# Commonwealth of Virginia

# State Lands Watershed Implementation Plan


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## EXECUTIVE SUMMARY

Virginia's Chesapeake Bay Total Maximum Daily Load (TMDL) Phase III Watershed Implementation Plan[1] (WIP) included a specific commitment to develop this State Lands Watershed Implementation Plan (SWIP). The commitment was agreed on by a diverse group of stakeholders in 2019 and written by representatives from relevant government agencies. The SWIP identifies opportunities for Virginia agencies to work collaboratively to reduce nutrient and sediment pollution from state lands.

The goal of the SWIP is to achieve significant reductions in, or to offset unregulated, nonpoint source nutrient and sediment pollution originating from the lands and activities of all Virginia agencies, public institutions of higher education and other state governmental entities that own or manage land within Virginia's Chesapeake Bay watershed. The SWIP work group collaborated to identify state lands and the Best Management Practices (BMPs) that when implemented would reach nutrient and sediment reduction goals outlined in the SWIP.

The SWIP began by creating a comprehensive dataset of acreage of all Virginia agencies, public institutions of higher education and other state governmental entities that own land within Virginia's Chesapeake Bay watershed. Once such a dataset was developed, it was combined with the Virginia Statewide Land Cover dataset to determine the acreage of each land use classification present on state lands. After the acreage was determined, load reductions were calculated using of the Chesapeake Bay Watershed model.

To be consistent with Virginia's Chesapeake Bay Phase III WIP, the Phase 6 watershed model CAST2017(d)[2] was used. The model's load sources were evaluated and grouped into classes closely resembling the land cover classifications for unregulated lands. Using this model, DEQ found that the reduction targets are 122,000 pounds of nitrogen and 10,100 pounds of phosphorus for 390,789 SWIP acres.

To reach the reduction targets, the SWIP work group identified 11 specific programmatic actions:

1. Standards for Sustainable Agriculture and Forestry
2. Converting Managed Turf to Native Landscapes
3. Unregulated Stormwater Runoff from Impervious Surfaces on Developed Land
4. Native Habitat Valuation for Human Health, Wildlife, and Water Quality
5. Onsite Sewer Systems
6. Pilot Fee-for-Documented-Performance Projects
7. Community Outreach and Education
8. Aligning Habitat Restoration, Resilience, and Water Quality Goals
9. Build Water Quality Improvements into Virginia's Hazard Mitigation Plan
10. Interagency Technical Support and Collaboration
11. Clean Water Jobs Training Collaborative

The SWIP also identifies specific pollutant load reducing practices treatments and technologies to be implemented between 2021 and 2025 in order to achieve nitrogen, phosphorus and sediment reduction targets by major basin for state lands within the Chesapeake Bay watershed. The SWIP work group also identified potential funding sources and next steps for implementation of the State Lands WIP.

[1] The Chesapeake Bay Phase III WIP can be found on DEQ's Phase III WIP webpage.
[2] CAST refers to the Chesapeake Assessment Scenario Tool.

## CHAPTER 1. OVERVIEW & PURPOSE

Virginia's Chesapeake Bay Total Maximum Daily Load (TMDL) Phase III Watershed Implementation Plan (WIP) describes the practices, policies, programs and funding necessary to achieve the Commonwealth's 2025 clean water goals for the Chesapeake Bay and its tidal tributaries. At the urging of local government stakeholders, the Chesapeake Bay Phase III WIP included a specific commitment to develop this State Lands Watershed Implementation Plan (SWIP).

Initiative #3 of the Chesapeake Bay Phase III WIP (Page 58):

*The Secretary of Natural Resources, in consultation with the Secretary of Administration and the Governor's Conservation Cabinet, will establish a team of state agency staff to develop a state agency watershed implementation plan to achieve significant reductions in nonpoint source nutrient and sediment pollution originating from the lands and activities of all state agencies, public institutions of higher education and other state governmental entities that own/or manage land in Virginia. The first step in this process is the identification and mapping of all state owned and/or managed lands not already encompassed in local government efforts. Once the area of state-owned lands is established, the land use on these areas will be used to determine the aggregate level of nutrient reductions needed. Virginia will strive to achieve reductions of nutrient and sediment pollution from state-owned and/or managed lands consistent with expectations of this WIP. The team will consider innovative approaches to achieving the aggregate reductions most cost-effectively, including geographic targeting, trading, and maximizing cobenefits. (Lead agency: OSNR; target date: 2020-2021.)*

The SWIP identifies opportunities for Virginia agencies to work collaboratively to reduce nutrient and sediment pollution from state lands[3]. The goal of the SWIP is to achieve significant reductions in, or to offset unregulated, nonpoint source nutrient and sediment pollution originating from the lands and activities of all Virginia agencies, public institutions of higher education and other state governmental entities that own or manage land within Virginia's Chesapeake Bay watershed. Hereinafter these entities will be collectively referred to as Virginia agencies. The SWIP follows the Chesapeake Bay Phase III WIP by putting in place by 2025 the programs and practices necessary to achieve reduction targets for nitrogen, phosphorus and sediment. The SWIP highlights innovative approaches and builds upon existing state expertise through establishment of an interagency technical support team. Implementing the SWIP should demonstrate to local governments and the public the Commonwealth's willingness to be a full partner in restoring the Chesapeake Bay and advance creative restoration activities with multiple public benefits.

The Secretary of Natural Resources, in consultation with the Secretary of Administration and the Governor's Conservation Cabinet[4], established a team of state agency staff to develop the SWIP. Membership for the SWIP Workgroup includes representatives from the Secretaries of Agriculture and Forestry, Administration, Transportation, Education, and Public Safety and Homeland Security agencies, and public institutions of higher education.

[3] For the purposes of the SWIP, "state lands" refers to all land owned or managed by Virginia agencies, public institutions of higher education and other state governmental entities within the Chesapeake Bay watershed.
[4] The Governor's Conservation Cabinet was established under Executive Order 22.

