by 2025. When complete, these five facilities should provide annual reductions of approximately 50,000 pounds of nitrogen and 10,000 pounds of phosphorus. These reductions represent less than one percent of the planned wastewater reductions from 2010 to 2025, however, they are cost effective relative to other structural practices[29]. Furthermore, since minor POTWs are typically located in rural watersheds, they may be the only local opportunity for permitted reductions. Beyond the BRF-funded upgrades, four other minor plants are operating at ENR treatment, bringing to twenty the total number of planned projects. At the end of 2018, funding was still available for additional non-significant POTW upgrades, so the number of completed projects for 2025 may exceed the estimate here.

Wastewater Strategy 3: Complete eleven remaining ENR upgrades for non-significant POTWs through the BRF, and continue to pursue additional upgrade opportunities

Eleven non-significant POTWs are scheduled to either be upgraded to ENR, or replaced with an ENR facility by 2025. These are: Betterton WWTP, Chesapeake City WWTP, Elk Neck State Park, Hancock Wastewater Lagoon, Harbourview WWTP, Oxford WWTP, Preston WWTP,

[29] A structural stormwater best management practice (BMP) is defined in the as a stationary and permanent BMP that is designed, constructed and operated to prevent or reduce the discharge of pollutants from stormwater or any other pollution source sector.

Trappe WWTP, Twin Cities WWTP, Tylerton WWTP and Victor Cullen WWTP. These upgrades are anticipated to provide a nitrogen reduction of 25,000 pounds per year and a phosphorus reduction of 5,000 pounds per year. Funding for these projects has already been allocated through the BRF.

POTW Upgrades and Performance Incentives

As is shown in the figure B-8 below, the average nitrogen effluent concentration for POTWs in Maryland has dropped from 18 mg/L in 1985 to 7 mg/L in 2017.

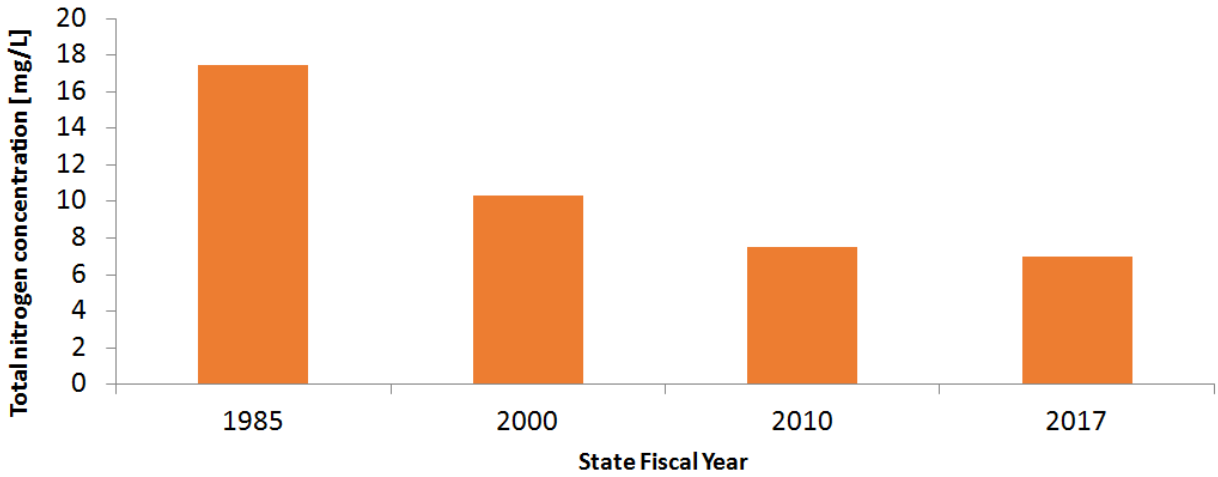


Figure B-8: *Historic average nitrogen discharges from municipal plants in Maryland's portion of the Chesapeake Bay watershed.*

Average nitrogen concentrations from the upgraded POTWs can be reduced to 3.0 mg/L or below. Maryland has performed a statewide nitrogen reduction analysis that shows that by achieving an average nitrogen concentration of 3.25 mg/L in the significant POTWs as an aggregate, the state will be able to meet its overall statewide target.

Currently, Maryland has several mechanisms in place to reach lower than permit limits effluent concentrations in ENR facilities. First, NPDES permits for significant POTWs require plants to operate below 4 mg/L on an annual basis, a requirement that is consistent with the allocations established under the 2010 Chesapeake Bay TMDL. Second, there are three programs in place to incentivize POTWs to achieve concentrations lower than 4 mg/L of nitrogen in their effluent—BRF Wastewater Fund Operations and Maintenance (O&M) Grants, the Clean Water Commerce Act (CWCA) and the Water Quality Trading Program (WQTP).

1) BRF O&M Grants are available to POTWs that achieve annual nitrogen and phosphorus discharge concentrations at or below 3 mg/L and 0.3 mg/L respectively. There has been strong participation in this program, and in FY2018, the BRF Wastewater Fund spent $4.8 million on grants to 41 qualifying facilities.
2) Under the CWCA, facilities can submit bids to sell nitrogen, phosphorus and sediment reductions to the BRF. Funds are disbursed annually based on a ranking process that prioritizes proposals offering the lowest cost per pound of reduction. To qualify to sell nitrogen reductions, POTWs

must operate below 3 mg/L. The CWCA began in SFY 2018 and is funded through 2021, with $6M allocated for 2019, and $10M allocated in each of the remaining years. Through 2018, no POTW had submitted a bid or received funding through this mechanism.

3) Maryland established the WQTP in 2018, allowing NPDES permittees to meet and maintain pollutant load limits through the acquisition of credits generated by pollutant load reductions elsewhere in Maryland's portion of the Chesapeake Bay watershed as long as the trade does not cause or contribute to a violation of state water quality standards. POTWs at ENR are allowed to generate tradable credit by operating below 3 mg nitrogen/L, the same performance threshold as the CWCA. In early 2018, several facilities certified reductions, which were used to meet county or industrial SW MS4 permit requirements. It is important to note that these trades are considered temporary, as any required nutrient and sediment reductions achieved through trading would eventually need to be met through appropriate stormwater practices.

Between 2019 and 2025, as part of the two-year milestones, Maryland will need to continue to assess the aggregate impact of these programs. With a number of large plants starting their ENR treatment processes, several years of additional discharge data will be necessary to assess the overall statewide performance. As is shown in Figure B-9, the largest three dischargers of wastewater from Maryland—Back River Wastewater Treatment Plant, Blue Plains Wastewater Treatment Plant and Patapsco Wastewater Treatment Plant— account for over half the state's capacity, meaning that a handful of plants have a significantly large impact on the state's overall loadings. If future participation in the programs above is not sufficient to meet the state's loading goals, consideration will need to be given to whether the programs need to be adjusted.

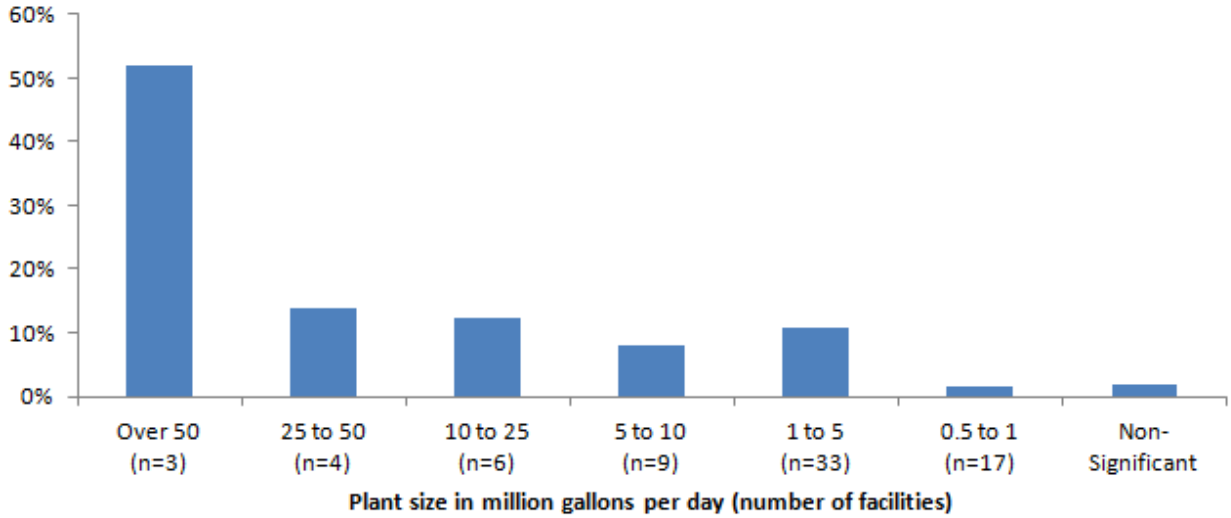


Figure B-9: *Percent of statewide flow capacity based on plant size.*

Wastewater Strategy 4: Continue to incentivize POTW performance to achieve lower nutrient discharge concentrations

Based on the feasible reduction commitments established by other source sectors to be achieved by 2025, Maryland will be able to meet its Phase III WIP targets if its significant POTWs reach an annual average nitrogen concentration of 3.25 mg/L. To help achieve this goal, and as described above, Maryland will continue to provide O&M grants to POTWs that discharge effluent concentrations below 3 mg/L of nitrogen and 0.3 mg/L of phosphorus. Funding of 10% of the BRF fee collected each year (roughly $10 million per year) has been allocated to O&M grants. In addition, through its administration of the CWCA and WQTP, the state anticipates that facilities will be further incentivized to lower their effluent concentrations. During subsequent milestone periods, Maryland will continue to assess its plant performance to determine whether the suite of incentives is sufficient to enable the state to meet its overall target. Using an anticipated statewide significant POTW annual flow of 600 MGD, each reduction of 0.25 mg/L in nitrogen concentration in plant effluent should yield a load reduction of 425,000 pounds per year. Continuing implementation in the other source sectors for additional reductions beyond 2025 remain a priority component of Maryland's WIP in combination with the performance goal for the POTWs.

Sewer and other Infrastructure Projects

Maryland is helping to finance a variety of sewer improvement projects through the BRF and through low interest loans offered through the Water Quality Revolving Loan Fund (WQRLF). These include projects to deal with combined sewer overflows (CSOs), sanitary sewer overflows (SSOs) and inflow and infiltration (I/I).

It is important to note that while the nutrient load reductions from CSO and SSO elimination are fairly small compared to the total project cost, the public health benefit of these projects can be substantial, with untreated sewage being directed toward a treatment plant rather than into Maryland's waters. CSOs represent approximately 0.2% and 0.4% of the total wastewater TN and TP loads to the Bay, respectively. SSOs represent approximately 0.1% and 0.4% of the total wastewater TN and TP loads to the Bay, respectively.

Combined Sewer Overflows

Combined sewer systems (CSSs) are collection systems that simultaneously collect sanitary sewage and surface runoff, and are designed to discharge to a treatment plant. During wet weather, CSOs may occur when a CSS's capacity is exceeded, resulting in the discharge of untreated waste directly to the environment. In Maryland, two approaches are being used to address CSOs—sewer separation, where the combined sewer is replaced with separate sanitary and storm sewer systems, and capture and treat, where a storage facility is constructed at the POTW to handle large inflow events.

Since the Phase II WIP, the CSO in Cambridge has been eliminated, and the remaining five CSOs in the state— Allegany County, Cumberland, Frostburg, LaVale and Westernport—are all located in western Maryland. Consent Decrees and Long Term Control Plans (LTCPs) are in place for all of the CSOs, and all are scheduled to be finished by 2023.

WW Strategy 5: Address CSOs through the implementation of LTCPs

Four of the remaining CSSs in Maryland, Allegany county, Frostburg, LaVale and Westernport will be addressed through sewer separation projects and the remaining combined sewer in Cumberland, will be addressed with a storage facility (a capture and treat system). These projects are all covered by LTCPs and are scheduled to be complete by 2023. The Chesapeake Bay Watershed Model estimates that CSO loads of 20,000 pounds per year of nitrogen and 2,000 pounds per year of phosphorus will be eliminated as a result of this work.

Sanitary Sewer Overflows

SSOs in Maryland are being addressed through Consent Decrees (CDs) with Baltimore City, Baltimore county and the Washington Suburban Sanitary Commission (WSSC). These CDs prescribe enhanced programs such as sewer cleaning and inspections, and measures to address illicit connections, roots and oils.

The CD covering Baltimore City's SSOs requires the city to address deficiencies in its sewer system contributing to SSOs by 2030. The majority of this work will be completed by 2025, with the completion of the Back River WWTP Headworks Project in 2021. Wastewater is currently conveyed to the Back River WWTP through an aging interceptor pipe which can cause ten-mile-long sewer backups leading to overflows into Jones Falls. The Headworks Project, estimated by Baltimore City to cost $430M, will improve sewage flow by replacing the pipe with a more modern system that includes eight pumps and new screening and grit removal facilities. It is anticipated that the volume of overflows will decrease by over 80 percent by 2021, with the remainder to be addressed by 2030. Because SSOs are a violation of the Clean Water Act, their elimination is not given TMDL credit, however reductions from SSO elimination should reduce, while small, real nutrient loads to the Bay beyond what is estimated in the model, in addition to provide public health benefits. The annual reduction from the Baltimore City SSO project is anticipated to be less than 20,000 pounds of nitrogen and 2,000 pounds of phosphorus annually.

WW Strategy 6: Address SSOs through Consent Decrees

There are currently CDs with Baltimore City, Baltimore county and WSSC to address SSOs. Eighty percent of the overflow volumes from Baltimore City are scheduled to be addressed by 2021, with the remainder of the overflows to be eliminated by 2030. The implementation of sewershed repair and replacement plans under the Baltimore county CD are scheduled to be completed by 2020[30]. Remedial measures under the WSSC SSO CD are required to be in place by 2024[31]. A portion of the sewer improvements in Baltimore City will be funded through the BRF, while the majority of funding will come from local sources, including using loans through the WQRLF. Actual nutrient reductions from the SSO work are anticipated to be around 11,100 pounds per year of nitrogen and 2,000 pounds per year of phosphorus, however, because SSOs

[30] resources.baltimorecountymd.gov/Documents/Public_Works/consentdecreefinal.pdf#page=35

[31] wsscwater.com/files/live/sites/wssc/files/PDFs/Final_CD_w_Signatures_1010853.pdf#page=20

wsscwater.com/business--construction/sewer-repair-replacement--rehabi/sanitary-sewer-overflow-consent.html

are illegal, and a violation of the Clean Water Act, reduction credit from these projects will not be counted toward the WIP.

The third category of BRF-funded sewer rehabilitation is I/I projects, which aim at reducing water entering sanitary sewers through cracks or leaks in the sewer pipes or through inappropriate connections. These flows can be significant, especially in older collection systems, with some plants attributing up to a quarter of their flows to I/I. Lowering the influent flows to POTWs reduces effluent discharges, yielding a corresponding decrease in loads. Due to weather fluctuations and uncertainty involved in remediating buried infrastructure, it is difficult to forecast the impact of planned I/I work, so no anticipated reductions are being estimated in this report. Given the high levels of I/I however, these reductions are likely to be substantial.

WW Strategy 7: Continue to fund I/I projects

Maryland continues to upgrade and rehabilitate its sanitary sewer infrastructure through the BRF, addressing inflow and infiltration of stormwater and groundwater into the sewer collection system. Due to the highly variable nature of the annual flows and the challenges of forecasting the impacts of future projects, no planned credit from these projects will be included in the WIP.

Industrial Facilities

Significant Industrial Facilities

For Maryland's eight significant industrial facilities, the Phase II WIP strategy adopted the individual loading allocations identified in Maryland's 2008 Tributary Strategies. As of the end of 2018, five of the facilities had nutrient targets written into their permits consistent with the Phase II WIP and another facility is anticipated to have its permit issued with nutrient targets in 2019. Of the remaining two facilities, one, the Maryland and Virginia Milk Producers Cooperative Association has transferred its flow and allocation to the Little Patuxent Water Reclamation Plant, as was described in Appendix F of the Phase II WIP. The other permit (NPDES number MD0001201) was last issued to ISG Sparrows Point, Inc., which has changed its operations from a steel plant (now dismantled) to a treatment plant operation for stormwater and potentially other new and legacy sources.

WW Strategy 8: Complete the issuance of permits to significant industrial dischargers with nutrient limits consistent with the Phase II WIP

Under the Phase III WIP Maryland's significant industrial facilities will maintain the targets assigned to them in the Phase II WIP. The associated nutrient load reduction identified under the Phase II WIP for these facilities has been achieved. Maryland will continue to issue significant industrial permits consistent with the Phase II WIP, however, since the load has already been achieved, no additional reductions will be required in the Phase III WIP.

Non-Significant Industrial Facilities

The Phase II WIP identified 1,038 non-significant industrial facilities with permits to discharge nutrients or with the potential to discharge nutrients into Maryland's surface waters, including estimates of nutrient discharges for each facility. Based on these loading estimates, the Phase II WIP specified a 15.6 percent

reduction in nitrogen discharges from non-significant industrial sources between 2009 and 2017 and a 33 percent reduction to 2025. Maryland committed to further refine its estimates of loads from these facilities, a project that was completed in 2013. The improved data was used to calibrate the Phase 6 Chesapeake Bay Watershed Model, and is used to assess annual progress. In order to meet the WIP reductions, for the issuance of new permits, the state has proposed loading targets and reduction schedules where appropriate. Under the Phase III WIP, Maryland will continue to work toward its Phase II WIP goal.

WW Strategy 9: For non-significant industrial facilities, continue to propose NPDES permits that will include loading targets and schedules for reductions

In the Phase II WIP, Maryland committed to a 15.6% reduction of non-significant industrial end-of-pipe nitrogen loads by 2017 and a 33% reduction by 2025. By 2017, non-significant industrial nitrogen loads had decreased by 18.7 percent, or 100,000 pounds per year end of pipe. Meeting the Phase II WIP target will yield an additional reduction of 75,000 pounds per year end of end of pipe. This corresponds to a 60,000 pound reduction to the Bay. No narrative phosphorus reduction goal was established in the Phase II WIP, however, the reductions from phosphorus have already exceeded 50 percent. No further phosphorus reductions will be anticipated in the Phase III WIP.

Another driver of reduced costs and accelerated pollution reduction implementation from industrial facilities is water quality trading. Industrial facilities that adopt nutrient or sediment limits into their permits can be eligible to generate tradable credits. Maryland's first permit to allow for trading under the new regulations was issued to the Dundalk Marine Terminal in 2018. The permitted discharge covers water that is withdrawn from Baltimore Harbor and treated using an Algal Flow-Way Technology, a system that converts nutrients to algal biomass which can then be harvested. Since the WQTP program is less than one year old, it is not possible to anticipate the 2025 participation in the program; however, the state will continue to work closely with facilities interested in generating credits in order to encourage a robust water quality trading market.

Dredged Material Containment Facilities

The Maryland Port Administration (MPA) continues to operate two Dredged Material Containment Facilities (DMCFs) in Baltimore Harbor—Cox Creek DMCF and Masonville DMCF. Nutrient discharges from these facilities are covered under a single overlay permit issued in 2015, with allocations consistent with the Phase II WIP. The DMCF at Hart Miller Island is no longer receiving dredged material. While the facility continues to have regulated discharges, the nutrient loads are minimal. For DMCFs further from the harbor, including Poplar Island, the Phase III WIP will follow the strategy described in the Phase II WIP Appendix A.

WW Strategy 10: For any DMCF permit that is reissued, continue to maintain allocations consistent with the Phase II WIP

Active DMCFs have received permits consistent with the Phase II WIP. No additional reductions will be assigned in the Phase III WIP.

WW Strategy 11: Work closely with facilities interested in generating nutrient reduction credits in order to encourage a robust trading market

Maryland will continue to work with municipal and industrial facilities interested in entering the trading market. The WQTP is intended to be a driver of reduced costs and accelerated implementation of reductions toward the WIP, both accelerating and reducing the cost of implementation. Reductions from facilities required to meet their baseline will result in reductions toward the WIP, and for POTWs, these will be accounted for in WW Strategy 4, performance incentives. Trades used to meet NPDES permit requirements will be accounted for in the individual NPDES permittee reduction strategies.

Wastewater Sector Challenges

Adaptive management will be critical to maintaining Maryland's wastewater reductions. Plant performance will be continually assessed to verify that the suite of programs and incentives is effective in meeting wastewater targets. Funding programs, mechanisms, and processes will likewise be evaluated to ensure they support achievement of lower effluent concentrations in ENR facilities.

A robust trading market for municipal and industrial treatment facilities could provide additional incentive to lower discharge concentrations. Beyond 2025, continuing implementation in other source sectors, especially stormwater and septic, is necessary in combination with the performance goal for the POTWs.

Appendix C. Local Sector Goals

During the development of the Phase III WIP, the state expended substantial effort to reach out to local government staff, nongovernmental organizations (NGOs), and the interested public to lay out their strategies for meeting 2025 TMDL targets and to ask for feedback on the framework for creating a feasible and balanced approach to creating goals for each jurisdiction, by sector. As part of this process, the state solicited feedback from all parties involved to come up with a plan for 2025 that could likely be implemented within the given timeline.

This section includes plans that were developed among local government, NGOs, and the public to determine 2025 sector goals by county. The sectors include agriculture, developed, septic, and wastewater. We anticipate that over time, the plans will become even more refined as new information, new technologies and additional resources are brought into the planning process. The successful completion of these plans will depend on the full availability of funding and personnel resources.

Agriculture

MDA held individual meetings in 2018 with each of the SCDs that included state and local staff as well as private citizens to establish its proposed Phase III WIP goals. The plan that was created went above and beyond the goals that the agricultural sector established for the Phase II WIP and will rely on continued support to maintain the high pace of BMP implementation and verification that is needed to ensure this sector will meet its goals.

Developed

MDE and MDP participated in one-on-one meetings with county staff in 2018 and participated in a series of follow-up discussions to create local goals for the developed sector, which includes stormwater and those practices associated with meetingMS4 permit goals. These goals reflect a current understanding of each jurisdiction's plan to meet both permit, where applicable, and WIP goals for 2025.

It is anticipated that these goals will change with the availability of additional input from more public outreach, improved reporting of existing BMP data, enhanced verification programs and additional resources brought to this sector.

Regional Meetings

MDA, MDE, MDP, and DNR all participated in a round of six regional meetings that were open to industry and citizenry as well. The results of the meetings were collated and distributed by the Harry Hughes Center for Agroecology in late 2018.

WIP Goals Summaries

The following section reflects changes to the local WIP goals that were provided during the state's 2018 fall regional WIP outreach meetings. It is our current understanding of what each jurisdiction's feasible goals are based on providing adequate resources. This includes providing funding and staff support at an

optimal level incentivize increased restoration efforts and to maintain existing pollution abatement practices and strategies.

County Phase III WIP Goals Summary

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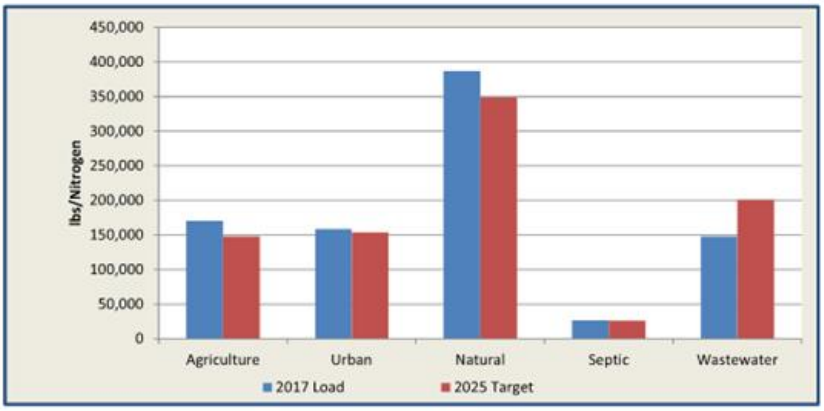
ALLEGANY

Sector	2025Nitrogen Reduction Goal
Agriculture	-22,778
Urban[1]	-5,062
Natural[2]	-38,745
Septic[3]	-414
Total Reduction	**-66,999**

Sector	2025 Target[4]
Wastewater	**201,090**



Notes:

1. This goal was built using impervious surface treatment strategies identified in the county's MS4 Financial Assurance Plan for meeting current Phase I MS4 permit requirements, with some assumptions made by MDE. This is a conservative estimate of county goals for the PIII WIP.
2. Reductions in the "Natural" Load Source sector can be attributable to urban and Agricultural Stream Restoration
3. These reductions were built using septic data provided in the 2017 Annual Progress scenario from County and Bay Restoration Fund (BRF) databases. They use past performance to predict a potential opportunity for implementation efforts in the future.
4. Sector targets for wastewater are expressed in overall loads that need to be maintained, not reductions, because of the accounting & planning mechanisms used in MDE's 2025 Strategy.
5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	8	systems
Septic Denitrification	56	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	420	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	3	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	1	acre-feet
Stormwater Treatment	18	acres
Stormwater Treatment	9	impervious acres
Stream Restoration Urban	4,800	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	48	acres
Urban Forest Planting	48	acres
Urban Nutrient Management Plan	5,700	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	30	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	7	50	Acres
Cover Crop - Commodity	206	206	Acres/Year
Cover Crop - Traditional	581	581	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	594	Acres
Grass Buffers	0	30	Acres
Horse Pasture Management	23	60	Acres
Land Conversion (Cropland to Hay/Pasture)	54	300	Acres
Land Retire (Open Space)	49	515	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	5	5	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	2,085	5,000	Linear Feet
Prescribed Grazing	586	1,500	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	10,360	10,360	Acres/Year
Tree Planting	6	250	Acres
Wetland Restoration	23	25	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

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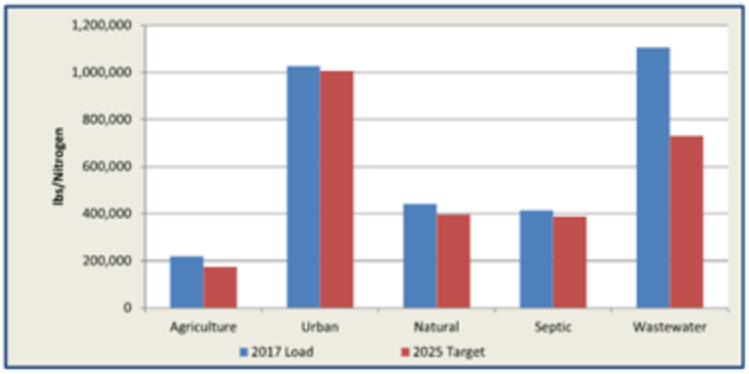
ANNE ARUNDEL

Sector	2025Nitrogen Reduction Goal
Agriculture	-45,392
Urban[1]	-20,200
Natural[2]	-44,127
Septic[3]	-26,817
Total Reduction	**-136,536**

Sector	2025 Target[4]
Wastewater	**730,690**



Notes:

1. This goal was built using impervious surface treatment strategies identified in the county's MS4 Financial Assurance Plan for meeting current Phase I MS4 permit requirements, with some assumptions made by MDE. This is a conservative estimate of county goals for the PIII WIP.
2. Reductions in the "Natural" Load Source sector can be attributable to urban and Agricultural Stream Restoration
3. These reductions were built using septic data provided in the 2017 Annual Progress scenario from County and Bay Restoration Fund (BRF) databases. They use past performance to predict a potential opportunity for implementation efforts in the future.
4. Sector targets for wastewater are expressed in overall loads that need to be maintained, not reductions, because of the accounting & planning mechanisms used in MDE's 2025 Strategy.
5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	403	systems
Septic Denitrification	2024	systems
Septic Tank Pumpout	6213	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	28	acre-feet
Runoff Reduction	704	acres
Runoff Reduction	352	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	249	acre-feet
Stormwater Treatment	6,286	acres
Stormwater Treatment	3,143	impervious acres
Stream Restoration Urban	204,609	feet
Street Sweeping	1,299	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	13,463	feet
Wet Extended Detention	270	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	100	126	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	80	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	17	48	Acres
Cover Crop - Commodity	1,138	1,138	Acres/Year
Cover Crop - Traditional	4,667	4,667	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	43	75	Acres
Grass Buffers	0	54	Acres
Horse Pasture Management	200	400	Acres
Land Conversion (Cropland to Hay/Pasture)	600	1,260	Acres
Land Retire (Open Space)	0	538	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	2	2	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	1,000	3,933	Linear Feet
Prescribed Grazing	672	1,500	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	14,000	14,000	Acres/Year
Tree Planting	10	200	Acres
Wetland Restoration	0	11	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

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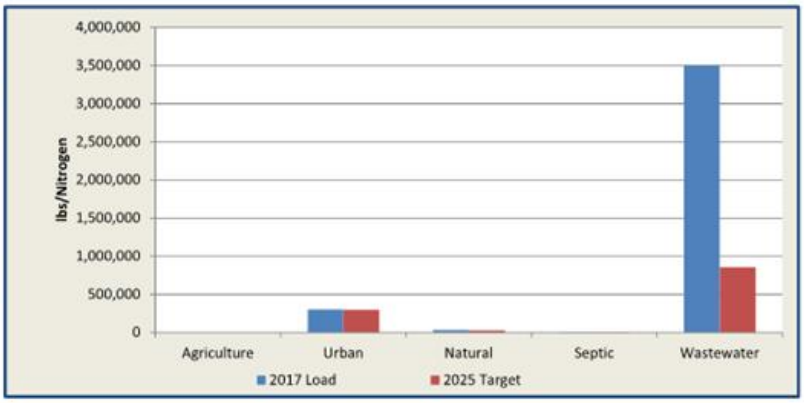
BALTIMORE CITY

Sector	2025Nitrogen Reduction Goal
Agriculture	0
Urban[1]	-3,799
Natural[2]	-3,147
Septic[3]	0
Total Reduction	**-6,946**

Sector	2025 Target[4]
Wastewater	**857,245**



Notes:

1. This goal was built using impervious surface treatment strategies identified in the county's MS4 Financial Assurance Plan for meeting current Phase I MS4 permit requirements, with some assumptions made by MDE. This is a conservative estimate of county goals for the PIII WIP.
2. Reductions in the "Natural" Load Source sector can be attributable to urban and Agricultural Stream Restoration
3. These reductions were built using septic data provided in the 2017 Annual Progress scenario from County and Bay Restoration Fund (BRF) databases. They use past performance to predict a potential opportunity for implementation efforts in the future.
4. Sector targets for wastewater are expressed in overall loads that need to be maintained, not reductions, because of the accounting & planning mechanisms used in MDE's 2025 Strategy.
5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	0	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	3	acre-feet
Runoff Reduction	88	acres
Runoff Reduction	44	impervious acres
Storm Drain Cleaning	315	lbs tn
Storm Drain Cleaning	126	lbs tp
Storm Drain Cleaning	37,800	lbs tss
Stormwater Treatment	173	acre-feet
Stormwater Treatment	4,361	acres
Stormwater Treatment	2,181	impervious acres
Stream Restoration Urban	78,020	feet
Street Sweeping	28,692	acres
Tree Planting	33	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	0	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	0	0	Acres
Cover Crop - Commodity	0	0	Acres/Year
Cover Crop - Traditional	0	0	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	0	Acres
Grass Buffers	0	0	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	0	0	Acres
Land Retire (Open Space)	0	0	Acres
Livestock Exclusion	0	0	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	0	0	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	0	0	Acres/Year
Tree Planting	0	0	Acres
Wetland Restoration	0	0	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

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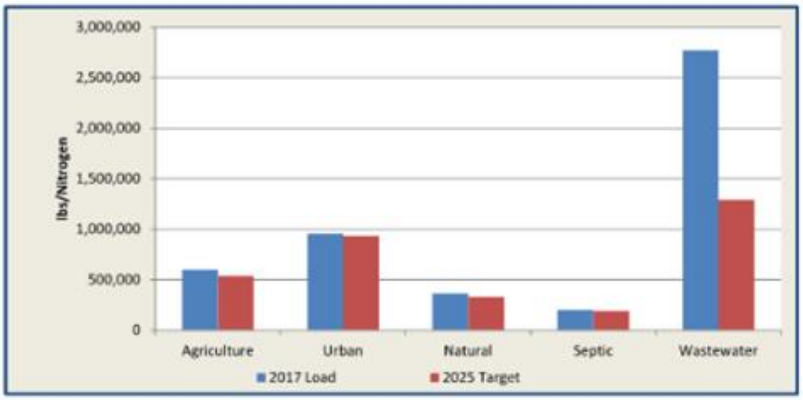
BALTIMORE

Sector	2025Nitrogen Reduction Goal
Agriculture	-59,926
Urban[1]	-21,487
Natural[2]	-36,329
Septic[3]	-13,553
Total Reduction	**-131,295**

Sector	2025 Target[4]
Wastewater	**1,292,486**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	888	systems
Septic Denitrification	376	systems
Septic Tank Pumpout	1956	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	2	acre-feet
Runoff Reduction	47	acres
Runoff Reduction	24	impervious acres
Storm Drain Cleaning	30	lbs tn
Storm Drain Cleaning	12	lbs tp
Storm Drain Cleaning	3,612	lbs tss
Stormwater Treatment	253	acre-feet
Stormwater Treatment	6,401	acres
Stormwater Treatment	3,200	impervious acres
Stream Restoration Urban	438,079	feet
Street Sweeping	2,852	acres
Tree Planting	171	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	16,956	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	50	50	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	80	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	33	Acres
Cover Crop - Commodity	3,514	3,514	Acres/Year
Cover Crop - Traditional	9,509	9,509	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	10	293	Acres
Grass Buffers	10	404	Acres
Horse Pasture Management	125	600	Acres
Land Conversion (Cropland to Hay/Pasture)	0	165	Acres
Land Retire (Open Space)	133	300	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	20,000	20,000	Linear Feet
Prescribed Grazing	48	450	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	40,000	40,000	Acres/Year
Tree Planting	0	47	Acres
Wetland Restoration	20	23	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

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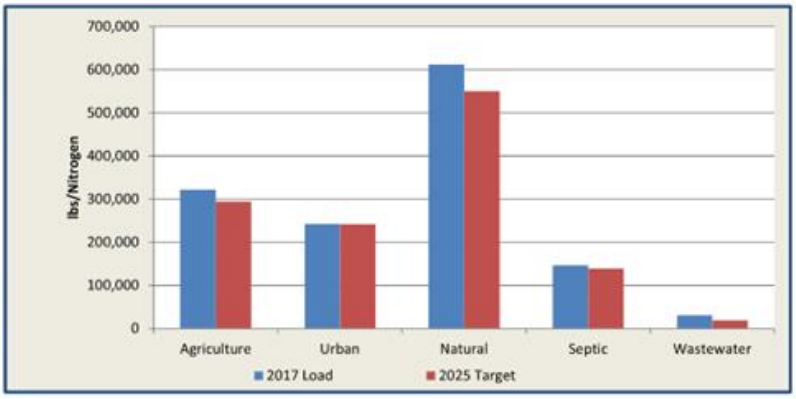
CALVERT

Sector	2025Nitrogen Reduction Goal
Agriculture	-28,037
Urban[1]	-291
Natural[2]	-61,169
Septic[3]	-8,166
Total Reduction	**-97,664**

Sector	2025 Target[4]
Wastewater	**19,119**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	960	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	720	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	3	20	Acres
Cover Crop - Commodity	1,000	1,000	Acres/Year
Cover Crop - Traditional	3,084	3,084	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	15	Acres
Grass Buffers	29	840	Acres
Horse Pasture Management	14	200	Acres
Land Conversion (Cropland to Hay/Pasture)	105	350	Acres
Land Retire (Open Space)	44	550	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	1	1	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	1,338	Linear Feet
Prescribed Grazing	191	725	Acres
Shoreline Protection	3,945	12,000	Linear Feet
Soil Conservation & Water Quality Plans	12,000	12,000	Acres/Year
Tree Planting	0	13	Acres
Wetland Restoration	17	120	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

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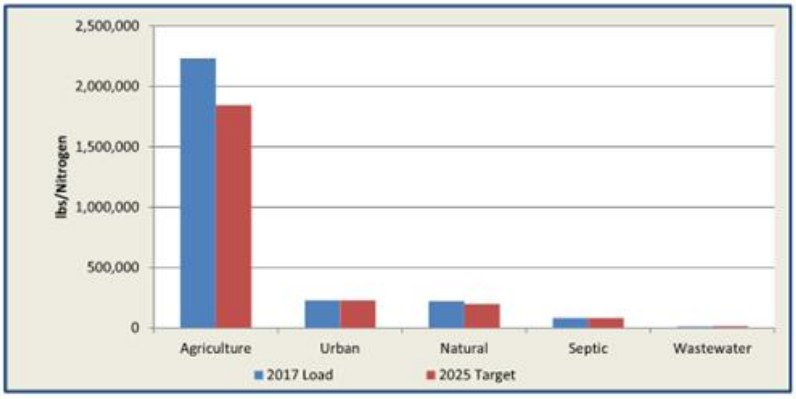
CAROLINE

Sector	2025Nitrogen Reduction Goal
Agriculture	-389,709
Urban[1]	-183
Natural[2]	-22,250
Septic[3]	-1,485
Total Reduction	**-413,627**

Sector	2025 Target[4]
Wastewater	**15,797**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	150	systems
Septic Denitrification	0	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	3	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	2	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	7	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	2,038	3,000	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	25	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	9	Acres
Cover Crop - Commodity	6,116	6,116	Acres/Year
Cover Crop - Traditional	43,740	43,740	Acres/Year
Ditch Filters (Phosphorus Sorbing)	100	100	Acres
Forest Buffers	0	187	Acres
Grass Buffers	512	4,500	Acres
Horse Pasture Management	0	19	Acres
Land Conversion (Cropland to Hay/Pasture)	0	121	Acres
Land Retire (Open Space)	2,000	2,243	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	0	4,097	Linear Feet
Prescribed Grazing	57	200	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	77,500	77,500	Acres/Year
Tree Planting	190	400	Acres
Wetland Restoration	0	0	Acres

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** MDA Regulatory Requirement

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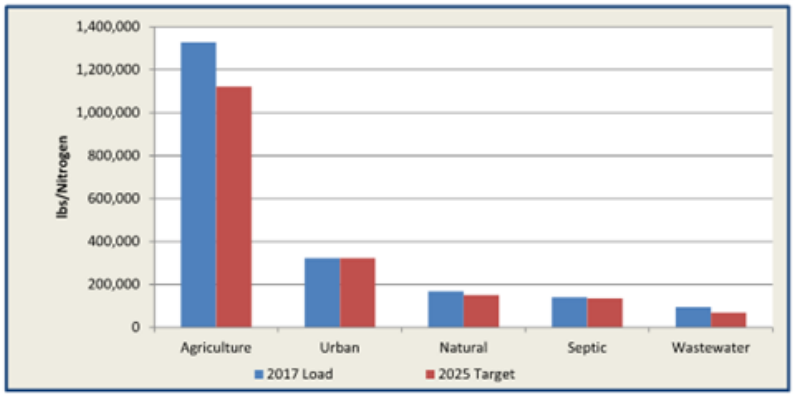
CARROLL