Membership in the SWIP Workgroup includes:

- Ann Jennings, Deputy Secretary of Natural Resources
- Katie Sallee, Confidential Assistant, Secretary of Natural Resources
- Mike Nolan, Manager of Owned Property, Department of General Services
- Ed Zimmer, Deputy State Forester, Department of Forestry
- Timothy Newton, Director of the Infrastructure and Environmental Management Unit, Department of Corrections
- Meghan Mayfield, Environmental and Energy Administrator, Infrastructure and Environmental Management Unit, Department of Corrections
- Tom Allen, Political Science and Geography Professor, Old Dominion University
- George McLeod, Director of Geospatial and Visualization Computing, Old Dominion University
- Chad Peevy, Assistant Director of Grounds/Landscapes, Facilities Management, Old Dominion University
- Chris Swanson, Assistant State L&D Engineer, Department of Transportation
- Ed Wallingford, Assistant Environmental Division Director, Department of Transportation
- Tracey Harmon, TMDL Program Planner, Department of Transportation
- Stephen Schoenholtz, Director, Virginia Water Resources Research Center
- Brian Benham, Professor and Extension Specialist, Virginia Tech
- David Spears, State Geologist, Department of Mines, Minerals, and Energy
- Kristin Carter, Associate Director for Environmental Resources, University of Virginia
- Nathan Burrell, Deputy Director, Department of Conservation and Recreation
- Gray Anderson, Chief of Wildlife Division, Department of Wildlife Resources
- James Martin, Chesapeake Bay Program Manager, Department of Environmental Quality
- Arianna Johns, Chesapeake Bay Data Coordinator, Department of Environmental Quality
- Megan Sommers Bascone, Chesapeake Bay Planning Coordinator, Department of Environmental Quality

The Virginia Department of Environment Quality (DEQ), with a grant from the Environmental Protection Agency (EPA) and the Chesapeake Bay Restoration Fund (§ 58.1-344.3.C(2)(c)), led a project to create a geographic information systems (GIS) layer for lands within Virginia's Chesapeake Bay watershed owned or managed by a Virginia agency. DEQ used this GIS layer along with land cover designations to estimate the unregulated, nonpoint source nutrient and sediment pollution loads from those lands. The workgroup then met virtually during the fall of 2020 to discuss current agency activities targeted to reduce runoff pollution and to design an implementation plan for reducing runoff pollution.

## CHAPTER 2. VIRGINIA'S GOALS FOR THE SWIP

The primary goal of the SWIP is to provide a roadmap to achieve significant reductions in unregulated, nonpoint source nutrient and sediment pollution originating from all state lands within Virginia's Chesapeake Bay watershed. The SWIP identifies specific programmatic actions and pollutant load reducing practices (Appendices A and B), treatments, and technologies to be implemented between 2021 and 2025 in order to achieve nitrogen, phosphorus and sediment reduction targets by major basin for state lands within the Chesapeake Bay watershed[5]. Planning targets were calculated taking into account the additional nutrient and sediment pollution resulting from 2025 climate change. The SWIP should provide sufficient explanation, transparency and accountability to provide Chesapeake Bay stakeholders and the general public reasonable assurance that the reduction targets will be achieved.

The SWIP will foster collaboration and partnership across multiple state agencies, colleges and universities pursuing policies and practices to implement the SWIP. The SWIP envisions resource and expertise sharing across secretariats and agencies in pursuit of Virginia's Chesapeake Bay restoration goals. Agency actions may also serve as demonstration projects, as well as innovative pilot efforts, for education and outreach by the Commonwealth and its local government partners to private landowners and the general public. Similarly, the SWIP will pursue best practices for communicating across diverse state programs that achieve water quality benefits, including, but not limited to, programs addressing natural resource restoration, resilience, flood protection, emergency management and hazard mitigation.

Similar to Virginia's Chesapeake Bay Phase III WIP, the SWIP will strive to identify and prioritize cost-effective and reasonable approaches that also provide multiple public benefits such as building resilience to sea level rise, improving air quality, providing wildlife habitat, safeguarding public health and enhancing soil quality.

[5] This goal for the SWIP reflects expectations from the U.S. Environmental Protection Agency for Virginia's Phase III WIP.

## CHAPTER 3. MAPPING STATE LANDS IN THE CHESAPEAKE BAY WATERSHED

In order to determine the necessary nutrient and sediment load reductions from state lands, it is important to first understand the existing loads, which are dependent on the acreage and land use of those state land parcels. Determining acreage of all Virginia agencies that own land within Virginia's Chesapeake Bay watershed required a comprehensive dataset of all such lands. Though many agencies have individual datasets for land they own, there was no single comprehensive dataset that included all state land holdings. Once such a dataset was developed, it was combined with the Virginia Statewide Land Cover dataset to determine the acreage of each land use classification present on state lands. This section will describe the process used to develop the database of state lands and the associated land use.

DEQ, with funding from the EPA Chesapeake Bay Program and the Commonwealth's Chesapeake Bay Restoration Fund, initiated a contract to utilize existing data sources and parcel ownership information to derive a single comprehensive dataset of state lands. The contract was awarded to Geodecisions to develop the methodology, gather the available data and produce a geodatabase of state lands. Geodecisions gathered parcel data from local governments in the Chesapeake Bay watershed and extracted those parcels where the ownership attribution indicated state ownership. These records were combined with state agency data on owned parcels, where such data was available, and a representation of Virginia Department of Transportation (VDOT) road rights of way. The resulting shapefile was merged with the high resolution Virginia Statewide Land Cover dataset based on 2012-2013 imagery and provided to DEQ. Details of the methods and procedures used by Geodecisions are available in the GeoDecisions State Lands Technical Plan of Operations for the project.

During July and August 2020, the resulting geodatabase was shared with all participating agencies in the ArcGIS 10.X, ArcPro, and another password protected format for agencies unable to utilize file geodatabase data formats for review. Once DEQ received each agency's feedback on the geodatabase, the changes determined to be achievable given the time constraints were incorporated into the master geodatabase. The final master geodatabase was then intersected with the high resolution land cover data to calculate the acres of each land use.

This state lands mapping project was conducted to inform the SWIP. The work product provides a state lands geodatabase that may provide a baseline for maintaining a dataset of state lands long term. The Department of General Services (DGS) is evaluating the agency's capacity to maintain a state lands geodatabase housed at the Virginia Geographic Information Network (VGIN) Division of the Virginia Department of Emergency Management.