Sector	2025Nitrogen Reduction Goal
Agriculture	-207,781
Urban[1]	-916
Natural[2]	-16,805
Septic[3]	-5,075
Total Reduction	**-230,577**

Sector	2025 Target[4]
Wastewater	**69,356**



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Septic Strategy[5]	Unit	Measure
Septic Connections	8	systems
Septic Denitrification	544	systems
Septic Tank Pumpout	8671	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	104	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	126	acre-feet
Stormwater Treatment	3,180	acres
Stormwater Treatment	1,590	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	46	acres
Tree Planting	24	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	1,352	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	90	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	5	260	Acres
Cover Crop - Commodity	4,576	4,576	Acres/Year
Cover Crop - Traditional	27,637	27,637	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	336	2,300	Acres
Grass Buffers	100	2,315	Acres
Horse Pasture Management	0	3	Acres
Land Conversion (Cropland to Hay/Pasture)	0	655	Acres
Land Retire (Open Space)	0	3,184	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	22	22	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	2,000	8,939	Linear Feet
Prescribed Grazing	710	1,700	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	84,000	84,000	Acres/Year
Tree Planting	70	181	Acres
Wetland Restoration	7	10	Acres

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** MDA Regulatory Requirement

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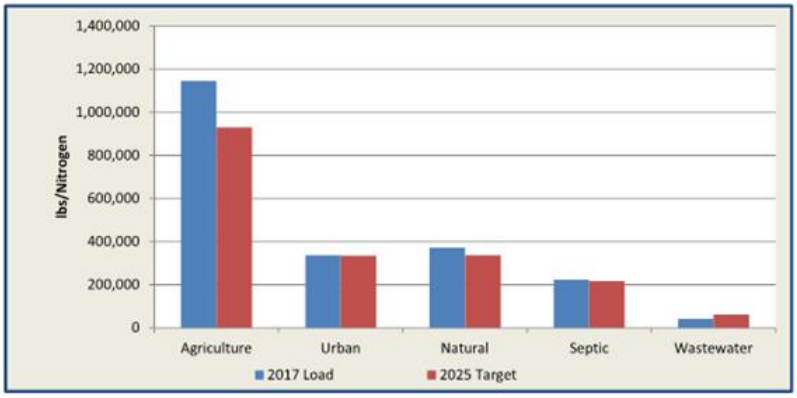
CECIL

Sector	2025Nitrogen Reduction Goal
Agriculture	-217,057
Urban[1]	-1,940
Natural[2]	-37,280
Septic[3]	-7,060
Total Reduction	**-263,337**

Sector	2025 Target[4]
Wastewater	**61,611**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	48	systems
Septic Denitrification	544	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	4	acre-feet
Stormwater Treatment	91	acres
Stormwater Treatment	45	impervious acres
Stream Restoration Urban	28,000	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	133	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	104	2,080	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	85	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	33	90	Acres
Cover Crop - Commodity	4,500	4,500	Acres/Year
Cover Crop - Traditional	16,500	16,500	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	4	420	Acres
Grass Buffers	66	1,200	Acres
Horse Pasture Management	0	51	Acres
Land Conversion (Cropland to Hay/Pasture)	170	550	Acres
Land Retire (Open Space)	25	1,600	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	2	2	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	636	3,800	Linear Feet
Prescribed Grazing	483	900	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	50,000	50,000	Acres/Year
Tree Planting	12	120	Acres
Wetland Restoration	32	85	Acres

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** MDA Regulatory Requirement

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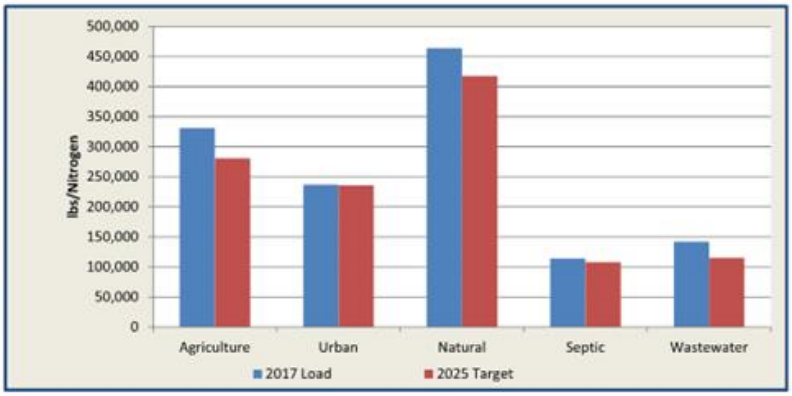
CHARLES

Sector	2025Nitrogen Reduction Goal
Agriculture	-50,357
Urban[1]	-1,382
Natural[2]	-46,403
Septic[3]	-6,203
Total Reduction	**-104,345**

Sector	2025 Target[4]
Wastewater	**115,458**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	72	systems
Septic Denitrification	472	systems
Septic Tank Pumpout	833	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	4	acre-feet
Runoff Reduction	95	acres
Runoff Reduction	47	impervious acres
Storm Drain Cleaning	20	lbs tn
Storm Drain Cleaning	8	lbs tp
Storm Drain Cleaning	2,352	lbs tss
Stormwater Treatment	66	acre-feet
Stormwater Treatment	1,666	acres
Stormwater Treatment	833	impervious acres
Stream Restoration Urban	29,980	feet
Street Sweeping	615	acres
Tree Planting	42	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	9,305	feet
Wet Extended Detention	132	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	8	18	Acres
Cover Crop - Commodity	2,000	2,000	Acres/Year
Cover Crop - Traditional	8,512	8,512	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	269	Acres
Grass Buffers	9	700	Acres
Horse Pasture Management	54	115	Acres
Land Conversion (Cropland to Hay/Pasture)	53	450	Acres
Land Retire (Open Space)	0	606	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	1	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	567	Linear Feet
Prescribed Grazing	499	750	Acres
Shoreline Protection	3,980	10,000	Linear Feet
Soil Conservation & Water Quality Plans	23,500	23,500	Acres/Year
Tree Planting	0	261	Acres
Wetland Restoration	0	11	Acres

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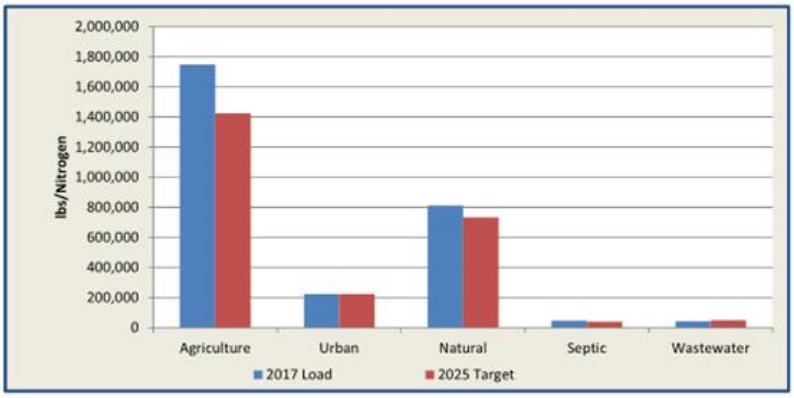
DORCHESTER

Sector	2025Nitrogen Reduction Goal
Agriculture	-323,484
Urban[1]	-79
Natural[2]	-81,448
Septic[3]	-7,054
Total Reduction	**-412,065**

Sector	2025 Target[4]
Wastewater	**48,301**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	400	systems
Septic Denitrification	448	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	3	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	7	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	2,844	3,000	Acres Treated
Alternative Crops	0	1	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	35	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	0	Acres
Cover Crop - Commodity	6,618	6,618	Acres/Year
Cover Crop - Traditional	41,000	41,000	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	810	Acres
Grass Buffers	0	7,637	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	0	56	Acres
Land Retire (Open Space)	1,395	2,000	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	229	500	Linear Feet
Prescribed Grazing	0	78	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	65,000	65,000	Acres/Year
Tree Planting	25	450	Acres
Wetland Restoration	89	600	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

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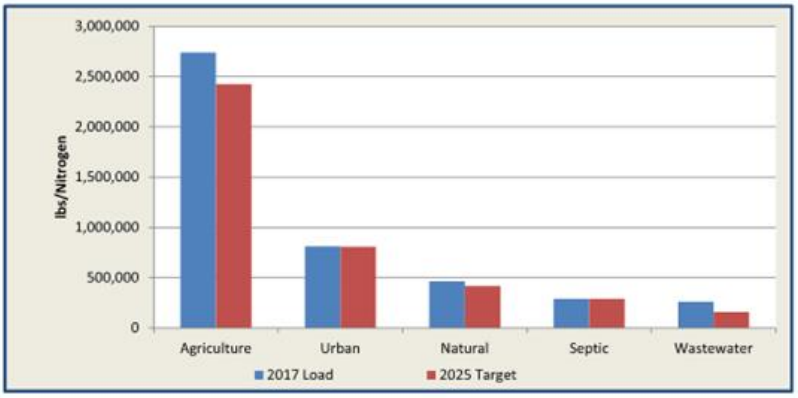
FREDERICK

Sector	2025Nitrogen Reduction Goal
Agriculture	-315,052
Urban[1]	-1,859
Natural[2]	-46,544
Septic[3]	-3,448
Total Reduction	**-366,902**

Sector	2025 Target[4]
Wastewater	**160,637**



Notes:

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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	536	systems
Septic Tank Pumpout	667	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	3	acre-feet
Runoff Reduction	84	acres
Runoff Reduction	42	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	64	acre-feet
Stormwater Treatment	1,623	acres
Stormwater Treatment	812	impervious acres
Stream Restoration Urban	26,360	feet
Street Sweeping	171	acres
Tree Planting	385	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	943	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	14	210	Acres
Cover Crop - Commodity	3,549	3,549	Acres/Year
Cover Crop - Traditional	32,385	32,385	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	575	3,000	Acres
Grass Buffers	0	582	Acres
Horse Pasture Management	0	79	Acres
Land Conversion (Cropland to Hay/Pasture)	552	1,500	Acres
Land Retire (Open Space)	0	1,769	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	5	5	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	1,108	1,500	Linear Feet
Prescribed Grazing	542	1,900	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	95,000	95,000	Acres/Year
Tree Planting	51	225	Acres
Wetland Restoration	0	0	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

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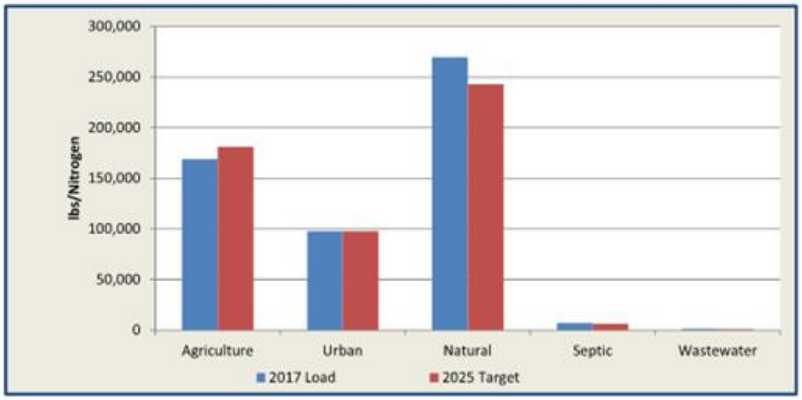
GARRETT

Sector	2025Nitrogen Reduction Goal
Agriculture	12,560
Urban[1]	0
Natural[2]	-26,982
Septic[3]	-510
Total Reduction	**-14,932**

Sector	2025 Target[4]
Wastewater	**1,029**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	8	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	5	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	80	Percent*
Animal Waste Management - Other Livestock	0	60	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	4	68	Acres
Cover Crop - Commodity	56	56	Acres/Year
Cover Crop - Traditional	1,266	1,266	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	340	Acres
Grass Buffers	0	13	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	22	75	Acres
Land Retire (Open Space)	103	300	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	5	5	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	300	400	Linear Feet
Prescribed Grazing	216	400	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	9,500	9,500	Acres/Year
Tree Planting	19	685	Acres
Wetland Restoration	0	2	Acres

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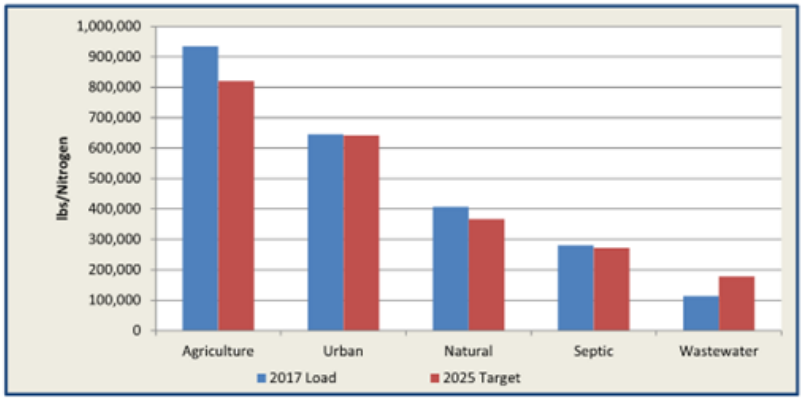
HARFORD

Sector	2025Nitrogen Reduction Goal
Agriculture	-115,295
Urban[1]	-4,064
Natural[2]	-40,641
Septic[3]	-9,657
Total Reduction	**-169,657**

Sector	2025 Target[4]
Wastewater	**178,765**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	107	systems
Septic Denitrification	368	systems
Septic Tank Pumpout	10000	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	4	acres
Runoff Reduction	2	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	93	acre-feet
Stormwater Treatment	2,351	acres
Stormwater Treatment	1,176	impervious acres
Stream Restoration Urban	65,160	feet
Street Sweeping	0	acres
Tree Planting	18	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	11	100	Acres
Cover Crop - Commodity	2,319	2,319	Acres/Year
Cover Crop - Traditional	17,000	17,000	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	111	700	Acres
Grass Buffers	40	150	Acres
Horse Pasture Management	0	5	Acres
Land Conversion (Cropland to Hay/Pasture)	44	100	Acres
Land Retire (Open Space)	135	500	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	5	5	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	27,489	50,000	Linear Feet
Prescribed Grazing	400	727	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	44,135	44,135	Acres/Year
Tree Planting	24	225	Acres
Wetland Restoration	0	0	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

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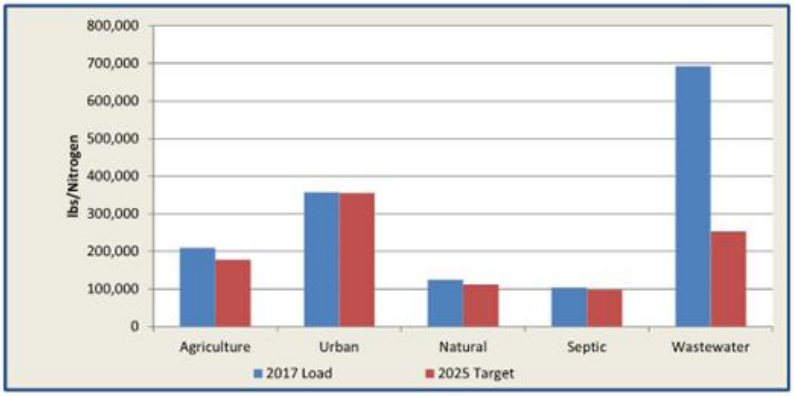
HOWARD

Sector	2025Nitrogen Reduction Goal
Agriculture	-31,868
Urban[1]	-1,753
Natural[2]	-12,447
Septic[3]	-6,012
Total Reduction	**-52,080**

Sector	2025 Target[4]
Wastewater	**252,847**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	64	systems
Septic Denitrification	664	systems
Septic Tank Pumpout	911	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	52	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	3	acre-feet
Runoff Reduction	69	acres
Runoff Reduction	35	impervious acres
Storm Drain Cleaning	56	lbs tn
Storm Drain Cleaning	22	lbs tp
Storm Drain Cleaning	6,720	lbs tss
Stormwater Treatment	103	acre-feet
Stormwater Treatment	2,607	acres
Stormwater Treatment	1,303	impervious acres
Stream Restoration Urban	42,260	feet
Street Sweeping	2,115	acres
Tree Planting	10	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	23	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	50	Percent*
Animal Waste Management - Other Livestock	0	60	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	4	30	Acres
Cover Crop - Commodity	999	999	Acres/Year
Cover Crop - Traditional	3,018	3,018	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	432	Acres
Grass Buffers	0	1,309	Acres
Horse Pasture Management	0	60	Acres
Land Conversion (Cropland to Hay/Pasture)	0	208	Acres
Land Retire (Open Space)	0	424	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	2	2	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	80	1,100	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	16,200	16,200	Acres/Year
Tree Planting	0	88	Acres
Wetland Restoration	0	1	Acres

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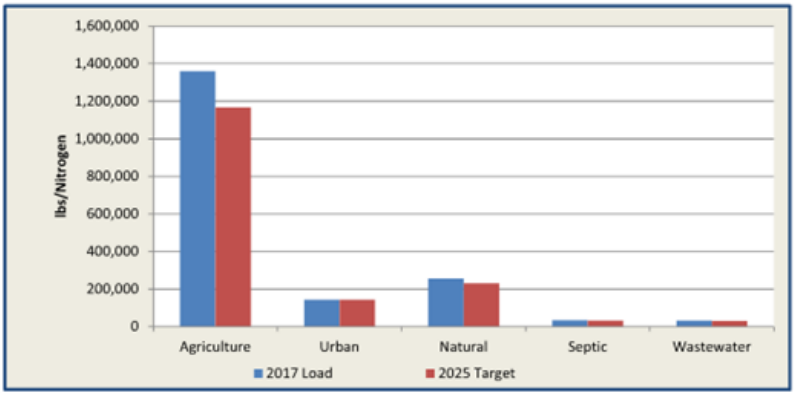
KENT

Sector	2025Nitrogen Reduction Goal
Agriculture	-192,394
Urban[1]	-101
Natural[2]	-25,619
Septic[3]	-1,949
Total Reduction	**-220,062**

Sector	2025 Target[4]
Wastewater	**29,503**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	0	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	4	acres
Stormwater Treatment	2	impervious acres
Stream Restoration Urban	1,200	feet
Street Sweeping	87	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	3	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	650	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	50	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	37	Acres
Cover Crop - Commodity	6,499	6,499	Acres/Year
Cover Crop - Traditional	54,740	54,740	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	402	Acres
Grass Buffers	97	2,150	Acres
Horse Pasture Management	50	50	Acres
Land Conversion (Cropland to Hay/Pasture)	100	122	Acres
Land Retire (Open Space)	186	2,000	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	0	150	Linear Feet
Prescribed Grazing	402	600	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	10,758	80,000	Acres/Year
Tree Planting	0	72	Acres
Wetland Restoration	35	450	Acres