The agencies included in the database with land owned or managed in Virginia's Chesapeake Bay watershed are:

Department of Agriculture and Consumer Services
Christopher Newport University
Department for Aging and Rehabilitative Services
Department for the Blind and Vision Impaired
Department of Behavioral Health and Developmental Services
Department of Conservation and Recreation
Department of Corrections
Department of Fire Programs
Department of Forensic Science
Department of Forestry
Department of General Services
Department of Housing and Community Development
Department of Human Resources
Department of Juvenile Justice
Department of Military Affairs
Department of Motor Vehicles
Department of Transportation
Department of the Treasury

Department of Wildlife Resources (formerly Game & Inland Fisheries)
Department of Veteran Services
Eastern Virginia Medical School
Frontier Culture Museum of Virginia
George Mason University
Gunston Hall
James Madison University
Jamestown-Yorktown Foundation
Longwood University
Marine Resources Commission
Norfolk State University
Old Dominion University
Richard Bland College
Southern Virginia Mental Health Institute
The College of William and Mary in Virginia
The Science Museum of Virginia
University of Mary Washington
University of Virginia
Virginia Alcoholic Beverage Control Authority
Virginia Commonwealth University
Virginia Community College System
Virginia Employment Commission
Virginia Institute of Marine Sciences
Virginia Military Institute
Virginia Museum of Fine Arts
Virginia Polytechnic Institute and State University
Virginia Port Authority
Virginia Public Building Authority
Virginia Retirement System
Virginia School for the Deaf and the Blind
Virginia State Police
Virginia State University
Virginia Tourism Authority
Virginia Workers' Compensation Commission

Virginia agencies, public institutions of higher education and other state governmental entities have 3,703 individual polygons representing land holdings in the geodatabase. The land area represented in this dataset, including owned lands and rights of way in 3,703 polygons, totaling 451,477 acres (Table 1).

**Table 1: Number of State Land Holdings Polygons by Size**

| State Land Area | Number of Polygons |
|---|---|
| < 1 acre | 1,648 |
| > 1 acre < 5 acres | 590 |
| > 5 acres < 10 acres | 232 |
| > 10 acres < 50 acres | 352 |
| > 50 acres < 100 acres | 126 |
| > 100 acres < 1,000 acres | 328 |
| > 1,000 acres | 50 |

The land cover breakdown by Basin of these areas are shown in Table 2.

**Table 2: Land Cover Class of State Lands (Acres) by Basin**

| Row Labels | Potomac | Rappahannock | York | James | Eastern Shore | Grand Total |
|---|---|---|---|---|---|---|
| Cropland | 755 | 847 | 788 | 2,652 | 234 | 5,275 |
| Pasture | 3,312 | 646 | 772 | 4,931 | 7 | 9,668 |
| Impervious Developed | 44,126 | 12,506 | 14,285 | 50,928 | 1,897 | 123,742 |
| Pervious Developed | 7,944 | 2,597 | 2,423 | 12,730 | 380 | 26,074 |
| Harvested/Disturbed | 61 | 33 | 1,458 | 2,209 | 1 | 3,763 |
| Barren | 187 | 22 | 17 | 60 | 108 | 395 |
| Forest | 26,632 | 16,458 | 25,268 | 149,439 | 630 | 218,427 |
| Hydro | 331 | 78 | 421 | 1,702 | 164 | 2,696 |
| Scrub/Shrub | 309 | 172 | 258 | 1,026 | 31 | 1,795 |
| Tree | 3,908 | 2,130 | 2,703 | 11,874 | 168 | 20,784 |
| Wetlands | 2,214 | 759 | 5,668 | 10,303 | 8,614 | 27,557 |
| **Grand Total** | **89,778** | **36,248** | **54,060** | **247,856** | **12,234** | **440,176** |

## CHAPTER 4. PLANNING TARGETS FOR STATE LANDS

With the state lands mapped and land cover of those areas assessed, the next step was to account for those state owned lands that are covered by Municipal Separate Storm Sewer System (MS4) general and individual permits. These state MS4 lands are already required to make nutrient load reductions for the Chesapeake Bay in accordance with their permits. Data from each MS4's Chesapeake Bay Action Plan was used to quantify the acres of pervious and impervious land subject to the permits and is summarized in Table 3. When comparing the MS4 acres against the state lands data, inconsistencies were apparent. It was determined that the effort to account for regulated lands was challenged by the timeline for MS4s to update regulated land mapping and the varied approaches to mapping lands. Given the inconsistencies, only the impervious regulated developed area was subtracted from the state lands acreage. The pervious developed acreage was retained unreduced, despite knowing MS4 permits already account for some of these acres. This method provides a conservative approach that should overestimate, rather than underestimate, the SWIP pollution reduction targets.

**Table 3: State MS4 Area**

| Basin | Impervious Acres | Pervious Acres |
|---|---|---|
| Potomac | 26,863 | 14,843 |
| Rappahannock | 2,308 | 1,477 |
| York | 2,776 | 1,383 |
| James | 17,441 | 11,308 |
| **Total MS4** | **49,388** | **29,011** |

Calculating the load reductions required pursuant to this SWIP required use of the Chesapeake Bay Watershed model[6]. To be consistent with Virginia's Chesapeake Bay Phase III WIP, the Phase 6 watershed model CAST2017(d)[7] was used. The model's load sources were evaluated and grouped into classes closely resembling the land cover classifications for unregulated lands. The impervious acres were reduced by the amount of impervious area covered under a general or individual MS4 permit. The resulting SWIP land cover acres are shown in Figure 1.

[6] Information on the Chesapeake Bay Program models can be found on the Program's Modeling webpage.
[7] CAST refers to the Chesapeake Assessment Scenario Tool.

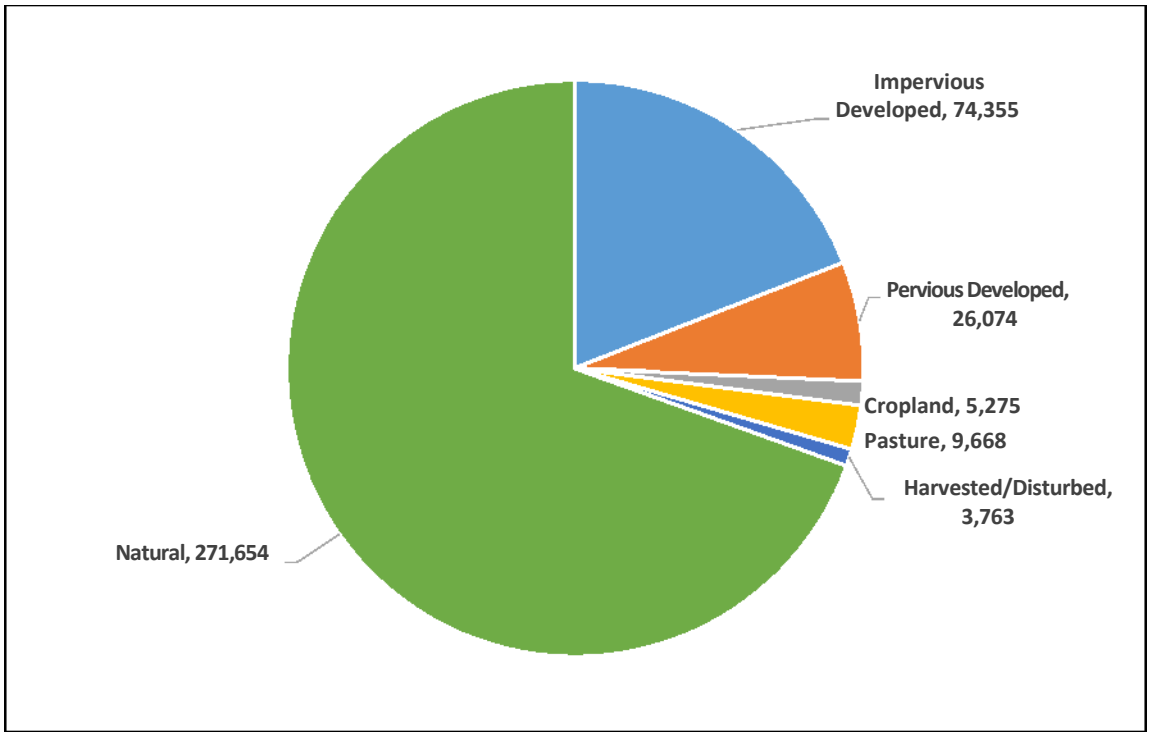


**Figure 1: SWIP Land Cover Acres**

The 2017 progress scenario in CAST2017(d) was the starting point for development of the Chesapeake Bay Phase III WIP and was used as the starting point for this state lands analysis as well. The Chesapeake Bay Phase III WIP scenario served as the end point. For each modeled land use class in each basin, the nitrogen and phosphorus delivered loads per acre (loading rate) were calculated for the starting and ending scenarios. The difference between these loading rates represent the per acre reductions called for in the Phase III WIP and that would be expected for each of the land uses in the state lands dataset. Finally, the total number of acres of state lands in each land use class was multiplied by the reductions needed per acre and summed for each basin to determine the total nitrogen and phosphorus load reduction needed for the state owned lands.[8] Given the uncertainty associated with the state lands data, the Bay models and this calculation approach, the SWIP reduction targets are rounded to thousands of pounds of nitrogen and hundreds of pounds of phosphorus. This is consistent with the practice of the Chesapeake Bay Program in evaluating loads. Detailed tables of the Basin calculations are available in Appendix C.

[8] This approach to calculating the per acre reduction expected for each land use differs from reductions calculated for regulated developed lands in Virginia's Chesapeake Bay WIP. The approach in the SWIP is focused on unregulated lands, including unregulated developed lands.

**Table 4: SWIP Nitrogen and Phosphorus Reduction Targets by Basin[9]**

| Basin | SWIP Acres | Total N Reduction (lbs.) | Total P Reduction (lbs.) |
|---|---|---|---|
| Potomac | 62,915 | 28,000 | 3,200 |
| Rappahannock | 33,941 | 22,000 | 800 |
| York | 51,284 | 17,000 | 900 |
| James | 230,415 | 47,000 | 4,800 |
| Eastern Shore | 12,234 | 8,000 | 400 |
| **Virginia Bay Watershed** | **390,789** | **122,000** | **10,100** |

The SWIP reduction targets are 122,000 pounds of nitrogen and 10,100 pounds of phosphorus. The reductions achieved will be tracked by Basin and assessed against the relative effectiveness of the Basins to ensure the reductions achieved have an equivalent effect on main stem dissolved oxygen as the Basin scale targets in Table 4. The sediment reduction target is based on the SWIP BMP implementation to achieve the nutrient targets. The SWIP initiatives that follow have been simulated in the CAST19 model. Details of the implementation scenario can be seen in Appendix B. The resulting implementation scenario meets and exceeds the SWIP nutrient reduction targets. In addition to the nutrient reductions, full implementation of the SWIP is estimated to reduce more than 14 million pounds of sediment to local streams and the Chesapeake Bay.

[9] Sediment reductions under the SWIP were calculated based upon the SWIP best management practice input deck. This same approach was used to calculate Virginia's sediment reduction target in the Chesapeake Bay Phase III WIP.

## CHAPTER 5. ONGOING STATE AGENCY INITIATIVES FOR RESTORING THE CHESAPEAKE BAY

Virginia state agencies and public institutions of higher education have taken significant actions throughout the last several decades to reduce runoff from their lands. Whether as result of environmental regulations, MS4 permit requirements, specific objectives, or voluntary initiatives, the actions of Virginia state agencies represent a commitment to improved land stewardship and clean water. Even while some actions have not explicitly focused upon clean water initiatives, implementation of these actions has still resulted in beneficial nutrient and sediment reductions. In fact, many state actions preceded the adoption of the Chesapeake Bay TMDL and subsequent WIPs.

The Commonwealth has a long history of requiring state agencies to consider and mitigate the potential negative effects agency activities may have upon Virginia waterways. For example, pursuant to Virginia code, state agencies and government entities are required to follow both nutrient management plans and Chesapeake Bay Preservation Act requirements. Workgroup members indicated compliance with these requirements.