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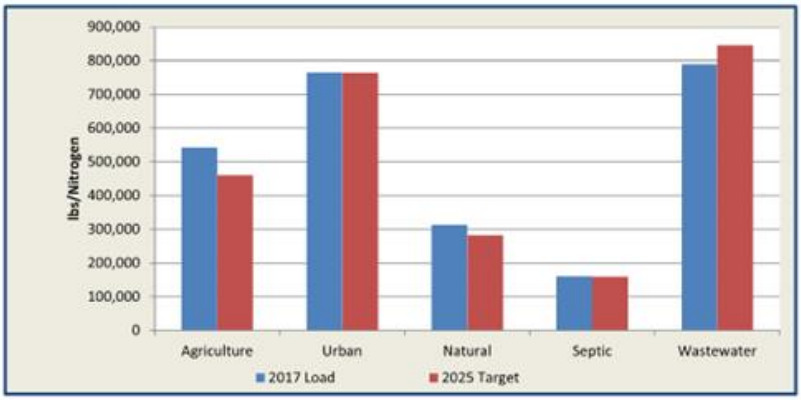
MONTGOMERY

Sector	2025Nitrogen Reduction Goal
Agriculture	-81,876
Urban[1]	-581
Natural[2]	-31,377
Septic[3]	-2,390
Total Reduction	**-116,225**

Sector	2025 Target[4]
Wastewater	**845,855**



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5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	394	systems
Septic Denitrification	256	systems
Septic Tank Pumpout	2000	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	595	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	4	acre-feet
Runoff Reduction	38	acres
Runoff Reduction	19	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	155	acre-feet
Stormwater Treatment	3,909	acres
Stormwater Treatment	1,954	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	1,409	acres
Tree Planting	108	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	455	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	55	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	7	33	Acres
Cover Crop - Commodity	4,065	4,065	Acres/Year
Cover Crop - Traditional	17,000	17,000	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	74	500	Acres
Grass Buffers	41	234	Acres
Horse Pasture Management	109	268	Acres
Land Conversion (Cropland to Hay/Pasture)	97	250	Acres
Land Retire (Open Space)	16	700	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	4	4	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	71	800	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	36,000	36,000	Acres/Year
Tree Planting	0	97	Acres
Wetland Restoration	0	0	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

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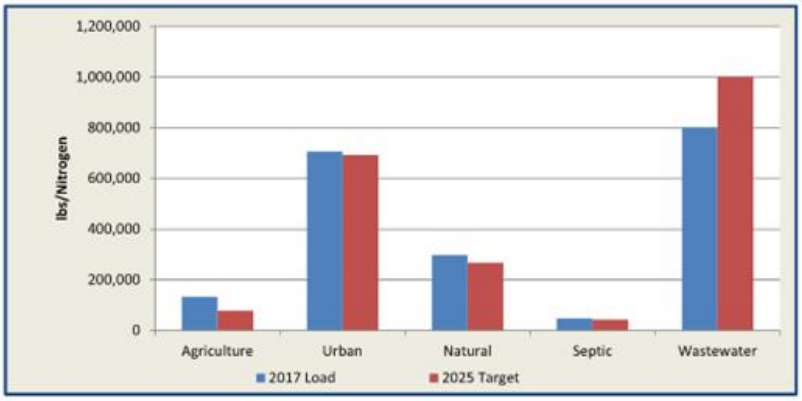
PRINCE GEORGES

Sector	2025Nitrogen Reduction Goal
Agriculture	-55,259
Urban[1]	-12,935
Natural[2]	-29,751
Septic[3]	-4,860
Total Reduction	**-102,806**

Sector	2025 Target[4]
Wastewater	**1,001,568**



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Septic Strategy[5]	Unit	Measure
Septic Connections	328	systems
Septic Denitrification	208	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	408	acre-feet
Stormwater Treatment	10,083	acres
Stormwater Treatment	5,042	impervious acres
Stream Restoration Urban	86,932	feet
Street Sweeping	0	acres
Tree Planting	2	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	0	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	75	75	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	50	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	36	74	Acres
Cover Crop - Commodity	1,189	1,189	Acres/Year
Cover Crop - Traditional	1,795	1,795	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	98	Acres
Grass Buffers	100	679	Acres
Horse Pasture Management	101	550	Acres
Land Conversion (Cropland to Hay/Pasture)	100	1,700	Acres
Land Retire (Open Space)	50	862	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	1,000	1,000	Linear Feet
Prescribed Grazing	188	450	Acres
Shoreline Protection	1,000	1,000	Linear Feet
Soil Conservation & Water Quality Plans	18,450	18,450	Acres/Year
Tree Planting	0	119	Acres
Wetland Restoration	0	33	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

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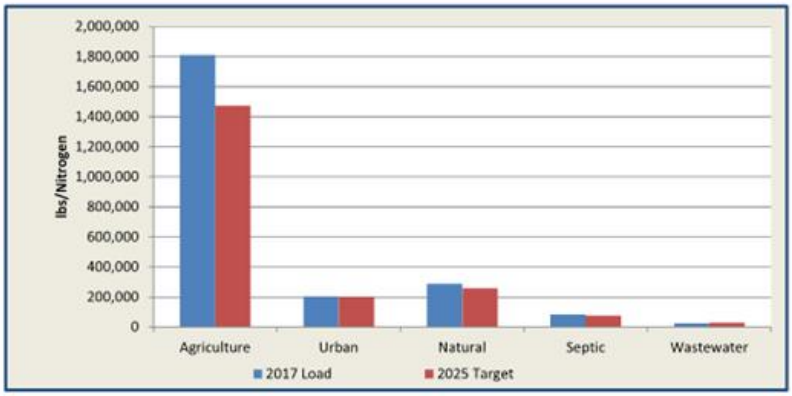
QUEEN ANNES

Sector	2025Nitrogen Reduction Goal
Agriculture	-335,787
Urban[1]	-178
Natural[2]	-28,715
Septic[3]	-6,051
Total Reduction	**-370,731**

Sector	2025 Target[4]
Wastewater	**30,455**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	1500	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	1,028	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	29	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	4,766	5,000	Acres Treated
Alternative Crops	50	50	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	25	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	5	22	Acres
Cover Crop - Commodity	5,829	5,829	Acres/Year
Cover Crop - Traditional	61,012	61,012	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	522	Acres
Grass Buffers	369	7,000	Acres
Horse Pasture Management	0	11	Acres
Land Conversion (Cropland to Hay/Pasture)	0	167	Acres
Land Retire (Open Space)	1,225	1,835	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	10	10	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	15,000	15,000	Linear Feet
Prescribed Grazing	25	300	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	90,000	90,000	Acres/Year
Tree Planting	6	33	Acres
Wetland Restoration	495	2,200	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

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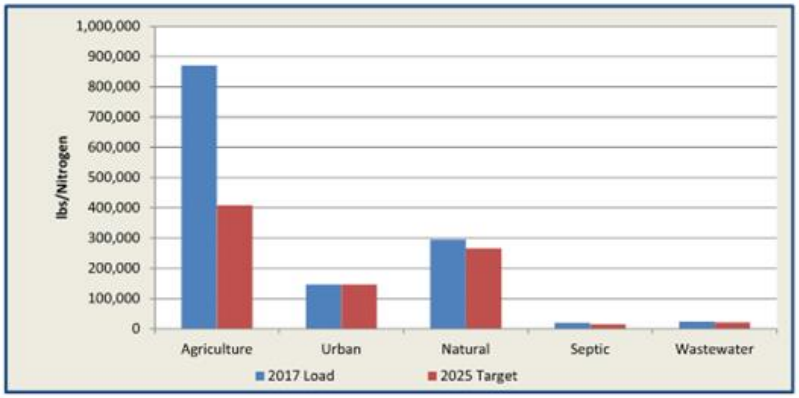
ST MARYS

Sector	2025Nitrogen Reduction Goal
Agriculture	-461,881
Urban[1]	-53
Natural[2]	-29,564
Septic[3]	-4,686
Total Reduction	**-496,184**

Sector	2025 Target[4]
Wastewater	**21,255**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	808	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	7,539	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	90	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	85	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	17	34	Acres
Cover Crop - Commodity	5,000	5,000	Acres/Year
Cover Crop - Traditional	7,500	7,500	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	7	350	Acres
Grass Buffers	66	450	Acres
Horse Pasture Management	20	200	Acres
Land Conversion (Cropland to Hay/Pasture)	40	470	Acres
Land Retire (Open Space)	139	600	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	10	10	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	458	1,200	Acres
Shoreline Protection	0	2,370	Linear Feet
Soil Conservation & Water Quality Plans	32,351	32,351	Acres/Year
Tree Planting	4	350	Acres
Wetland Restoration	0	26	Acres

* Percent of all animals within county

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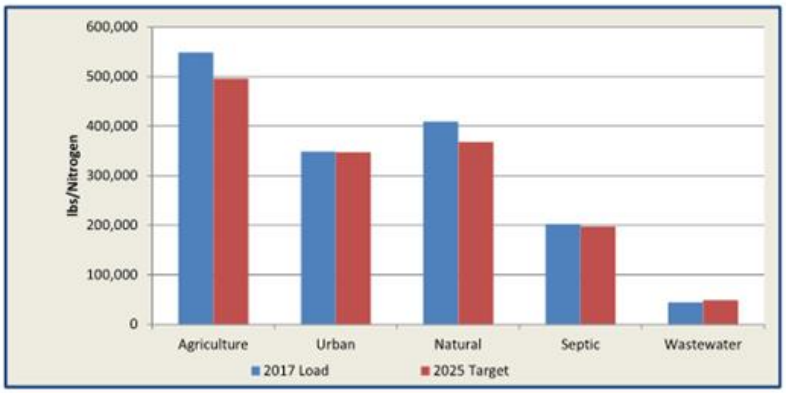
SOMERSET

Sector	2025Nitrogen Reduction Goal
Agriculture	-53,069
Urban[1]	-1,353
Natural[2]	-40,933
Septic[3]	-4,330
Total Reduction	**-99,685**

Sector	2025 Target[4]
Wastewater	**48,558**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	232	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	3	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	7	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	4,021	4,411	Acres Treated
Alternative Crops	50	50	Acres
Animal Waste Management - Dairy	0	0	Percent*
Animal Waste Management - Other Livestock	0	70	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	0	Acres
Cover Crop - Commodity	4,739	4,739	Acres/Year
Cover Crop - Traditional	13,447	13,447	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	211	2,200	Acres
Grass Buffers	801	2,378	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	200	200	Acres
Land Retire (Open Space)	95	107	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	170	200	Acres
Shoreline Protection	1,000	1,000	Linear Feet
Soil Conservation & Water Quality Plans	32,811	32,811	Acres/Year
Tree Planting	75	100	Acres
Wetland Restoration	999	2,800	Acres

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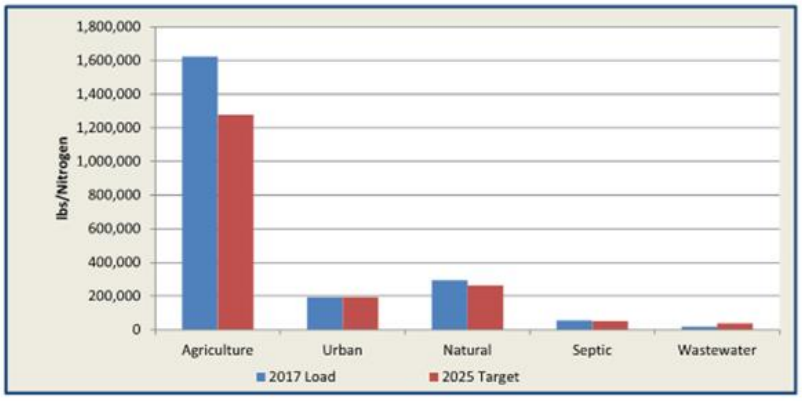
TALBOT

Sector	2025Nitrogen Reduction Goal
Agriculture	-345,962
Urban[1]	-83
Natural[2]	-29,289
Septic[3]	-3,878
Total Reduction	**-379,212**

Sector	2025 Target[4]
Wastewater	**39,617**



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Septic Strategy[5]	Unit	Measure
Septic Connections	144	systems
Septic Denitrification	392	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	3	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	7	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	1,792	2,000	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	20	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	1	Acres
Cover Crop - Commodity	3,899	10,000	Acres/Year
Cover Crop - Traditional	939	48,000	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	37	400	Acres
Grass Buffers	1,691	5,000	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	0	0	Acres
Land Retire (Open Space)	180	1,000	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	975	2,500	Linear Feet
Prescribed Grazing	0	8	Acres
Shoreline Protection	6,000	6,000	Linear Feet
Soil Conservation & Water Quality Plans	75,000	75,000	Acres/Year
Tree Planting	12	80	Acres
Wetland Restoration	325	2,200	Acres

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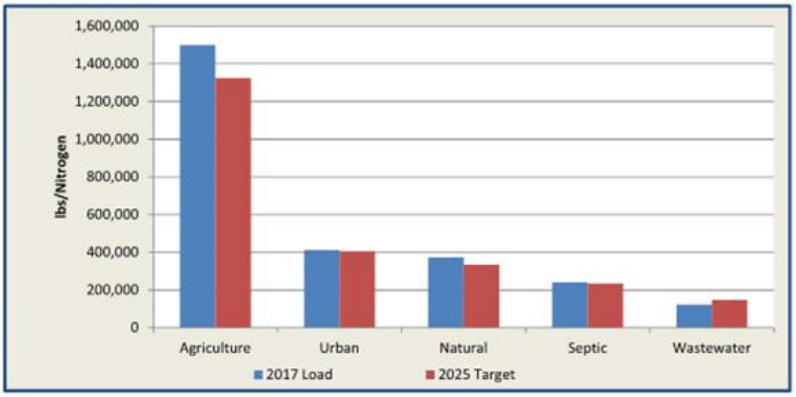
WASHINGTON

Sector	2025Nitrogen Reduction Goal
Agriculture	-174,535
Urban[1]	-4,873
Natural[2]	-37,199
Septic[3]	-3,850
Total Reduction	**-220,458**

Sector	2025 Target[4]
Wastewater	**147,123**



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Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	280	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	19	acre-feet
Stormwater Treatment	477	acres
Stormwater Treatment	238	impervious acres
Stream Restoration Urban	32,951	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	366	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	0	0	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	85	Percent*
Animal Waste Management - Other Livestock	0	30	Percent*
Animal Waste Management - Poultry	0	0	Percent*
Barnyard Runoff Control	10	85	Acres
Cover Crop - Commodity	4,044	4,044	Acres/Year
Cover Crop - Traditional	5,800	5,800	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	247	1,400	Acres
Grass Buffers	0	246	Acres
Horse Pasture Management	0	0	Acres
Land Conversion (Cropland to Hay/Pasture)	684	1,000	Acres
Land Retire (Open Space)	0	855	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	10	10	Acres
Mortality Management	0	0	Percent*
Non-Urban Stream Restoration	8,000	16,877	Linear Feet
Prescribed Grazing	2,000	4,075	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	65,000	65,000	Acres/Year
Tree Planting	40	244	Acres
Wetland Restoration	2	16	Acres

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In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

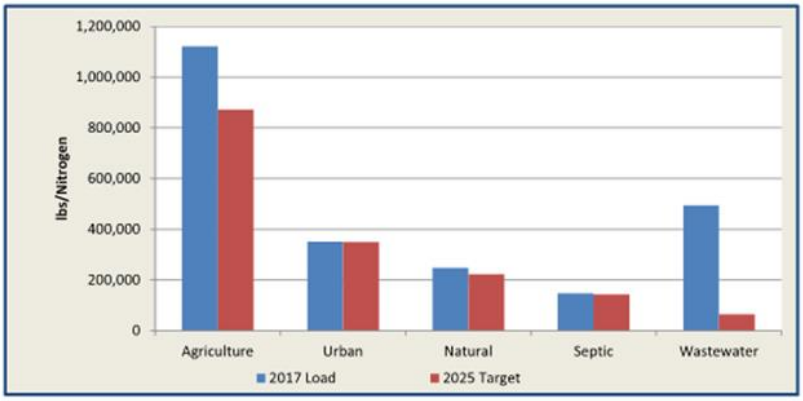
County Phase III WIP Goals Summary

Disclaimer: This summary represents a planning document created by the State of Maryland and does not represent a legal requirement for the Phase III Watershed Implementation Plan. Implementation of strategies and BMPs identified in this document are based on available funding and local staff resources . ***The information included in this handout is for planning purposes only!***

WICOMICO

Sector	2025Nitrogen Reduction Goal
Agriculture	-249,282
Urban[1]	-1,511
Natural[2]	-24,762
Septic[3]	-4,051
Total Reduction	**-279,606**

Sector	2025 Target[4]
Wastewater	**64,945**



Notes:

1. This goal was built using impervious surface treatment strategies identified in the county's MS4 Financial Assurance Plan for meeting current Phase I MS4 permit requirements, with some assumptions made by MDE. This is a conservative estimate of county goals for the PIII WIP.

2. Reductions in the "Natural" Load Source sector can be attributable to urban and Agricultural Stream Restoration

3. These reductions were built using septic data provided in the 2017 Annual Progress scenario from County and Bay Restoration Fund (BRF) databases. They use past performance to predict a potential opportunity for implementation efforts in the future.

4. Sector targets for wastewater are expressed in overall loads that need to be maintained, not reductions, because of the accounting & planning mechanisms used in MDE's 2025 Strategy.

5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	31	systems
Septic Denitrification	364	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	0	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	1	acre-feet
Stormwater Treatment	34	acres
Stormwater Treatment	17	impervious acres
Stream Restoration Urban	13,097	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	146	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	218	400	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	70	Percent*
Animal Waste Management - Other Livestock	0	15	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	0	1	Acres
Cover Crop - Commodity	813	813	Acres/Year
Cover Crop - Traditional	27,358	27,358	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	1,705	Acres
Grass Buffers	0	2,674	Acres
Horse Pasture Management	0	42	Acres
Land Conversion (Cropland to Hay/Pasture)	0	19	Acres
Land Retire (Open Space)	0	365	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	0	20	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	43,000	43,000	Acres/Year
Tree Planting	0	121	Acres
Wetland Restoration	269	1,300	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

County Phase III WIP Goals Summary

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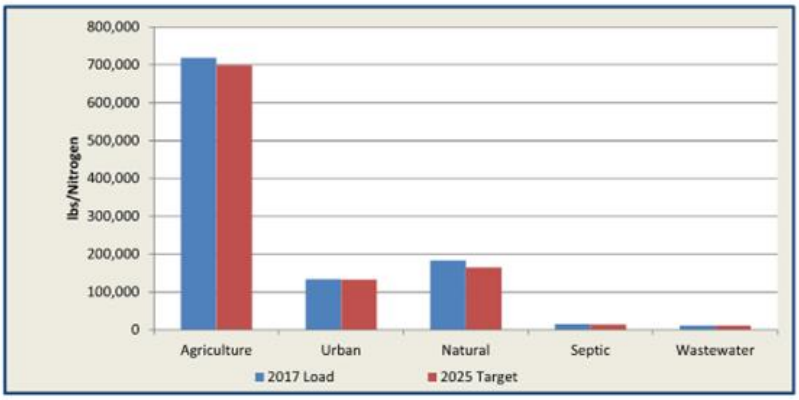
WORCESTER

Sector	2025Nitrogen Reduction Goal
Agriculture	-19,336
Urban[1]	-83
Natural[2]	-18,304
Septic[3]	-1,021
Total Reduction	**-38,743**

Sector	2025 Target[4]
Wastewater	**10,856**



Notes:

1. This goal was built using impervious surface treatment strategies identified in the county's MS4 Financial Assurance Plan for meeting current Phase I MS4 permit requirements, with some assumptions made by MDE. This is a conservative estimate of county goals for the PIII WIP.
2. Reductions in the "Natural" Load Source sector can be attributable to urban and Agricultural Stream Restoration
3. These reductions were built using septic data provided in the 2017 Annual Progress scenario from County and Bay Restoration Fund (BRF) databases. They use past performance to predict a potential opportunity for implementation efforts in the future.
4. Sector targets for wastewater are expressed in overall loads that need to be maintained, not reductions, because of the accounting & planning mechanisms used in MDE's 2025 Strategy.
5. This goal was built using a State septic strategy, using BRF trends. In some counties this may be augmented with local goals.