> *§ 10.1-104.4. All state agencies, public institutions of higher education in the Commonwealth, and other state governmental entities that own land upon which fertilizer, manure, sewage sludge or other compounds containing nitrogen or phosphorus are applied to support agricultural, turf, plant growth, or other uses shall develop and implement a nutrient management plan for such land.*
>
> *§ 62.1-44.15:78. State agency consistency with the Chesapeake Bay Preservation Act. All agencies of the Commonwealth shall exercise their authorities under the Constitution and laws of Virginia in a manner consistent with the provisions of comprehensive plans, zoning ordinances, and subdivision ordinances that comply with §§ 62.1-44.15:74 and 62.1-44.15:75.*

In addition to the above requirements and specifically regarding construction activities, all state agencies and public institutions of higher education must comply with both state and federal erosion and sediment control (ESC) and stormwater management (SWM) requirements. Moreover, some of these state agencies and public institutions of higher education are required to develop and submit to DEQ annual standards and specifications for ESC and SWM, which outline how the agency will operate their own compliance program including plan review, inspections, enforcement and long-term maintenance.

MS4 permits have special conditions that require MS4 permittees to implement Action Plans to achieve necessary pollutant reductions and have been a backbone of the TMDL process since Virginia's first WIP. Many of Virginia's state agencies and public institutions of higher education including: VDOT, Old Dominion University and the University of Virginia, for example, are managed under existing general or individual MS4 permits with oversight by DEQ. As an example, the following best management practices are typical actions to achieve nutrient and sediment reductions under the MS4 program:

- Addressing excessive sediment discharges and loading within 24 hours
- Targeted public education such as pet waste stations and storm sewer stenciling
- Promoting stream and litter cleanups and prevention
- Developing guidance manuals on proper operation and maintenance of best management practices
- Developing illicit discharge detection and elimination manuals and field guides
- Developing stormwater pollution prevention plans (SWPPPs) for facilities with a high potential of discharging pollutants

As stated previously, many agencies have adopted mission policies, cooperated with outside organizations, and sought other initiatives to address polluted runoff. Below is a small sample of such actions:

- The Virginia Department of Forestry (DOF) enforces the Silviculture Water Quality Law (§10.1-1181.1 to 1181.7) in state forests.
- Many public institutions of higher education, through both internal initiatives and with community partnerships, have established environmental sustainability policies and green building programs.
- The Virginia Department of Conservation and Recreation (DCR) through its State Parks has dedicated themselves to implementing projects that serve to reduce runoff, including converting mowed areas and abandoned agricultural fields into warm season grasses and native pollinator habitat.
- The Virginia Department of Corrections (DOC) has begun to seek out prisons, buildings and areas with impervious surface area to return them to their original grade with plantings to increase pervious surfaces on state lands.

## CHAPTER 6. INITIATIVES FOR THE SWIP

The following programmatic initiatives are necessary for preventing and reducing unregulated runoff pollution from state lands and are intended to achieve the Commonwealth's SWIP reduction targets for nitrogen, phosphorus and sediment. In addition to the programmatic initiatives described below, Appendix B provides the list of best management practices and their coverage necessary to achieve the nitrogen, phosphorus and sediment reduction targets.

### Standards for Sustainable Agriculture and Forestry on State Lands

Best management practices for reducing nutrient and sediment loss will be employed on all state lands in active cultivation (cropland and hayland) – conservation tillage, cover crops, nutrient management planning and a minimum 35-foot riparian forest buffer[10].

Best management practices for reducing nutrient and sediment loss will be employed on all state lands supporting animal agriculture including pastures – a minimum 35-foot riparian forest buffer, livestock stream exclusion, rotational grazing, animal waste management systems, nutrient management planning, management of barnyard runoff control and loafing management[11].

Best management practices for reducing nutrient and sediment loss will be employed on all state lands in forestry. This will include a Forest Stewardship Management Plan for the property prior to any decision to harvest, a Pre-Harvest Plan within 30 days of the harvest commencing, and adherence to all Forestry Best Management Practices for Water Quality, as outlined in the most current Virginia DOF Technical Manual[12].

DCR and DOF shall provide technical support for state agencies and public institutions of higher education implementing these agriculture and forestry best management practices.

### Converting Managed Turf[13] to Native Landscapes

Where feasible, state agencies and public institutions of higher education with areas of managed turf on state lands shall actively or passively replace turf with conservation landscaping, native grass or shrub vegetation, native tree canopy cover or forest. Objectives for active or passive conversion should emphasize the use of native plant material and conservation landscape practices to result in an increase of native trees, shrubs, warm season grasses, pollinator plantings and/or other related flora and fauna elements. In locations where a state agency or public institution of higher education determines managed turf to be of critical value for the purposes of the agency's core mission or is deemed to be in the greater public interest for reasons to include public safety, recreational engagement or historical integrity, the respective agency shall retain written documentation identifying the reasons for retaining such area(s) as managed turf. State agencies and public institutions of higher education shall periodically review such

[10] Where state agencies or public institutions of higher education are conducting research involving nutrient application rate and timing on state agricultural and forest lands, such lands shall be exempt from the application rate and timing provisions contained in the nutrient management regulations. A grass buffer may be restored in lieu of a forest buffer if necessary for public safety.

[11] Ibid.

[12] State agencies with forestry management experts on staff may not need to engage DOF to prepare the management plan or pre-harvest plan.

[13] Managed turf refers to pervious areas that are managed to attain dense grass cover, which may involve one or more of the following: fertilization, irrigation, weed control and other turf management practices.

determinations. In such cases, for areas of managed turf identified by an agency for retention, the agency shall adhere to a nutrient management plan as required pursuant to §10.1-104.4 if fertilizer is applied.

In aggregate, state agencies and institutions of higher education will pursue conversion of managed turf on state lands through installation of best management practices, including conservation landscaping and urban tree planting, to achieve the coverage listed in Appendix B.

**Unregulated Stormwater Runoff from Impervious Surfaces Associated with Existing Development on State Lands**

Each state agency and public institution of higher education shall evaluate and employ where feasible and practicable an array of urban best management practices to reduce nutrient and sediment stormwater pollution from unregulated impervious surfaces, including but not limited to the following structural and non-structural practices:

1. Instead of repairing deteriorating concrete and pavement with in-kind replacement, install pervious pavers or pavement and retrofit with swales to improve storm water management.
2. Convert existing obsolete or defunct impervious surfaces to natural grade and establish native vegetation.
3. Disconnect downspouts to prevent runoff going directly to storm sewers. Disconnect or direct to an appropriate best management practice.
4. Retrofit areas where stormwater is not already routed to an existing urban best management practice with practices including, but not limited to, rain gardens, bio retention areas, dry wells/French drains, compost amended filter strips, dry swales, wet swales, grass channels and sheet flow to conserved open space.
5. Practice harvesting and reuse of rainwater.
6. Convert existing dry detention ponds to wet ponds, constructed wetlands or vegetated best management practices. Enhance, convert or restore other existing stormwater best management practices by incorporating missing design elements or addressing an undersized practice.
7. Utilize “green” or “living roof” structures in new building construction where feasible.
8. Employ street-sweeping and catch basin cleanout practices.

Evaluations shall prioritize implementing practices that are cost-effective at reducing nutrient and sediment pollutant loads and achieve multiple benefits.

**Native Habitat Valuation for Human Health, Wildlife, and Water Quality**

State agencies and public institutions of higher education shall prepare agency-wide plans for the protection and restoration of tree canopies and riparian forest buffers. The plans shall focus restoration on larger state land parcels, generally those greater than 5 acres in size. If technical expertise is not available within the agency or public institution of higher education to prepare these plans, technical assistance may be sought from DOF. DOF may also be consulted for site specific project designs. The plans shall include the following components: conservation and maintenance planning for existing forest resources on developed or developing lands, identification of potential tree planting locations and a list of targeted priorities for maximizing the ecological benefits of tree canopy establishment. For nonagricultural state lands, the plan shall also include forest buffer implementation and/or restoration to create an area of trees at least 35 feet wide along perennial streams. Forest buffer restoration shall occur to the maximum extent possible noting where existing structural assets encroach within a riparian buffer zone.

Specific attention of a tree canopy implementation plan should be given to the establishment of: increasing tree canopy cover for state lands currently occupied by managed turf or impervious surface

area; the creation or connection of green corridors targeted for wildlife movement or recreational opportunities, wildlife habitat and ecosystem creation/restoration; and forest diversification appropriate to the priorities of an agency's tree canopy implementation plan.

State agencies and public institutions of higher education shall seek guidance from the Department of Wildlife Resources (DWR) to identify cost-effective and technically sound opportunities for nontidal wetland and stream restoration on state lands greater than 10 acres. If such restoration opportunities are available, feasible and appropriate, the state agency or public institution of higher education and DWR will collaboratively pursue funding and DWR will provide technical support. For stream restoration opportunities on state lands, a determination to pursue will take into account the return on investment for pollution reduction and whether a restoration effort would be consistent with the overall condition of the stream.

State agencies and public institutions of higher education shall seek direct guidance from the Shoreline Erosion Advisory Service (SEAS) to identify cost-effective and technically sound opportunities for establishing living shorelines on state lands greater than one acre adjacent to tidal waters. If such opportunities are available, feasible and appropriate, the state agency or public institution of higher education and SEAS will collaboratively pursue funding and SEAS will provide technical support.

State agencies and public institutions of higher education that have already conducted the planning efforts described above may not take any further action unless additional restoration efforts are desired.

Where feasible and practicable, state construction activities that convert intact forestland, identified within *ConserveVirginia*[14] as an outstanding forest conservation land, to impervious surfaces shall replace the lost forestland by restoring one acre of forestland for each acre lost.

The Commonwealth should prioritize development and maintenance of tree nurseries sufficient to achieve the Phase III WIP by reestablishing the New Kent nursery to produce tree seedlings[15]. Those seedlings should be dedicated to restoring forest buffers throughout the Commonwealth and provided at cost to state agencies and public institutions of higher education.

**Onsite Sewer Systems**

All state agencies and public institutions of higher education will implement inspection and maintenance of small or large conventional onsite sewage systems at a minimum of once every five years. When an onsite system requires replacement, state agencies shall connect the onsite system to sanitary sewer or employ a nitrogen-reducing alternative onsite system. When correcting a failing or failed septic system, a state agency or public institution of higher education shall document if action other than connecting to a sewer system or constructing onsite a nutrient-reducing system is necessary due to feasibility or cost concerns.

**Pilot Fee-for-Documented-Performance Projects**

DEQ shall pilot a fee-for-documented-performance grant program with funding through the Water Quality Improvement Fund. The pilot project will seek to purchase documented pounds of nitrogen and phosphorus reductions from best management practices approved by the Chesapeake Bay Program Partnership. Practices to be considered are those that lend themselves to measureable outcomes rather than model estimated pollution reductions, such as nitrogen reducing bioreactors. The project will prioritize improvements in local water quality and pilot incentives for enhanced project outcomes.

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[14] The *ConserveVirginia* tool is available on DCR's *ConserveVirginia* webpage.

[15] Reestablishing production of tree seedlings at the New Kent nursery will require an investment of $2.5 million.

**Community Outreach and Education**

All state agencies and public institutions of higher education will utilize their social media networks, where appropriate and practicable, to educate the general public and students on steps to improve water quality in their local streams, creeks and rivers, and in the Chesapeake Bay. If a state agency or public institution of higher education requires assistance in preparing messages, DEQ and DCR may provide standard messaging for their use.

At urban stormwater best management practices and where appropriate, state agencies and public institutions of higher education are encouraged to place signage to educate the public about steps they may pursue at home to protect local water quality.

Pet waste stations and signage shall be provided at all state parks and any other publicly accessible state lands where people frequent with their dogs.

**Aligning Habitat Restoration, Resilience, and Water Quality Goals**

The Virginia DEQ shall enter into one or more Memorandums of Agreement (MOA) with DOF, DCR, DWR and Virginia Marine Resources Commission to establish collaborative reporting on all habitat restoration and resilience initiatives. The MOA will align water quality, resilience and habitat restoration goals and solicit documentation of nitrogen, phosphorus and sediment reductions achieved by state agency restoration projects for annually reporting on Chesapeake Bay TMDL progress. The MOA shall be finalized no later than September 1, 2021.