Septic Strategy[5]	Unit	Measure
Septic Connections	0	systems
Septic Denitrification	176	systems
Septic Tank Pumpout	0	systems

Urban BMP Strategy	Unit	Measure
Abandon Mine Reclimation	0	acres
BioSwale	3	acres
Dry Detention Ponds & Hydrodynamic Structures	0	acres
Dry Extended Detention Ponds	0	acres
Erosion and Sediment Control	0	acres
Impervious Surface Reduction	0	acres
Permeable Pavement	0	acres
Runoff Reduction	0	acre-feet
Runoff Reduction	0	acres
Runoff Reduction	0	impervious acres
Storm Drain Cleaning	0	lbs tn
Storm Drain Cleaning	0	lbs tp
Storm Drain Cleaning	0	lbs tss
Stormwater Treatment	0	acre-feet
Stormwater Treatment	0	acres
Stormwater Treatment	0	impervious acres
Stream Restoration Urban	0	feet
Street Sweeping	0	acres
Tree Planting	0	acres
Urban Forest Buffer	0	acres
Urban Forest Planting	7	acres
Urban Nutrient Management Plan	0	acres
Urban Shoreline Management	0	feet
Wet Extended Detention	0	acres

Agriculture BMP Strategy	PIII WIP BMPs	2025 Goal	Unit
Ag Drainage Management	2,448	2,500	Acres Treated
Alternative Crops	0	0	Acres
Animal Waste Management - Dairy	0	100	Percent*
Animal Waste Management - Other Livestock	0	40	Percent*
Animal Waste Management - Poultry	0	100	Percent*
Barnyard Runoff Control	9	10	Acres
Cover Crop - Commodity	3,229	3,229	Acres/Year
Cover Crop - Traditional	31,349	31,349	Acres/Year
Ditch Filters (Phosphorus Sorbing)	0	0	Acres
Forest Buffers	0	3,262	Acres
Grass Buffers	912	3,161	Acres
Horse Pasture Management	50	50	Acres
Land Conversion (Cropland to Hay/Pasture)	327	400	Acres
Land Retire (Open Space)	43	200	Acres
Livestock Exclusion	0	90	Percent**
Loafing Lot Management	0	0	Acres
Mortality Management	0	100	Percent*
Non-Urban Stream Restoration	0	0	Linear Feet
Prescribed Grazing	327	400	Acres
Shoreline Protection	0	0	Linear Feet
Soil Conservation & Water Quality Plans	40,800	40,800	Acres/Year
Tree Planting	53	100	Acres
Wetland Restoration	1,078	2,000	Acres

* Percent of all animals within county

** MDA Regulatory Requirement

Notes:

In PI MS4 jurisdictions, an additional 10% treatment goal was added on top of the Financial Assurance Plan scenario provided.

Appendix D: Conservation Plus (Land Policy BMPs) and Protection

Conservation Plus and Land Use Policy BMPs

1. Description of Phase III WIP strategies and why these were chosen

The Chesapeake Bay Land Change (CBLC) Model, and the choice by the CBP partnership to incorporate expected growth impacts into the Bay TMDL process, provides Maryland with an excellent opportunity to get credit for local and state land preservation efforts and resource-protective development requirements.

The CBLC model provides a baseline called "Current Zoning" (i.e., based on where development can happen, not on density restrictions) for how land use patterns are expected to look in Maryland in 2025; however, the baseline did not capture state or local existing land preservation programs or resource-protective development requirements. The CBLC model can run alternative 2025 scenarios to demonstrate how those baseline land use patterns would change given local and state level land conservation and land use programs and policies. Changes in land use patterns can result in less additional nutrient and sediment loads from growth between 2019-2025 than the baseline. These changes can be considered a land use policy BMP.

2. Background

Maryland's goal was to seek accurate CBLC model results for how future loads will change between 2019-2025 due to programs and policies, and to provide as much clarity as possible regarding the specific programs and policies that comprise the land use policy BMPs. These suite of BMPs can then be aggregated into a conservation plus scenario that is run through the modeling suite to calculate resulting load reductions.

Maryland assembled a team of state agencies involved with land conservation and land use (MDE, MDA, DNR, MDP, Maryland Environmental Trust (MET), and Maryland Agricultural Land Preservation Foundation (MALPF)). The team determined and then described the array of existing land conservation and land use requirements and policies in Maryland. Next, the team identified the geographic areas where each requirement and policy has its effect and drafted instructions to the CBP regarding how much of these areas are forecasted to be conserved between 2019-2025. After working with the CBP to determine the types of GIS and tabular data needed to model our conservation and land use programs, the team developed the data and completed other directions and tasks from the CBP to seek an accurate forecast of program impacts.

The team created two CBLC model scenarios:

1) A regulatory scenario, which captures existing local and state land use restrictions and requirements (e.g., county zoning, forest conservation requirements) and existing trends for land conservation programs 2019-2025; and 2) a policy scenario, which captures state policy efforts, such as goals for land conservation and compact development, that are not reflected in law or regulation.

Regulatory scenario

Growth and Density
1. Local Zoning
2. State-level density restrictions (e.g., Critical Area law)
3. Avoid Permanently Preserved Land

Land Conservation 2019-2025
1. State conservation programs (MALPF, MET, Rural Legacy, POS)
2. CREP easements for riparian buffers
3. Local programs

Development requirements
1. Forest Conservation Act, including forests and forest buffers
2. Wetland and wetland buffer preservation
3. Local development requirements that exceed state requirements

Policy scenario

Growth and Density
1. 75 percent compact development goal
2. Areas subject to a 1-meter sea level rise by 2100

Conservation Policies
1. Land within 100-year floodplain
2. Forested land within anti-degradation watersheds
3. Designated local agricultural preservation areas
4. Currently achieved conservation through the Forest Conservation Act

3. Overall Sector Load Reduction Summary for the Team's Phase III WIP strategies

Maryland is awaiting results from CBP (preliminary results are expected in April 2019; however, tentative results for Maryland equals approximately 100,000 lbs. of nitrogen prevented through 2025)

4. Key Challenges and Opportunities

Projecting land conservation gains, and defining growth management strategies and regulations at the state level builds on existing statewide programs, funding, regulations and policies. Challenges exist incorporating conservation and growth management efforts at local scales due to wide variability across local jurisdictions, the CBLC cannot easily model differences between local and state resource-protective development requirements, and the degree of outreach needed to collect this information and translate it as a land use policy BMP element; however, Maryland has surveyed local governments and local land trusts to collect this information.

Many opportunities for complementing strategies developed by the natural land, agriculture and climate change teams can be found on lands protected through various local and state conservation programs. Ensuring that these lands are performing at their highest and best use possible should be a priority for the state, knowing that investments in Bay restoration are more likely to be maintained over the long-term in these areas since development of these lands is restricted. Currently, stateside POS conducts restoration assessments for lands under evaluation for acquisition and considers these opportunities desirable for meeting water quality goals. This practice, in addition to evaluating existing public lands and lands under easement protections for restoration opportunities, could be broadened to other local and state conservation programs.

5. Description of funding capacity for team strategies (Identify any funding gaps, Authorities, Costs)

Established under the DNR in 1969, Program Open Space (POS) symbolizes Maryland's long term commitment to conserving our natural resources while providing exceptional outdoor recreation opportunities for our citizens. Funding for POS typically comes from the collection of a 0.5 percent state property transfer tax and funds state land acquisitions and easements through stateside POS, Rural Legacy Program (RLP), MALPF, and Maryland's CREP. Funding is also provided to local governments for parks, playgrounds and other open space facilities. There is no reason to expect that POS funds will not be available for continued conservation efforts now and into the future. MET, funded through a combination of state funds and private donations, is a land trust that works directly with landowners, communities and citizen land trusts, and largely acquires easements through donations. A comprehensive description of Maryland's Land Preservation Programs, prepared for the chair of the Senate Budget and Taxation Committee and the House Appropriations Committee is available for more information. Whenever possible, state funding is leveraged with funds from other sources including the federal Land and Water Conservation fund, Farm Bill, nonprofit organizations such as The Nature Conservancy or Trust for Public Lands, and through the resources available from local governments and land trusts.

Growth management and regulatory controls on land use change do not require implementation funding, but may be based on state regulatory authorities of MDE or DNR, in addition to those of local government. Policy and planning measures are voluntary and often benefit from technical and financial resources provided by the state or local governments.

6. Discussion/Identification of strategy Co-Benefits

Maintaining lands in their natural or rural state generates many important habitat, climate change adaptation and economic co-benefits, particularly when conservation efforts are directed towards lands with high ecological value and areas that are important for sustaining agricultural economies. Stateside POS directs its funding towards GreenPrint Targeted Ecological Areas, which identifies the state's most ecologically valuable lands and waters. Areas of high aquatic and terrestrial biodiversity, forest lands exceptionally valuable for protecting water quality, wetlands important for coastal resilience and climate change adaptation areas for future wetlands are noted as key ecological benefits. The RLP, MET and CREP also use these indicators to inform easement actions. Agricultural landscapes have been noted for their role in supporting sustainable fisheries, particularly because aquatic stressors arising from impervious surfaces associated with development is minimized. Many of the most productive watersheds for striped bass production that occur on the Eastern Shore are dominated by agricultural land use.

Rural landscapes, conserved areas of high ecological value and urban forests maintained through the Forest Conservation Act also provide economic benefits to the citizens of Maryland. Natural resource based economies, such as agriculture, forestry, fishing, and hunting, contribute 26.5 billion dollars to the state's economy every year (Guy et al. 2017, OIA, 2018). These lands also generate economic benefits for ecosystem services that are not valued through traditional markets, but provide important public services. The Accounting for Maryland's Ecosystem Services framework provides economic values for seven non-market ecosystems services: 1) air pollution removal, 2) carbon sequestration, 3) nitrogen removal, 4) groundwater recharge, 5) surface water protection, 6) stormwater mitigation/flood prevention and 7) wildlife habitat provision. Currently, the 1.5 million acres of protected land in Maryland generate 4 billion dollars in ecosystem service benefits and reflect what society is willing to pay to retain these services and the costs associated with replacing them (Campbell et al. 2018).).

References:

Guy, Sarah, Chambers, Dustin, Diriker, Memo. 2017. The Impact of Resource Based Industries on the Maryland Economy. BEACON at Salisbury University. Partially Funded by Maryland Agricultural and Resource-Based Industry Development Corporation (MARBIDCO)

Outdoor Industry Association (OIA). 2018. Maryland Outdoor Industry Economic Report. outdoorindustry.org/state/maryland/

Campbell, Elliott, Conn, Christine, Marks, Rachel. 2018. Accounting for Maryland's Ecosystem Services: Integrating the value of nature into decision making. Maryland DNR Publication Number 14-081518-92. dnr.maryland.gov/ccs/Pages/Ecosystem-Services.aspx

7. Future plans or considerations (i.e., beyond 2025) (Sustainability)

EPA's "Clarification of Accounting for Growth Expectations for the Phase III Watershed Implementation Plans (WIPs)" document (Feb. 5, 2019), provides the following guidance to help jurisdictions adaptively manage growth over time:

"**Updating Observations of Land Use Change and 2025 "Current Zoning" baseline**
Regular updates to the Chesapeake Bay land use data will inform an adaptive management approach to achieve pollution reduction targets and will constitute an important part of the process to verify the effects of land policy BMPs. Coarse-scale, "hot spots" of land use change (approx. >= 10 acres) will be observed every two years (with a 1 to 2-year lag) through the interpretation of satellite imagery. Fine-scale changes in land use (approx. >= 1 acre) will be observed every four years (with a two to three year lag) through the interpretation of aerial imagery. When available, these data will be provided to the jurisdictions to inform their two-year milestones and annual progress narratives, indicating the need for greater or lesser emphasis on BMPs for different sectors. The data will also be evaluated for use in updating the 2025 current zoning baseline. The 2025 baseline condition will be updated every odd year, coinciding with the two-year milestones, using the best available data (e.g., population and employment projections, protected lands, census of agriculture, and potentially new observed patterns of land use change). The updated baseline conditions will be used to inform the two-year milestones and annual progress assessments and to help the jurisdictions verify the effects of actions specified in their land policy BMPs. For example, updating the current zoning baseline in the summer of 2019 will inform 2019 and 2020 progress and the 2021-2022 milestones.

Annual Progress Reporting Recommendations
Every year, the Bay jurisdictions must report progress towards achieving the goals outlined in their WIPs and two-year milestones. Reporting progress has a narrative programmatic component and a quantitative component consisting of a table of approved BMPs that were implemented over the previous year. Implemented BMPs are combined with expected land use conditions in CAST to quantify their expected nutrient and sediment reductions. Land policy BMPs determine the expected land use conditions for 2025, and affect land use conditions for interim years between the latest mapped land uses (i.e., 2013) and 2025. Actions specified in the Phase III WIP to achieve the land policy BMPs adopted by each jurisdiction should not be included in the tables of implemented BMPs. However, verification of the land policy BMPs warrants narrative, programmatic and numeric reporting of actions implemented each year to ensure that the jurisdictions are on track to achieving them. For example, annual progress reporting might include documentation of acres of forest and farmland conserved by county, investments to expand wastewater infrastructure, issuance of new subdivision ordinances, or implementation of zoning regulations that protect riparian zones from development. Annual reporting of activities along with monitored changes in land use will help verify land policy BMP actions intended to reduce and minimize potential future increases in water pollution due to land use activities. The and Use Workgroup, Water Quality Goal Implementation Team and Management Board will be asked to clarify CBP partnership expectations about the level of detail needed to verify Land Policy BMP actions in annual progress narratives.

8. **Describe any specific local engagement conducted and that will continue through the implementation process (recognizing the WIP local engagement team will draft the broader engagement strategy)**

   Maryland completed three approaches to obtain information from local governments and local land trusts to inform the conservation plus effort. Through the local WIP inventory meetings (September - October 2018) and through a separate survey (October 2018), MDP asked local governments to forecast the amount of forest and farmland between 2018 and 2025 that would be preserved through local purchase of development rights and/or transfer of development rights programs. Similarly, through a survey of local land trusts (September 2018), MET and MDP worked to identify the amount of land that private conservation organizations expected to protect between 2018 and 2025. In January 2019, Maryland surveyed local governments to identify development requirements (e.g., stream buffer requirements) that exceeded state development requirements.

Water Quality and Aquatic Resource Protection Programs

Background

It is important to remember that Maryland's WQS establish not only the minimum water quality that must be maintained in our waterways, but also include an antidegradation policy whereby protection is afforded to waters that are better than the minimum required standard. As various levels of government focus on Chesapeake Bay restoration goals and meeting pollution reduction targets, it is critical that water quality protection efforts are not neglected and jeopardize progress made on other fronts. To prevent backsliding or unintentional degradation of upstream resources, Bay restoration efforts should not only focus on reducing nutrients and sediments, without protecting our healthy waters and living resources. Aligning the Phase III WIP protection strategies for high quality and/or high value resources with existing water quality management programs that are already providing oversight of these resources will help to maintain water quality gains downstream in the Bay, and increase both watershed ecological and climate resilience. Although the strategies listed are of benefit to most streams, the non-tidal stream resources considered to be high value and high quality for the purpose of this document are: drinking water sources; Tier II high quality streams; trout fisheries; natural heritage areas; rare, threatened, and endangered species; anadromous fish; and non-tidal wetlands.

Though the focus of the protection strategies are to promote the protection of vital high quality/value non-tidal resources, this is not intended to dismiss the need to address tidal resources. Tidal resources are more difficult to specifically target through direct place-based management because they are cumulatively impacted by stressors from both upstream and downstream sources. Regardless, the protection of vital freshwaters will have many positive water quality impacts on both nearby non-tidal freshwaters and the downstream tidal waters of the Chesapeake Bay and its tributaries.

Protection Strategies

1. Develop guidance, products, and factsheets

Rationale: Guidance documents, products, and factsheets can be a simple and effective way to encourage consistent implementation of protection measures across the state. Guidance is also a valuable education tool to help link the co-benefits of certain restoration actions for protection.

Tasks:

- Identify existing guidance documentation and elevate the level of awareness for underutilized, but useful resources.
- Identify existing resource screening and evaluation tools. Review to determine if all high quality/high value resources are adequately incorporated.
- Coordinate the co-development of guidance, products, or factsheets by state environmental and natural resource agencies to identify opportunities for protecting multiple high quality/high value water resources.
- Align products with county needs and ongoing initiatives.

2. Coordinate outreach and unify messaging

Rationale: The Chesapeake Bay WIP provides a unique opportunity to coordinate individual federal and state water resource protection efforts, and encourage broader goal alignment.

Tasks:

- Beginning with state environmental and resource agencies, compile a comprehensive list of water resource protection outreach opportunities, and the timing of each opportunity, while prioritizing the opportunities that will a) benefit multiple resources, b) reach a large audience, or c) have a high potential for overlap with current Bay restoration actions (e.g., MS4 permit monitoring requirements and the monitoring of Tier II waters).
- Develop a methodology to identify existing and new opportunities to make protection outreach more efficient, and provide a consistent, consolidated message from state agencies.
- Streamline outreach materials so that local governments have an easier-to-understand menu of resource protection options and partners to choose from.

3. Improve cross-jurisdictional cooperation and coordination

Rationale: High quality and high value non-tidal stream resources have distinct geographic extents, often spanning county boundaries. Strategies designed to make protection efforts consistent across jurisdictions will increase the overall resource protection benefit. Also, from a watershed perspective,

a more holistic approach to protection and restoration may result in a more efficient use of funding through joint efforts.

Tasks:

- Develop user-friendly GIS based and online products to relate where multiple resources occur and where such important areas cross county boundaries.
- Identify areas where the level of high quality/value resource protection could be strengthened across jurisdictional boundaries and explore opportunities for collaboration.

4. Better leverage work completed by the Maintain Healthy Watersheds Goal Implementation Team (GIT) into protection initiatives

Rationale: The GIT is currently conducting a preliminary healthy watersheds and vulnerability assessment for the Chesapeake Bay and\, state-identified healthy watersheds. The outcomes of this assessment should be used in the planning and implementation process alongside actions undertaken to meet Bay restoration goals.

Tasks:

- Provide outcomes to counties for use during the comprehensive planning process.
- Provide communities and public-private partnerships with guidance on scientifically supported actions on a stream segment-catchment scale to enhance protection beyond conservation and stream restoration, to address stream health, vulnerabilities and threats.
- Use outcomes to develop or improve MDE strategies for the protection of Tier II streams.

5. Streamline the Tier II Stream Review Process Across Key state Agencies

Rationale: MDE currently reviews all applications for impacts to Tier II streams; however, there are other state agencies that conduct environmental reviews for the same project. There have been several incidences where this independent review process has delayed permit issuance at one or both agencies (e.g. reviews related to energy and transportation projects, require additional review due to the potential for widespread impacts to streams and other watershed resources). Coordinated environmental reviews between agencies would minimize review times, and ensure a more complete and comprehensive review.

Tasks:

- Pilot study with one agency review program.
- Based on study outcome develop coordination plan, policies, conditions, etc.
- Identify and work with other relevant agencies to develop similar coordination plans.