**Build Water Quality Improvements into Virginia's Hazard Mitigation Plan**

The Virginia Hazard Mitigation Plan (March 2018) provides guidance for hazard mitigation activities within the Commonwealth. Its vision[16] is supported by goals, categories and actions for Virginia that will reduce or prevent injury from natural hazards to residents, communities, state facilities and critical facilities. The Virginia Hazard Mitigation Plan is updated every 5 years.

In preparation of the 2023 update to the Virginia Hazard Mitigation Plan, DEQ will assist the Virginia Department of Emergency Management in identifying actions that can address both the needs for hazard mitigation and nutrient reductions on state lands necessary to achieve the Commonwealth's goals for the Chesapeake Bay TMDL and develop a process for documenting nitrogen, phosphorus and sediment reductions resulting from those actions.

**Interagency Technical Support and Collaboration**

The Office of the Secretary of Natural Resources shall oversee an ongoing SWIP interagency technical team to assist state agencies in restoration planning, grant application, permitting, implementation and shared communication strategies. This technical team will be available to all state agencies and public institutions of higher education implementing the SWIP. The technical team shall include representatives from DEQ, DOF, DCR, DWR, Department of Corrections and VDOT and may include representatives from public institutions of higher education with stormwater discharges regulated pursuant to a general or individual MS4 permit. The technical team will also assist if a state agency or public institution of higher education identifies training needs.

[16] It is the Commonwealth's vision to promote resiliency and reduce the long-term impacts of hazards on human, economic and natural resources throughout the state.

The SWIP interagency technical team should pursue all financial resources available to state agencies and public institutions of higher education (refer to Chapter 7 for funding sources) to implement the SWIP. The team shall collaborate with nongovernmental organizations that can provide significant expertise in developing and implementing project proposals as well as pursuing funding sources. The team will also engage local agencies and the federal government, where appropriate, to coordinate identifying, designing, and implementing restoration projects on state lands. Where feasible and appropriate, state agencies and public institutions of higher education will pursue opportunities to partner with local governments on restoration projects that further the needs of both the local government and the Commonwealth.

The interagency technical team may also consider restoration opportunities, in partnership with nongovernmental organizations, local governments, federal agencies and private landowners on lands governed by state held easements, utility rights-of-way and local government memoranda of agreement. Such restoration efforts shall only occur with the full and clear support of the landowner.

**Clean Water Jobs Training Collaborative**

The Virginia DCR, DWR, DOF, DOC, Department of Education, Virginia Cooperative Extension and the Virginia Community College System shall enter into a Memorandum of Agreement (MOA) establishing a natural resource restoration/clean water jobs training collaborative. These agencies shall advance and expand ongoing work by the Commonwealth to develop clean water job skills training. Trainings will include, but are not limited to, riparian buffer establishment and maintenance, livestock fencing and water-system construction, nutrient and resource management planning certification and conservation landscaping. The clean water jobs training collaborative will solicit participation by nongovernmental organizations engaged in natural resource restoration and/or community development such as the Chesapeake Bay Landscape Professionals, as well as local Soil and Water Conservation Districts (SWCDs).

## CHAPTER 7. FUNDING SOURCES FOR THE SWIP

While many state and federal funding sources are not available for water quality projects on state lands, the following programs offer potential support for implementation of the SWIP:

- DOF administers federal funding from the U.S. Forest Service (USFS) for the Urban and Community Forestry Assistance Program Grants. This program is designed to encourage projects that promote tree planting, the care of trees, the protection and enhancement of urban and community forest ecosystems and education on tree issues in cities, towns and communities.
- DOF's Virginia Trees for Clean Water program is designed to improve water quality in the Chesapeake Bay through on-the-ground efforts to plant trees where they are needed most. The program is administered by DOF with funding from USFS Chesapeake Watershed Forestry Program.
- The Virginia Clean Water Revolving Loan Fund provides low interest loans for the construction of facilities or structures or the implementation of best management practices that reduce or prevent pollution of state waters. Some of these loans may be eligible for principal forgiveness. The program is administered by DEQ.
- The Section 319 Nonpoint Source Management Implementation Grant Program is a federal grant administered by DEQ to fund watershed projects, demonstration and educational programs, nonpoint source pollution control program development and associated technical and program staff for nonpoint source pollution prevention and control.
- The Section 117 Chesapeake Bay Implementation Grant Program is a federal grant from EPA, administered by DEQ to fund work toward meeting the goals of the Chesapeake Bay Watershed Agreement, with particular emphasis on programs to reduce nutrient and sediment pollution. When competitive or special funding is made available for implementation activities and capacity development assistance, it is posted for public announcement and disseminated through the partnerships.
- The Section 117 Chesapeake Bay Regulatory and Accountability Program is a federal grant from EPA, administered by DEQ to implement and expand regulatory, accountability, assessment, compliance and enforcement capabilities to reduce nitrogen, phosphorus and sediment loads to meet the water quality goals of the Watershed Agreement and the Chesapeake Bay TMDL. When competitive or special funding is made available for implementation activities and capacity development assistance, it is posted for public announcement and disseminated through the partnerships.
- The National Fish and Wildlife Foundation (NFWF), in partnership with government agencies and private corporations, administers the Chesapeake Bay Stewardship Fund, which offers two competitive grant programs: the Innovative Nutrient and Sediment Reduction Grant Program and the Small Watershed Grants Program. These programs benefit the communities, farms, habitats and wildlife of the Chesapeake Bay region.
- The Virginia Water Quality Improvement Fund (WQIF) established a special permanent, non-reverting fund in the state treasury, consisting of sums appropriated to it by the General Assembly. These include, unless otherwise provided in the general appropriation act, 10% of the annual general fund revenue collections in excess of the official estimates, and 10% of any unrestricted and uncommitted general fund balance at the close of each fiscal year whose reappropriation is not required. Moneys in the fund shall be used solely for Water Quality Improvement Grants.