6. Improve high quality resource protection at the county level

Rationale: To inform ongoing local comprehensive plan updates, new information and better science related to protection of healthy waters should be made available. Counties and municipalities should be encouraged and assisted with incorporating new knowledge and innovations into protection initiatives and Master plans. This would also help establish a minimum policy and protection threshold at the earliest stages of the planning process and streamline concurrent review activities.

Tasks:

- Develop guidance for local governments for updating comprehensive plans for consistency of language, up-to-date maps, web links, and basic healthy streams protection policy.
- Provide information for counties to address high quality water protection at each stage of the planning process.

7. Recommend new or modifications of existing legislation, regulation, policy, ordinances, etc.

Rationale: There are a myriad of programs, legislation, regulation, policy and ordinances that directly and indirectly confer protection to high quality or high value non-tidal resources, often with one program providing multiple benefits. However, these programs, laws, regulations and policies may not address all the necessary protection gaps. In addition, current regulations should be revisited to ensure efficiency, avoid future issues, correct past pitfalls and introduce novel ways to make both protection and restoration gains.

Tasks:

- Work with stakeholders to identify protection gaps, discuss possible methods and capacity to address protection gaps, and identify economic and environmental consequences of those methods.
- Identify programs that offer some protection to each resource and evaluate the level of protection conferred.
- Identify gaps in protection.
- Facilitate discussion and formulation of new programs to address identified gaps in protection and key challenges.
- Prioritize recommendations based on this information.

Key Protection Challenges and Gaps

Tier II anti-degradation waters: inconsistent implementation of comprehensive Tier II policies and requirements at local levels; resource-limited outreach, and limited dedicated staff. There needs to be a strategy to systematically introduce Tier II stream protections earlier in the local planning process, and within relevant county and local ordinances and laws like resource protection zones. There are several existing programs, legislation, regulation, policy, ordinances, etc. that align well with tier protection, and such relationships could be more intentional. However, it is often very difficult to modify legislation.

Being based on biological condition, there is difficulty in relating Tier II impacts to discrete discharge parameters and specific pollutants.

Anadromous Fish: Several anadromous finfish species depend on healthy waters in the Bay to maintain healthy populations. Recent studies conducted by Uphoff et al. (2006-2017) have documented declines in spawning habitat compared to historical distributions. Survival of early life stages greatly influences sustainability of a population, as declines in survival of eggs and larvae limit recruitment of adults into the population. Persistent losses over time can reduce resiliency of a population and limit its sustainability. For these reasons and more, habitat is a key factor in the success of early life stages. Expanding development and specifically the associated impervious surfaces threatens the suitability of anadromous fish habitat. New measures, limiting the expansion of impervious surfaces in high quality/value habitats may be needed to protect existing stocks of anadromous fish. Using information from various studies, DNR has mapped high priority watersheds where conservation of rural lands is an effective strategy to promote protection of spawning habitat.

Universal gaps and challenges: The greatest challenge is how to account for the impacts of permanent land use conversion on high water quality and high value resources. With so many resources being dedicated towards Bay restoration, protection is often considered a separate process, yet protection and restoration are synergistic. There are gaps in understanding how some BMPs confer multiple protections, providing water quality benefits that may outweigh a less costly, narrowly applied practice. For example, the most favorable cost-to-credit ratio may skew preferred sites to more downstream locations in target watersheds, rather than nearer to the headwaters where strategically placed practices could be more effective long term by addressing problems closer to the source. Although it is a constant challenge to better quantify these benefits within the BMP selection framework, doing so will help address not only Bay restoration efforts, but also prevent localized degradation, net resource loss, and address local TMDLs. Maryland will begin to overcome this challenge when fifth generation MS4 permits are revised in 2019 to incentivize credits for BMPs that maximize impact on all ecological concerns, not just nutrients and sediment. High quality resources have geographic extents, which often cross jurisdictional boundaries and more interjurisdictional collaboration is necessary for consistent and effective levels of protection. Limited funding and staff highlight the need for more intentional collaborative work, education, and new strategies that best encourage a holistic approach to protecting water quality.

Cross-team Considerations and/or Challenges: There needs to be a way to represent the true value of protection of non-tidal water quality within the BMP selection framework, so as not to sacrifice biological and chemical quality upstream to maximize nutrient and sediment load reductions downstream. Balance is required, and there are local TMDLs, impairments, and resource losses that could mutually be addressed. While stormwater controls for nontidal TMDLs are essential components of Maryland's WIP, thus far there is no cross sector mechanism or series of mechanisms to address net losses of natural assets that support high quality/high value streams and resources.

Funding Capacity

Some of these strategies can be implemented with existing resources. Others may require direct funding sources, which have not yet been identified. It is also hard to estimate the cost associated with strategy

implementation until more refined areas of guidance, factsheets, products, documentation, outreach materials and actions are developed. Leveraging existing programs, etc., where possible will make implementation more feasible.

Co-benefits

1. Bay Restoration: Forest cover and riparian buffers help meet sediment and nutrient reduction goals.
2. Climate Change: Maturing forests act as CO2 sinks, and offer stability to offset the "heat island" effect while buffers cool streams protecting in-stream aquatic organisms.
3. Resilience: Protection can improve flood control, promote stream stabilization and regulation of hydrologic flows, and recovery after storms and major weather events.
4. Economics: Protection of upstream high quality waters and resources is more economically sustainable than having to engineer restoration solutions. According to the EPA, the cost per pound of nitrogen reduction is $3.10 for a forest buffer vs. $8.56 for wastewater treatment in the Bay watershed (2012).
5. Local Government Support: Strategies compliment local government programs, core commitments, goals and initiatives including addressing local impairment issues and TMDLs.

Future plans/considerations: Future plans or considerations (i.e., beyond 2025) (Sustainability)

1. Develop framework for updates and ways to better track progress.
2. Develop further justification for protection based on natural resource-based economics.
3. Develop watershed-specific high-quality vulnerability and health strategies for each county to encourage joint protection actions.
4. Identify and or develop funding sources to support strategy implementation.
5. Develop a process to take the list of potential cross-jurisdictional protection opportunities and conduct a pilot study. Use this as a template for scaling similar actions across the Bay watershed.

Specific Local Engagement

Tier II anti-degradation reviews provide an opportunity to inform the public about high quality waters protection. Web resources, presentations, publications, etc. are continually produced by state agencies and are generally focused on one particular resource such as brook trout. The Healthy Watersheds Bay Program cohort includes several goal teams that focus on fish habitat, fish passage, streams, etc., and teams conduct outreach through public meetings, workshops, presentations, publications and web products.

Figure 3-6 represents high quality stream and resource density across the state of Maryland. The grey areas to the west of the Bay primarily represent drinking water sources, while those to the east of the Bay represent anadromous fish priority streams. Brown, green, or blue areas indicate locations with the highest density of high quality resources. There are high density – high quality areas located in every county in Maryland.

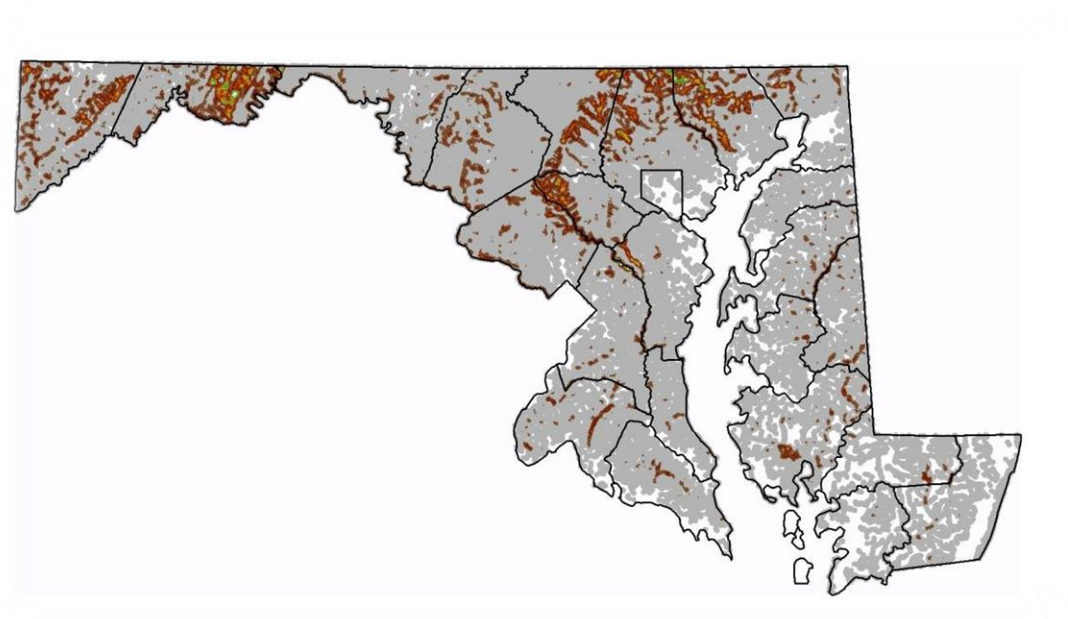


Figure D-1: *High quality stream and resource density in Maryland.*

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Appendix E. Department of Defense Input: Maryland Phase III Watershed Implementation Plan

1.0 Location and Description of the Federal Land or Facility

1.1 Facility Name

The following Department of Defense (DoD) installations are located within the jurisdictional boundaries of Maryland in the Chesapeake Bay Watershed:

- 99th RSC (MD)
- Aberdeen Proving Ground
- Adelphi Laboratory Center[1]
- Army Reserve National Guard (MD)
- Fort George G. Meade
- Fort Detrick[2]
- Joint Base Andrews[3]
- NAS Patuxent River[4]
- Naval Research Laboratory[5]
- NSA Annapolis[6]
- NSA Bethesda
- NSA Washington - NSF Carderock
- NSA Washington – Suitland
- NSA South Potomac - Indian Head

[1] Includes Blossom Point Research Facility and Naval Research Laboratory (NRL) at Blossom Point
[2] Includes Forest Glen Annex
[3] Includes Brandywine Receiver/Defense Reutilization and Marketing Office and Davidsonville Transmitter Sites
[4] Includes Naval Recreation Center Solomons, Webster Field Annex, and Bloodsworth Island Range
[5] Includes Chesapeake Bay Detachment and Pomonkey, Blossom Point Training Facility located on Adelphi Laboratory Center
[6] Includes North Severn, the U.S. Naval Academy, Dairy Farm, Brandywine Defense Reutilization and Marketing Office, and the Davidsonville Receiver Site

1.2 Property Boundaries

GIS property boundary information for each of the installations can be found in the Chesapeake Assessment and Scenario Tool (CAST) located at the following link under the Spatial Data heading: cast.chesapeakebay.net/Documentation/BMPsModelsGeography.

1.3 Land Cover

The land cover on DoD installations within the Chesapeake Bay watershed is comprised of developed and natural acres. Table E-1 summarizes the acres of various load source groups extracted from CAST for DoD lands. Although CAST does not include the acres of active construction sites on DoD installations, these activities are part of the land cover condition. Once the construction activities are completed, both the developed and natural load source groups will be updated based on the land use changes. As of December 2018, there were 103 active construction permits on DoD installations. There are six point sources (i.e., wastewater treatment plants) owned and operated by DoD installations in Maryland. In addition, there are three DoD facilities with land that is leased to farmers or ranchers for agricultural use. NAS Patuxent River out-leases approximately 462 crop acres; NAS Patuxent River-Webster Field out-leases 136 crop acres; and the NSA Annapolis Dairy Farm out-leases 857 pasture and crop acres**.**

Table E-1: DoD Land Cover Acreages per Load Source Group:

CAST Compare Scenarios between 2010 No Action and 2017 Progress V9

Jurisdiction: Maryland	2010 Partnership No Action Scenario	2017 Partnership Progress Scenario V9
Developed	21,567.4	22,002.5
Developed Impervious	8,054.4	8,248.0
CSS Buildings and Other	2.6	2.6
CSS Roads	0.0	0.0
CSS Tree Canopy over Impervious	0.1	0.1
MS4 Buildings and Other	18.1	18.4
MS4 Roads	81.9	82.3
MS4 Tree Canopy over Impervious	5.9	6.0
Non-Regulated Buildings and Other	5,855.9	5,993.3
Non-Regulated Roads	1,694.2	1,736.0

Non-Regulated Tree Canopy over Impervious	395.7	409.3
Developed Pervious	13,513.0	13,754.5
CSS Tree Canopy over Turf Grass	1.7	1.7
CSS Turf Grass	0.7	0.7
MS4 Tree Canopy over Turf Grass	15.1	15.3
MS4 Turf Grass	68.5	68.7
Non-Regulated Tree Canopy over Turf Grass	1,644.5	1,698.1
Non-Regulated Turf Grass	11,782.5	11,970.0
Developed Construction	0.0	0.0
CSS Construction	0.0	0.0
Regulated Construction	0.0	0.0
Natural	50,825.3	50,389.8
CSS Forest	1.4	1.4
CSS Mixed Open	0.6	0.6
Harvested Forest	0.0	0.0
Headwater or Isolated Wetland	2,614.8	2,592.4
Mixed Open	10,419.5	10,286.5
Non-tidal Floodplain Wetland	1,452.1	1,437.0
True Forest	33,084.3	32,846.7

Water	3,252.7	3,225.1
Total	72,392.7	72,392.2

1.4 Area

In total, DoD installations cover 102,485 acres within Maryland. See Table E-2 for a breakdown by Installation.

Table E-2: Acreage of DoD Installations within Maryland

Installation	Total Area	Impervious Area	Pervious Area
99th RSC (MD)	277.6	155.8	121.9
Aberdeen Proving Ground	71,568.3	2,024.9	69,543.4
Adelphi Laboratory Center	207.0	51.8	155.3
Blossum Point Research Facility (includes NRL)	1,579.5	35.8	1,543.7
Army Reserve National Guard (MD)	940.7	165.1	775.6
Fort Detrick	1,212.0	334.0	878.0
Forest Glen Annex	124.8	46.4	78.4
Fort George G. Meade	5,107.0	869.0	4,238.0
Joint Base Andrews	4,404.0	1,302.0	3,059.0
Brandywine Receiver Site and Defense Reutilization and Marketing Office	1,687.0	11.8	1,667.3
Davidsonville Transmitter Site	895.0	6.5	888.5

NAS Patuxent River	3,326.0	1,259.7	2,066.3
NAS Patuxent River - Solomon's Island	241.0	63.0	178.0
NAS Patuxent River - Webster Outlying Field	454.0	119.2	334.8
NAS Patuxent River - Bloodsworth Island Range	5,379.0	0.0	5,379.0
Naval Research Laboratory (CBD, Pomonkey, BPTF)	160.0	8.0	152.0
NSA Annapolis	1,170.0	251.2	918.8
NSA Bethesda	243.0	93.0	150.0
NSA Washington - NSF Carderock	156.7	67.7	89.0
NSA Washington – Suitland	39.0	18.9	20.1
NSA South Potomac - Indian Head	3,314.0	373.0	2,941.0
Total	102,485.6	7,256.7	95,178.0

1.5 Land Use Types

DoD installations are composed of military, industrial, administrative, recreational, residential and open space land uses. NAS Patuxent River and the NSA Annapolis Dairy farm also have agricultural land uses.

1.6 Nature of Activities

DoD installations in Maryland are engaged in a variety of activities, including military training, weapon testing, ceremonial activities, research and development, environmental compliance and natural resources protection, enhancement and restoration.

2.0 Description and Estimation of Current Releases of Nitrogen, Phosphorus and Sediment from those Federal Lands or Facilities (Point and Nonpoint Sources) and an Estimate of Anticipated Growth Through 2025

Each year, the DoD collects stormwater BMP records from installations. Those records are then consolidated and reported to all of the Chesapeake Bay jurisdictions, including Maryland. From there, the records are entered into a state record and assigned a unique identification. Jurisdictions then report their entire progress from all partners, which is then compiled in the National Environmental Information Exchange Network (NEIEN). After passing through NEIEN, the stormwater BMP data is uploaded into CAST with unique identification numbers. The unique number allows DoD to track crediting through the various stages of reporting. Stormwater BMP crediting is an important step in understanding current releases of TN, TP, and total suspended solids/sediment (TSS) because it allows DoD to determine if the CBP partnership's annual progress scenario properly characterizes our implementation and nutrient and sediment load reductions.

BMP implementation data based on the 2017 partnership scenario indicated that 87 percent of the 1,455 BMP records reported by installations are fully credited in the Bay model and to DoD; another 2 percent of the BMPs were partially credited; and 11 percent received no credit. Using preliminary data from the 2018 partnership scenario, both the developed and natural loads for DoD have increased slightly from the partnership's 2017progress scenario. It is not clear as to why this has occurred and DoD will be evaluating if BMP crediting is one of those causes. Because there were some discrepancies in the model as it related to DoD crediting, DoD developed an alternate 2018 progress scenario that characterizes our current TN, TP and TSS loads based on installation BMP implementation.

DoD also developed two additional scenarios to assist in understanding the change in TN, TP and TSS loads for the developed and natural load source groups only. The first, which DoD refers to as the 2010 DoD baseline included BMPs implemented between July 1, 1984 and June 30, 2009 at the state-Chesapeake Bay watershed only area (state CBWS-only) scale. This scenario helps to determine the loads at the end of the 2009 progress year. The second scenario, called the 2018 DoD progress scenario, included all BMPs implemented between July 1, 1984 and June 30, 2017 at the state CBWS-only scale. This scenario quantifies DoD TN, TP and TSS loads at the end of the 2018 progress year. Tables E-3 through E-5 provide the DoD MD-CBWS only TN, TP and TSS loads at the Edge of Stream (EOS) and Edge of Tide (EOT) in pounds per year and the 2010 baseline scenario.

Table E-3: DoD TN Loads (in lbs/year)

Jurisdiction	2010 Baseline (EOS)	2018 DoD Progress (EOS)	2010 Baseline (EOT)	2018 DoD Progress (EOT)
Maryland	348,161	351,583	395,694	396,311

Table E-4: DoD TP Loads (in lbs/year)

Jurisdiction	2010 Baseline (EOS)	2018 DoD Progress (EOS)	2010 Baseline (EOT)	2018 DoD Progress (EOT)
Maryland	39,900	38,045	108,947	106,529

Table E-5: DoD TSS Loads (in lbs/year)				
Jurisdiction	2010 Baseline (EOS)	2018 DoD Progress (EOS)	2010 Baseline (EOT)	2018 DoD Progress (EOT)
Maryland	66,102,062	66,679,373	411,939,341	406,519,417

Developing the 2010 DoD baseline and 2018 progress TN, TP and TSS loads allowed DoD to determine the changes in TN, TP and TSS loads (i.e,. reductions/load increases) at the EOS and EOT in pounds per year between 2010 and 2018 on DoD installations in Maryland (Table E-6). Between 2010 and 2018, loads increased for TN at the EOS and EOT and TSS increased at the EOS; TP loads decreased at both the EOS and EOT and TSS decreased at the EOT.

Table E-6: DoD Change in Load (in lbs/yr EOS and EOT) between 2010 and 2018			
Jurisdiction: Maryland	TN	TP	TSS
EOS	(3,423)	1,855	(577,311)
EOT	(617)	2,418	5,419,924

DoD owns and operates six wastewater treatment plants in Maryland that discharge to the Chesapeake Bay; four are significant/major plants located at Aberdeen Proving Ground, Fort Detrick, NSF Indian Head and NSA Annapolis. The two non-significant/minor plants are located at NAS Patuxent River-Webster Field and Naval Research Lab-Chesapeake Beach. The load source is not tracked by EPA in the model for DoD or any other federal agency owned wastewater treatment plant and therefore reductions are not credited to DoD. However, point source data is provided by EPA and DoD is able to track our reductions from wastewater treatment plants. Since 1984, DoD has reduced TN, TP and TSS loads from wastewater treatment plants in Maryland by 84 percent, 97 percent and 70 percent, respectively. The reductions also demonstrate the significant investments that were made by DoD to address these loads via enhanced nutrient removal technologies. Figure E-1 provides the watershed-wide total load TN, TP and TSS reductions for all DoD owned WWTPs.

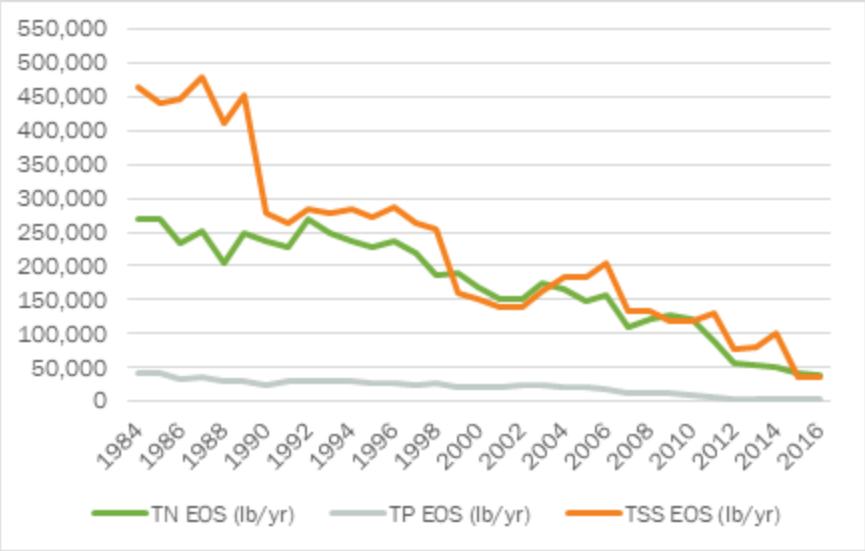

Figure E-1: Total Loads from DoD WWTPs at EOS from 1984 to 2016 in Maryland, Virginia, and Pennsylvania

While it is difficult for DoD installations to predict future mission requirements, estimates of anticipated growth through 2025 were reported by installations during the FY18 CBP data call and are represented in Table 7 below. Based on installation input, 334 acres of new development and 78 acres of redevelopment were reported in 2018, and 156 acres of new development and 287 acres of redevelopment are expected through 2025. However, it should be noted that if DoD mission needs change, future construction estimates may be changed within Maryland. Nevertheless, based on DoD policies, programs and strategies identified in Section 4, redevelopment will not result in any additional runoff or pollutant loading to the Chesapeake Bay.

Table E-7: DoD Estimates of Anticipated Growth Through 2025 (acres) in Maryland

Installation	2018 New Development	2018 Redevelopment	New Development Through 2025	Redevelopment Through 2025
99th RSC (MD)	15.0	0.0	0.0	0.0
Aberdeen Proving Ground	141.3	27.3	68.1	172.8
Adelphi Laboratory Center	1.5	0.0	0.0	1.0
Army Reserve National Guard (MD)	25.0	0.0	0.0	0.0

Fort Detrick	72.8	2.4	25.0	10.0
Fort George G. Meade	30.0	4.0	29.1	29.1
Joint Base Andrews	0.0	25.0	25.0	25.0
NAS Patuxent River	40.0	0.2	0.0	0.0
NAS Patuxent River - Solomon's Island	0.0	0.0	0.0	0.0
NAS Patuxent River - Webster Outlying Field	0.0	0.2	0.0	0.0
NAS Patuxent River - Bloodsworth Island Range	0.0	0.0	0.0	0.0
Naval Research Laboratory (CBD, Pomonkey, BPTF)[2]	0.0	2.0	0.0	4.0
NSA Annapolis	7.2	6.0	1.0	16.0
NSA Bethesda	0.0	9.0	5.0	9.0
NSA Washington - NSF Carderock	0.0	0.0	0.0	0.0
NSA Washington – Suitland	1.3	0.5	3.0	20.0
NSA South Potomac - Indian Head	0.0	1.5	0.0	0.0
Total	**334.0**	**78.1**	**156.2**	**286.9**

3.0 Verified Records of the Existing BMPs that have been Implemented and Maintained through 2017

Installations are responsible for ensuring stormwater BMPs are inspected and maintained according to design standards and permit requirements. In Maryland, installations with MS4 permits are required to develop a BMP inventory with fields for inspection and maintenance requirements that demonstrate that BMPs are inspected during the first year of operation and then at least every three years after that.

Maintenance requirements differ based on the type of BMP, but is typically performed via contract based on available funding for hydrodynamic structures or when inspections note BMP failure.

Each year, the DoD collects BMP records from installations. Those records are then consolidated and reported to the jurisdiction by the DoD Chesapeake Bay Program (DoD CBP).

As part of DoD's overall reporting framework, which strives to improve the data quality reported by installations, DoD integrated verification into their FY18 annual BMP data call. DoD flagged specific BMPs within the historical record on (1) their inspection and maintenance status and (2) if a BMP was not installed or had not been inspected in the past five years. Installations were expected to update BMP information with inspection dates, inspection status and maintenance performed.

In 2019, DoD will be developing a BMP crediting report that highlights those BMPs that lost credit due to missing inspection and/or maintenance information. The report will be used to communicate with the installations and leadership the long-term consequences that translates into annual nutrient and sediment reductions that DoD cannot get credit for as a result of not providing the required maintenance information or not performing the appropriate maintenance. DoD's intent is to ensure long-term credit in the model and acknowledges the importance of proper BMP operations and maintenance. Throughout 2019, DoD will be evaluating the best methods to ensure long-term funding of BMP maintenance.

4.0 Description of Existing Programs, Policies, and Strategies (with examples) Used to Drive BMP Implementation

There are several existing policies and programs that, since their promulgation, have provided the necessary drivers for DoD to fund projects and ultimately drive stormwater BMP implementation. The following provides those existing polices internal and external to DoD.

4.1 Compliance with the Clean Water Act (CWA): Twelve DoD installations are covered by the MS4 General Permit for state and federal agencies and submitted their Notice of Intent to Maryland in October 2018. As part of permit compliance, installations develop stormwater management programs that improve water quality and control the discharge of pollutants through six minimum control measures. In relation to the Chesapeake Bay TMDL and the necessary reductions of TN, TP and TSS, the Maryland MS4 General Permit for state and federal agencies establishes new requirements for impervious area restoration for 20 percent of existing developed lands that have little or no stormwater management. Installations covered by the MS4 permit developed restoration planning strategies and implementation schedules to improve local water quality and restoration of the Chesapeake Bay. In addition, several DoD installations without MS4 permits are covered by permits that regulate stormwater discharges associated with industrial activities. Those general industrial permits also include conditions that require installations to perform restoration of impervious surfaces. Therefore, most if not all installations within Maryland are completing restoration activities for reducing nutrients and sediment loads delivered to the Chesapeake Bay.

4.2 Compliance with Maryland's Stormwater Management regulations: Installations or contractors performing the construction activities obtain construction general permits to manage stormwater associated with the construction activity with a planned total disturbance of 5,000 square feet or more. Compliance with those permits includes erosion and sediment control, stormwater management plans, water quality standards/TMDLs, self-monitoring/inspections/maintenance and record keeping.

4.3 2014 Chesapeake Bay Watershed Agreement: DoD was one of the first federal agencies to become formally involved in the Chesapeake Bay restoration effort in 1984, and in 1990 we further strengthened our participation and role by linking DoD environmental initiatives to the CBP. The latest Chesapeake Bay Watershed Agreement, signed in 2014, identifies specific goals and outcomes for the restoration of the Chesapeake Bay. As an engaged partner towards clean water, DoD committed to the WIP outcome as a participating agency. In addition, the DoD monitors, assesses and reports on installation efforts that enhance abundant life, conserve lands and engage communities.

4.4 Local Area Planning Goals/Federal Agency Planning Goals: By definition, local planning goals "are not finer scale wasteload and load allocations in the Bay TMDL, but when added together are expected to equal the relevant state-basin TMDL allocation caps[32]." DoD received TN, TP and TSS federal facility targets/local area planning goals in 2015 for all installations located in Maryland for the urban stormwater developed sector only. The development of the federal facility targets was consistent with the strategies outlined in Maryland's Phase I and Phase II WIP that entails a 20 percent retrofit of developed urban land that has little or no stormwater management.

Because the DoD planning, programming, budgeting and execution process can be long and cumbersome, early indications of future requirements can help secure future funding. Identification of local planning goals that are applied equitably across all entities in the watershed assists DoD, other federal agencies, local governments and businesses in planning for actual, future requirements. Having local planning goals identified is a good first step in the planning cycle since DoD requires actual requirements to assure funding to meet our obligations. Using the local area planning goals process that is consistent with the permit conditions established for MS4s continues to align with DoD's funding policies.

Therefore, the planning goal/federal facility target represents an equitable portion of DoD's reduction requirements and supports Maryland in meeting their Phase III WIP Planning target. It is important to understand that in terms of regulatory compliance, DoD must ultimately be treated in the same manner (i.e., load calculations and pollutant target reductions) and to the same extent (i.e., implementation schedule) as any other entity.

[32] Protocol for Setting Targets, Planning BMPs and Reporting Progress for Federal Facilities and Lands (2015)

Therefore, DoD continues to follow a strategic approach that emphasizes compliance with CWA and other permit requirements along with reduction of nutrient and sediment from non-permitted sources as funds are made available.

4.5 2009 Executive Order (EO) 13508 / 2010 EO 13508 Strategy: In accordance with EO 13508, the federal government should lead the effort to restore and protect the Chesapeake Bay. DoD continues to demonstrate our commitment to this effort in accordance with the EO and accompanying strategy. Since their release, the DoD has conducted installation-wide BMP inventories or conducted surveys or BMP Opportunity Assessments to determine potential locations for additional stormwater retrofits on developed land that have little to no stormwater management. These assessments identify ways to strengthen and manage stormwater including structural and non-structural BMPs, erosion control, and infrastructure maintenance and repair opportunities.

4.6 Unified Facilities Criteria (UFC) 3-210-10: The UFC provides technical criteria, technical requirements, and references for the planning, design and construction, renovation, repair, maintenance and operation, and equipment installation in new and existing facilities in support of DoD policy goals, including compliance with stormwater requirements under Section 438 of the Energy Independence and Security Act (EISA) enacted in December 2007, and the Deputy Under Secretary of Defense DoD policy on implementation of stormwater requirements under EISA Section 438.

4.7 Section 438 of the Energy Independence and Security Act (EISA) of 2007: EISA Section 438 addresses stormwater runoff requirements for federal development projects. EISA Section 438 requires that the sponsor of any development or redevelopment project involving a federal facility with a footprint that exceeds 5,000 square feet shall use site planning, design, construction and maintenance strategies for the property to maintain or restore, to the maximum extent technically feasible, the pre-development hydrology of the property with regard to the temperature, rate, volume and duration of flow. The Deputy Under Secretary of Defense Memorandum of Jan. 19, y 2010 directs DoD components to implement EISA 438 using Low Impact Development (LID) techniques. Individual services may have more stringent implementation and applicability requirements relating to LID.

4.8 Implementation of the Navy's Low Impact Development Policy: Navy installations continue to implement the LID Policy for Stormwater Management. LID minimizes the impact of development by mimicking pre-development runoff hydrology. It uses site planning and IMPs to store, infiltrate, evaporate and detain runoff to restore pre-development infiltration rates. Practicing LID helps DoD installations by recharging groundwater supply, reducing runoff volume and the potential for flooding, improving water quality by reducing pollutant loads, and reducing the impacts from pollution on aquatic habitat and wildlife. The UFC provides for planning, design, construction, sustainment, restoration, and modernization criteria consistent with LID.

4.9 EO 13834 Efficient Federal Operations: Under EO 13834, federal agencies are directed to prioritize actions that reduce waste, cut costs, enhance the resilience of federal infrastructure and operations, and enable more effective accomplishment of its mission. In implementing policy, federal agencies must meet several goals, which are based on statutory requirements, in a cost effective manner including reduce potable and non-potable water consumption and comply with stormwater management requirements. As federal agencies work toward meeting the full range of sustainability goals, the Chesapeake Bay watershed will benefit. DoD continues to develop an annual Sustainability Report and Implementation Plan, which includes implementation status, operational issues, and strategies to advance its mission through resilient infrastructure and business practices that improve performance and affordability.

4.10 Army Policy for Sustainable Design and Development (SSD): The Army SSD Policy builds on the Army's long-standing energy efficiency and sustainability practices with the goal of increasing the resiliency of its facilities and installations, enhance mission effectiveness, reduce the Army's environmental footprint and achieve levels of energy independence that enhance continuity of mission-essential operations. The policy applies to all infrastructure planning, design, sustainment, restoration, modernization and construction on Army installations. Accordingly, the Army will plan, design, build, maintain and operate facilities to achieve the highest-performing sustainable design that is life-cycle cost effective. Construction activities will be planned programmed, budgeted, designed, built, maintained and operated to comply with Energy Policy Act of 2005, EISA 2007, and EO 13834 and conform to the Guiding Principles for Federal Sustainable Buildings as detailed in the policy. The following policy requirements address water quality issues in the WIP:

- Siting and Site Development: Compact development, in-fill, minimal building footprints and spacing, and greater residential densities will be applied to achieve optimal densities. These practices will also help minimize or reduce impervious surface area and the potential for resulting polluting runoff.
- Stormwater Management. Site development for all projects of 5,000 square feet or greater shall retain the pre-development site hydrology in accordance with EISA 2007 Section 438 and UFC 3-210-10. These projects must be planned, designed, and constructed to manage any increase in stormwater runoff (i.e., the difference between pre- and post-project runoff) within the limit of disturbance. Projects will maximize the use of existing site topography including soils, flora, slope, and hydrology to minimize site disturbance including clearing and soil grubbing activities. Documentation of the project's compliance with EISA 438 will be maintained in the project file and will be reported via the chain of command for annual Strategic Sustainability Performance Plan reporting.
- Water Use: The overall goal is to identify and implement water reuse strategies to use water efficiently, including the use of alternative water sources (e.g., rainwater, reclaimed water, greywater, etc.). All projects will use water-efficient landscape strategies that achieve a minimum of 50 percent water reduction. To further reduce outdoor water use, native plant species and dry-scape architectural

alternatives will also be considered. Irrigation will not be used except where specifically required by Army policy or during the initial plant establishment phase. Projects that require irrigation will use alternative water in place of potable water.

- Planning, Design and Construction: All new construction vertical projects and comprehensive building renovations meeting the thresholds in UFC 1-200-02 Table 1-1 will be certified at the Leadership in Energy and Environmental Design (LEED) for Building Design and construction Silver level at a minimum.

4.11 Leadership in Energy and Environmental Design (LEED): LEED is an internationally recognized green building certification system developed by the U.S. Green Building Council. It promotes a whole building sustainability approach through energy savings, water efficiency, materials management and air emissions. With regard to stormwater management, LEED addresses stormwater quality and quantity and increased water efficiency. For DoD, new construction vertical projects and comprehensive building renovations that meet specific thresholds must be certified at the LEED for Building Design and Construction (LEED-BD+C) Silver level at a minimum.

4.12 Sikes Act: DoD installations with significant natural resources are required by the Sikes Act to develop and implement Integrated Natural Resource Management Plans (INRMPs). They integrate military mission requirements, environmental and master planning documents, cultural resources, and outdoor recreation to ensure both military operations and natural resources conservation are included and consistent with stewardship and legal requirements. INRMPs require installations to look holistically at natural resources on a landscape or ecosystem basis. They are living documents that provide direction for daily natural resources management activities and they provide a foundation for sustaining military readiness. They describe how to manage natural resources, allow for multipurpose uses of those resources, and define public access—all while ensuring no net loss in the capability of an installation to support its military testing and training mission. Although variations exist among the different military services, a basic INRMP includes:

- A description of the installation, its history, and its current mission;
- Management goals and associated timeframes;
- Projects to be implemented and estimated costs;
- A discussion of how the military mission and training requirements are supported while protecting the environment;
- Natural resources' biological needs and legal requirements;
- The role of the installation's natural resources in the context of the surrounding ecosystem; and
- Input from the U.S. Fish & Wildlife Service, state fish and wildlife agency and the general public.

To address installation requirements and regional issues, INRMPs involve appropriate stakeholders, thereby providing for more efficient and effective management of natural resources on a landscape-scale basis, all while ensuring that military readiness is sustained.

INRMPs propose projects to address natural resources, but many of those projects also provide a water quality co-benefit (wetland restoration, tree planting, riparian buffer enhancement, etc.). Projects with water quality co-benefits will be considered for meeting additional TN, TP and TSS reductions and tracked and reported to the jurisdictions for BMP credit in the Bay Model.

5.0 Inventory of National Pollution Discharge Elimination (NPDES) Permits

Table E-8: provides a summary of the types of NPDES permits located on DoD Installations in Maryland that discharge to the Chesapeake Bay:

Table E-8: Type of NPDES Permit Coverage located on DoD Installations in Maryland

Installation	MS4	Industrial	WWTP	Construction (2018)
99th RSC (MD)	Y	Y	N	Y
Aberdeen Proving Ground	Y	Y	Y	Y
Adelphi Laboratory Center	Y	N	N	Y
Army Reserve National Guard (MD)	Y	N	N	Y
Fort Detrick	Y	Y	Y	Y
Fort George G. Meade	Y	Y	Y	Y
Joint Base Andrews	Y	Y	N	Y
NAS Patuxent River	Y	Y	N	Y
NAS Patuxent River - Solomon's Island	N	Y	N	N
NAS Patuxent River - Webster Outlying Field	N	Y	Y	Y
NAS Patuxent River - Bloodsworth Island Range	N	N	N	N

Naval Research Laboratory (CBD, Pomonkey, BPTF)	N	Y	Y	Y
NSA Annapolis	Y	Y	Y	Y
NSA Bethesda	Y	N	N	Y
NSA Washington - NSF Carderock	Y	Y	N	Y
NSA Washington – Suitland	N	N	N	N
NSA South Potomac - Indian Head	Y	Y	Y	Y

6.0 Description of Facility's Stormwater Management Program including, but not limited to, Municipal Separate Storm Sewer System (MS4) Permit Requirements, if applicable

As mentioned in Section 5, 12 installations within Maryland are covered by an MS4 permit. DoD complies with regulations governing stormwater management as required by the CWA. In relation to the Chesapeake Bay TMDL and the necessary reductions of TN, TP and TSS, MS4s and industrial stormwater permittees are required to develop a restoration plan that identifies areas for impervious area restoration for 20 percent of existing developed lands that have little or no stormwater management.

7.0 Planned Pollutant Reductions from Point and Nonpoint Sources Associated with Federal Lands and Facilities that meet the Federal Facility's Share of a Local Planning Goals (as agreed to with the jurisdiction) and Address any Anticipated Growth

In 2019, the DoD funded a follow on analysis that included input from installations and what they estimated for planned implementation through 2025. The following information is provided to demonstrate the TN and TP loads expected through 2025 and a comparison to the DoD Federal Agency Planning Goals/Federal Facility Targets issued by Maryland in Tables E-9 and E-10. The reductions also incorporate recent verification measures that ensure inspections and maintenance are being performed. Some BMPs within the 2018 DoD Progress scenario did not pass verification protocols and were not included in the scenarios to calculate reductions through 2025.

Table E-9: DoD TN Load Reductions (in lbs/year EOT) between 2018 and 2025

DoD 2018 Progress and 2025 Planned Implementation Scenarios

Jurisdiction	DoD Federal Planning Goal	2025 Planned Implementation Scenario	Remaining Reductions
Maryland	324,611	348,209	23,598

Table E-10: DoD TP Load Reductions (in lbs/year EOT) between 2018 and 2025

DoD 2018 Progress and 2025 Planned Implementation Scenarios

Jurisdiction	DoD Federal Planning Goal	2025 Planned Implementation Scenario	Remaining Reductions
Maryland	37,827	36,649	-1,178[2]

DoD estimates of anticipated growth through 2025 were reported by installations during the FY18 CBP data call and are represented in Table E-7 (see Section 3.0). Based on installation input, 334 acres of new development and 78 acres of re-development were reported in 2018, and 156 acres of new development and 287 acres of redevelopment are expected through 2025. Based on DoD policies, programs and strategies discussed in Section 4, the development and redevelopment projects will not result in any additional runoff or pollutant loading to the Chesapeake Bay.

8.0 BMP Implementation Scenarios to Reduce Nitrogen, Phosphorus and Sediment to Reach the New Facility-Specific Targets, Consistent with the [Clean Water Act] CWA

As mentioned above, the 2025 planning implementation is a result of data collected by DoD from the installations on estimated BMPs to be installed. Scenarios have been developed in CAST and will be shared on or about June 14, 2019. These scenarios will include the estimated implementation plus implementation that would be necessary to fill the gaps between future progress and the DoD Federal Agency Planning Goal. The fill gap scenario is a best guess, hypothetical scenario based on best professional judgement.

As mentioned in prior sections, the DoD local area planning goal is a good first step in the budget process. DoD will make every effort to request and obtain the funding necessary for implementing projects, but changes in mission or budget constraints would mean a project or series of projects may not be executed as planned. The DoD may not be held responsible for failing to implement BMPs that are not required by law.

9.0 Planned Actions, Programs, Policies, and Resources Necessary Through 2025 to Reduce Nitrogen, Phosphorus, and Sediment Pollutant Loads Associated with Federal Lands and Facilities with Specific Target Dates

Achieving 2025 load targets will require the DoD to account for historical effort (progress through 2018), currently planned effort (2019 planned BMPs), and some remaining effort. Based on DoD data provided by installations in 2018 that requested implementation through 2025, the DoD CBP developed a scenario that included those planned BMPs. In addition, the DoD will be developing a "fill gap scenario" of BMPs that may be feasibly implemented on DoD installations based on the level of effort to reduce the remaining TN and TP loads. The scenarios will be developed based on input from installations, but are non-binding and are intended for planning purposes only.

In addition to the programs already mentioned, while DoD is on track to meet 2025 goals, the following conclusions were gleaned from an initial effort conducted by DoD that generated a hypothetical 2025 scenario to meet 2025 targets that were established by EPA in 2015:

- Continuously improve DoD's historical and current BMP implementation record: ensuring all criteria are populated, providing verification information, filling general data gaps, and reporting annual BMPs such as urban nutrient management;
- Track crediting and communicate errors so that the CBP partnership's scenarios can be used by DoD without having to generate a separate scenario;
- Get BMPs that were removed from credit as a result of verification back in as soon as feasible;
- Have installations focus on BMPs that reduce TN where a greater effort is needed since TN is the limiting pollutant in meeting reduction goals;
- Implement runoff reduction practices. Many installations are already considering these through development and redevelopment projects;
- Consider older BMPs and identify possibilities for enhancements for added TN, TP and TSS reduction benefits;
- Consider projects listed in INRMPs that have water quality co-benefits for TN, TP and TSS load reductions such as stream/shoreline restoration or wetland creation;
- Through stewardship activities increase the number of trees planted or other land use change BMPs;
- Engage post Phase III WIP development to ensure there is an understanding of changes to the level of effort as a result of climate change inputs and updates to the Bay model;
- Local TMDLs: Several installations within Virginia are also covered by permits that include local TMDLs that address local water quality impairments. DoD will consider

nutrients and sediment when implementing stormwater pollution control devices to meet these local TMDLs that do not directly correlate with TN, TP and TSS reductions.

10.0 Description of Plans to Address Any Gaps in Achieving the Pollutant Reduction Goals

The gap to address non regulated loads is a challenge, but many of the planned strategies help to fill those gaps. Installations have performed BMP opportunity assessments to identify new opportunities for BMPs and are looking to enhance those assessments to identify more innovative practices available for retrofit. The DoD performed an internal midpoint assessment and it will be used to accurately quantify the gap in Maryland. In addition to projects in the hypothetical 2025 DoD Implementation Plan with high TN removal efficiencies, the DoD will look at proposed INRMP natural resource projects with water quality co-benefits and how other DoD programs can contribute to water quality goals/requirements. Additional load reductions to address climate impacts will be incorporated when estimates of their effects are known.

11.0 Procedure for Tracking, Verifying and Annually Reporting BMPS to the Jurisdiction (Copy to EPA) in a Manner that is Consistent with the Jurisdiction's Procedures

DoD continues to lead by example through their continued methods that track, verify and report BMPs implemented on their installations. Our process integrates procedures established by the Jurisdictions, including the development of templates for all federal agencies to use. Each year, the DoD issues a support contract to facilitate the development of templates for reporting BMP implementation. The templates are developed in coordination with each of the jurisdictions and EPA to ensure the latest information for each BMP is collected and compatible with Phase 6 model data needs. Templates are then issued to the installations to provide responses. DoD reviews and then submits a consolidated DoD BMP progress dataset in the format requested by the jurisdiction by October 1 of each year. Installations also provide project data that support other aspects of the Chesapeake Bay restoration and protection effort. Over several years, the DoD has evaluated those projects to see if there was a potential to receive additional nutrient and sediment reductions. If projects are identified to have those water quality co-benefits the DoD consolidates and provides a supplemental dataset to the appropriate jurisdiction by November 1.

DoD installations follow the inspection and maintenance requirements established by Maryland. As part of the verification procedures, the DoD integrated process controls in their reporting template to highlight specific BMPs that needed inspection, status, and maintenance information for the installation to populate in order for that BMP to continue to receive nutrient and sediment reduction credit. If the verification information was not populated for that BMP it was removed from the submittal to the Jurisdiction and did not receive credit.

12.0 A description for how the Federal Facilities are going to Verify BMPs that is consistent with the CBP Partnership's Basinwide BMP Verification Framework and the Partnership Approved and Published BMP Verification Protocols

Installations are responsible for ensuring stormwater best management practices are inspected and maintained according to design standards and permit requirements. In Maryland, installations with MS4

permits are required to develop a BMP inventory with fields for inspection and maintenance requirements that demonstrate that BMPs are inspected during the first year of operation and then at least every three years after that and routinely maintained. Maintenance requirements differ based on the type of BMP, but is typically performed via contract based on available funding for hydrodynamic structures or when inspections note BMP failure.

13.0 Process for Assessing Implementation Progress and Adapting Management Actions to Continually Improve the Implementation of Practices to Reduce Nitrogen, Phosphorus, and Sediment Loads

In 2017, DoD conducted, the first of its kind among federal departments, an evaluation of progress at the 2017 midpoint via Phase 6 CAST using data collected annually from installations. The initiative included reviewing and developing scenarios that captured:

- What installations had already installed in the ground (i.e., historical implementation);
- Planned 2018 and 2019 implementation as part of DoD's numeric two-year water quality milestones; and
- Estimates of 2025 implementation that would be needed to fill gaps towards meeting federal facility goals that were based on the 2015 Protocol for Setting Targets, Planning BMPs and Reporting Progress for Federal Facilities and Lands.

This project established baseline scenarios and an overall framework and methodology in order for DoD to utilize lessons learned and support Phase III WIP development and implementation.

In 2018, DoD continued to fund this effort and requested information from installations on implementation planned through 2025. This information was used to build on the scenarios that have already been developed for DoD via CAST including the new DoD 2018 Progress Scenario, DoD 2020-2025 Planned Implementation Scenario, and 2020-2025 DoD Fill Gap Scenario that would meet new federal agency planning goals.

DoD has acknowledged and recognized the value of this effort and will prioritize to ensure funding remains in place to evaluate our progress, track two year periods and develop an appropriate level of implementation as we move towards 2025.

Placeholder for tables and graphs once a fill gap scenario is finalized that will provide an estimate of TN and TP loads at the EOT in lbs/yr that demonstrate implementation meets DoD's Federal Agency Planning Goal:

- DoD 2018 Progress Loads;
- 2018/2019 DoD Water Quality Milestones Scenario;
- DoD 2025 Implementation Plan: includes all historical BMPs and those planned through 2025; BMPs that did not pass the verification requirements were removed from the 2025 plan;
- DoD 2025 Fill Gap Scenario; and
- DoD Federal Agency Planning Goal

14.0 Challenges

DoD installations report that funding for projects needed to reduce loading is contingent upon authorization and appropriation of funds in accordance with appropriate statutes. The DoD will be competing for funding against all other federal entities and there is no guarantee that funding will be available. The DoD will make every effort to obtain necessary funding, but changes in priorities or budget constraints would mean a project or projects may not be executed as planned. As some installations are highly developed, space for new on-the-ground BMPs can be extremely limited. The DoD will look to programmatic BMPs to achieve pollutant reductions in these cases. Securing long term sustainable BMP maintenance funding to safeguard our investments is a challenge that we are working through.

Appendix F. Development of State-Basin Targets, Countywide-Sector Goals and Impaired Bay Segment Targeting

State-Basin Targets

On July 9, 2018, the CBP PSC agreed on nutrient planning targets for the Phase III WIP at the state-basin scale. Maryland received 10 planning targets—a nitrogen and phosphorus load target for each of its five Chesapeake Bay basins. These planning targets were calculated using a methodology similar to that used in the Chesapeake Bay TMDL and the Phase II WIP. The approach, described in detail in Section 6.3 of the Chesapeake Bay TMDL report, relied on three key principles:

- Water quality and resource goals should be achieved in all 92 Bay segments
- Basins that contribute the most should reduce the most
- All previous reductions in nutrient loads should receive credit

The state-basin planning targets served as a starting point for states to establish their Phase III WIP state-basin targets. Rather than requiring states to meet a fixed loading target, EPA's Phase III WIP expectations document defines a process whereby the states are required to meet a defined water quality improvement. This is achieved through basin exchange factors, which define the impact that a load reduction from the basin would have on dissolved oxygen in the Bay, specifically in terms of micrograms per liter of dissolved oxygen per million pounds of nutrient reduction. For example, a one-million-pound reduction of nitrogen in the Western Shore basin would be expected to increase dissolved oxygen in the Bay by over 14 micrograms per liter, whereas the same reduction in the Eastern Shore basin would only raise dissolved oxygen by around 11 micrograms per liter. In setting state-basin targets, exchange factors ensure equivalency of water quality impact between basin reductions, so that a 14-pound reduction from the Eastern Shore basin would be equivalent to an 11-pound reduction from the Western Shore basin.

The expectations document defines three mechanisms by which the planning targets can be adjusted through exchange factors: nitrogen-to-phosphorus (N2P) exchanges, phosphorus-to-nitrogen (P2N) exchanges and basin-to-basin (B2B) exchanges. The N2P and P2N exchanges involves reducing the target load of nitrogen or phosphorus in a basin, and raising its counterpart based on a specific ratio. Maryland did not employ either N2P or P2N exchanges. The N2P exchange was not necessary since the state was able to meet its phosphorus goals, and the P2N exchanges were not pursued since the exchange ratio would not provide a meaningful increase in the nitrogen targets.

Maryland did rely on B2B exchanges of nitrogen to meet its targets. For B2B nitrogen exchanges, each minor basin had an associated exchange factor, and a target load could be shifted from one basin to another by multiplying the transferred load by the factor from the contributing basin and dividing it by the

factor from the receiving basin. Maryland was able to achieve reductions beyond the nitrogen planning target in the Western Shore basin by over 1.5 million pounds per year, and from this, target loads were transferred to the Eastern Shore, Potomac and Susquehanna basins. These final state-basin targets were increased by 0.4, 0.5 and 0.4 million pounds of nitrogen per year, respectively, over the planning targets. The state-basin planning targets and final targets are shown in Table F-1.

Maryland is providing two sets of loads per basin, a final state-basin target, which meets the water quality response of the planning targets, and a Phase III WIP, which specifies reductions beyond the final target. The Phase III WIP is based off of projected implementation to 2025 based on feasibility, and incorporating county-level implementation commitments. The load difference between the Phase III WIP and the final targets represents a margin of safety and load reductions beyond the targets would potentially be used to meet the state's additional climate change reduction commitments.

Table F-1: *Phase III WIP State-Basin Planning Targets and Final Targets.*

Maryland Basin	Nitrogen (M Pounds per Year)			Approximate Exchange Factor*	Phosphorus (M Pounds per Year)			Approximate Exchange Factor*
	Planning Target	State-Basin Target	Phase III WIP Plan		Planning Target	State-Basin Target	Phase III WIP Plan	
Eastern Shore	15.2	15.6	15.6	10.6	1.29	1.29	1.23	33.4
Patuxent	3.2	3.1	3.1	12.2	0.30	0.30	0.27	31.6
Potomac	15.3	15.8	15.8	13.6	1.09	1.09	0.87	22.2
Susquehanna	1.2	1.6	1.6	16.3	0.05	0.05	0.05	38.5
Western Shore	10.9	9.6	9.0	14.1	0.95	0.95	0.96	35.3
Statewide	**45.8**	**45.8**	**45.2**	-	**3.68**	**3.68**	**3.38**	-

* The Approximate Exchange Factor is expressed in units of micrograms of dissolved oxygen per liter for one million pounds of nutrients reduced. The values shown here are approximated based on the average of minor basins within the state basin.

Countywide Goals

EPA's June 9, 2018, Expectations for the Phase III Watershed Implementation Plans required goals to be established at a scale finer than the state-basin level

> … EPA expects the jurisdictions to work with their local and regional partners, stakeholders, and federal and state facilities to establish measurable local planning goals at a geographic scale below the state-major river basin and implement them through their Phase III WIPs …
>
> EPA Expectations for the Phase III WIPs

As part of the Phase III WIP, Maryland is establishing countywide sector goals. These are presented in Appendix C, and are derived from Maryland's Phase III WIP CAST scenario, meaning that they are consistent with the Phase III WIP Plan loads.

Targeting of Impaired Bay Segments

Appendix A. of EPA's Expectations for the Phase III WIPs requires tidal states to use greater targeting in Bay segments that are significantly out of attainment.

> EPA expects the four tidal jurisdictions—Delaware, District of Columbia, Maryland and Virginia—to use the information from these geographic isolation runs, as well as explanations of observed long term trends in watershed and tidal water quality and biological resource

monitoring data, to develop Phase III WIPs that demonstrate a greater level of targeting towards those Bay segments significantly out of attainment (based on monitoring assessments) with their Chesapeake Bay water quality standards.

EPA Expectations for the Phase III WIPs

An analysis of dissolved oxygen (DO) concentrations measured in the Bay between 2014 and 2016 was used to develop Maryland's 2018 Integrated Report of Surface Water Quality. This analysis showed 17 of 57 segments with exceedances above one percent for summer, open water dissolved oxygen criteria. These segments are shown in Table F-2.

Table F- 2: *Water quality and nitrogen reductions in Bay segments with summer dissolved oxygen exceedances above one percent.*

Bay Segment	Segment ID	Basin	Summer Open Water DO Exceedances	Nitrogen reduction from 2017 to WIP3
Pocomoke Tidal Fresh	POCTF	Eastern Shore	85%	15%
Pocomoke Oligohaline (Maryland)	POCOH_MD	Eastern Shore	50%	34%
Anacostia Tidal Fresh (Maryland)	ANATF_MD	Potomac	35%	4%
Pocomoke Oligohaline (Virginia)	POCOH_VA	Eastern Shore	30%	7%
Anacostia Tidal Fresh (Washington, DC)	ANATF_DC	Potomac	22%	3%
Wicomico Mesohaline	WICMH	Eastern Shore	21%	39%
Patuxent Tidal Fresh	PAXTF	Patuxent	12%	-11%
Chester Tidal Fresh	CHSTF	Eastern Shore	11%	19%
Patuxent Oligohaline	PAXOH	Patuxent	10%	10%
Chester Oligohaline	CHSOH	Eastern Shore	7.7%	18%
Patapsco Mesohaline	PATMH	Western Shore	4.9%	52%
Choptank Tidal Fresh	CHOTF	Eastern Shore	4.8%	19%
Rhode Mesohaline	RHDMH	Western Shore	4.8%	36%
Nanticoke Tidal Fresh (Delaware)	NANTF_DE	Eastern Shore	4.6%	17%
Nanticoke Tidal Fresh (Maryland)	NANTF_MD	Eastern Shore	4.6%	15%
Sassafras Oligohaline	SASOH	Eastern Shore	2.2%	14%
Chester Mesohaline	CHSMH	Eastern Shore	1.1%	15%
State (average)				**17%**
State (average w/o BACOH and PATMH)				**9%**

Maryland's Phase III WIP specifies reductions of 17 percent for statewide watershed loads from 2017 to 2025, but these largely occur in two Bay segments—the Patapsco Mesohaline and the Back River Oligohaline—where large wastewater treatment plants are being upgraded to include ENR processes. In the other 55 segments, average planned nitrogen reductions is nine percent. Table 7-2 also shows the planned reductions in the 17 segments with DO exceedances above 1 percent. All but four of these, Anacostia Tidal Fresh (Maryland), Anacostia Tidal Fresh (Washington, D.C.), Patuxent Tidal Fresh and Pocomoke Oligohaline (Virginia), have reductions at or above the nine percent mark. Eleven of the segments have reductions of more than 50 percent higher than that.

One segment below 9 percent, the Pocomoke Oligohaline Segment (Virginia), is a very small watershed on the lower Eastern Shore and when viewed together with Pocomoke Oligohaline Segment (Maryland), planned reductions to 2025 are 25 percent.

Of the three other segments below nine percent, additional near-term reductions are challenging due to the limited amount of wastewater and agricultural reduction opportunities in the watersheds. Furthermore, for the two Anacostia segments, water quality is anticipated to improve with the recent construction of the Anacostia River Tunnel System. The tunnel system, completed in 2018, handles combined sewer overflows that would historically be discharged into the river. It will be several years before Maryland has a three-year dataset for water quality in the river post-construction, however the state is committed to reassessing these segments and looking for additional opportunities where they can be found.

For the Patuxent Tidal Fresh segment, there are nine wastewater treatment plants, which discharged about 55 million gallons per day of wastewater in 2017. All of these have already been upgraded to ENR treatment, and their average concentration in 2017 was below two milligrams per liter, leaving little potential for additional reductions. Because the Phase III WIP projects future concentrations of 3.25 milligrams per liter at all of its significant municipal treatment plants, the WIP anticipates a load increase here, however if current discharge concentrations are maintained, the loads will be reduced by around five percent.

Conclusion

For all of these segments, while near-term reductions may be challenging, long term reductions from the stormwater and septic sectors should be possible. The Patuxent and Anacostia segment sheds are all wholly located in Phase I MS4 jurisdictions, so absent a full improvement of water quality, future permits will need to require additional implementation. This is consistent with the strategy laid out in the stormwater section of this document.