- The Virginia Chesapeake Bay Restoration Fund was created in 1992 by the General Assembly to support environmental education and restoration projects in the Chesapeake Bay and its tributaries (§ 46.2-749.2). Revenue for the fund is generated from the sale of Friend of the Chesapeake license plates from the Department of Motor Vehicles.
- Pursuant to § 58.1-344.3.C(2)(a), voluntary contributions of tax refunds can be made to the Chesapeake Bay Restoration Fund to fulfill "the Chesapeake Bay Watershed Implementation Plan submitted by the Commonwealth of Virginia to the U.S. Environmental Protection Agency on November 29, 2010, and any subsequent revisions thereof." These funds are managed by the Secretary of Natural Resources.
- The Forest Management of State Owned Lands Fund (§ 10.1-1120 to 1123) is managed by DOF and used to defray the costs of timber sales, to develop forest management plans for state-owned lands pursuant to § 10.1-1124, and to implement those plans. This fund is supported by proceeds from the sale of timber on state-owned lands. For the purposes of this fund, "State-owned lands" means forest land owned or managed by the various departments, agencies and institutions of the Commonwealth and designated by the Department in cooperation with the Division of Engineering and Buildings of the DGS as being of sufficient size and value to benefit from a forest management plan. State-owned land shall not include properties held or managed by DWR, DOF or DCR.

## CHAPTER 8. NEXT STEPS TO IMPLEMENTATION

The success of this SWIP will require the engagement, collaboration and cooperation of all state agencies and public institutions of higher education. The SWIP team is not recommending the establishment of new mandates as the identified programmatic initiatives and best management practices can be readily built into agency or institution planning and programming through their respective management plans or business strategic plans.

A gubernatorial executive order or directive would promote and advance the important role each state agency and public institution of higher education will play in the success of the SWIP. Agencies will be encouraged to document funding needs to pursue the goals of the SWIP.

Following completion of the SWIP, the Office of the Secretary of Natural Resources and DEQ will conduct outreach to Chesapeake Bay stakeholders as well as to state agencies and public institutions of higher education. Outreach to boards such as the State Council of Higher Education for Virginia, the Commonwealth Transportation Board, the State Board of Community Colleges, the Board of Wildlife Resources and the Virginia Board of Soil and Water Conservation, will be conducted to solicit engagement in the SWIP goals. Stakeholder groups will include, but are not limited to, the Chesapeake Bay Stakeholders Advisory Group[17], local Planning District/Regional Commissions and local SWCDs.

The SWIP interagency technical team will meet at least annually to assess progress toward the SWIP goals and adaptively manage implementation so as to achieve success.

To initiate implementation of the SWIP and with support from the Chesapeake Bay Restoration Fund, the DEQ will evaluate a subset of state lands, their associated land use and LiDAR (Light Detection and Ranging) based flow-path data to identify specific opportunities for implementation of cost effective best management practices with significant co-benefits. The results will identify areas on state lands that support clean water practices and inform application for existing implementation funds, such as Sections 319 and 117 Clean Water Act grants. The subset of state lands will include non-natural state lands not currently regulated pursuant to a MS4 permit.

[17] DEQ provided an overview of the state lands mapping project and development of pollution reduction targets to the Chesapeake Bay Stakeholders Advisory Group (Group) on October 28, 2020. The Office of the Secretary of Natural Resources provided an update on the SWIP to the Group on April 29, 2021.

## APPENDIX A. NUTRIENT AND SEDIMENT POLLUTANT LOAD REDUCING BEST MANAGEMENT PRACTICES BY SECTOR

### Agriculture Practices

**Conservation Tillage:** Reduces or eliminates soil disturbance by plows and implements intended to invert residue. The practice involves all crops in a multi-crop, multi-year rotation and the crop residue cover requirement (including living and dead material) is to be met immediately after planting of each crop. There are three levels of tillage management ranging from 15% to 60% residue cover.

**Cover Crop:** A short-term crop grown after the main cropping season that reduces nutrient losses to ground and surface water by sequestering nutrients. Fall nutrients are not applied and the crop may not be harvested in the spring. There are many varieties of cover crop BMPs based on what is planted, when it is planted and how it is planted.

**Forest Buffer:** Forest buffers are linear wooded areas that help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. The recommended buffer width is 100 feet, with 35 feet minimum width required.

**Livestock Exclusion:** Prevents livestock from entering the stream and creates a buffer between active pasture and streams. The recommended buffer width is 100 feet, with 35 feet minimum width required.

**Nutrient Management:** The planned application of fertilizer and organic nutrients at the proper rate, timing and placement for the crops being grown.

**Precision Intensive Rotational/Prescribed Grazing (PG):** This practice utilizes a range of pasture management and grazing techniques to improve the quality and quantity of the forages grown on pastures and reduce the impact of animal travel lanes, animal concentration areas or other degraded areas. Pastures under the PG systems are defined as having a vegetative cover of 60% or greater.

**Soil Conservation and Water Quality Plans (Resource Management Plans):** Farm conservation plans are a combination of agronomic, management and engineered practices that protect and improve soil productivity and water quality, and to prevent deterioration of natural resources on all or part of a farm.

**Wetland Restoration:** Re-establish wetlands in headwaters or floodplain by manipulation of the physical, chemical or biological characteristics of a site with the goal of returning natural/historic functions to a former wetland.

### Urban / Suburban Practices

Note: Definitions are based on Bay Program BMP standards. Additional specifications or alternative designs may be required per the Virginia Stormwater Management Program. VSMP standards and specifications for best management practices can be found on the Virginia Stormwater BMP Clearinghouse website.

**Bioretention/raingardens:** An excavated pit backfilled with engineered media, topsoil, mulch and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants.

**Bioswale:** With a bioswale, the load is reduced because, unlike other open channel designs, there is now infiltration into the soil. A bioswale is designed to function as a bioretention area.

**Conservation Landscaping Practices:** The conversion of managed turf into actively maintained, but not fertilized, perennial meadows, using species that are native to the Chesapeake Bay region.

**Dry (Extended) Detention Ponds**: Dry (extended) detention basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently.

**Filtering Practices:** Practices that capture and temporarily store runoff and pass it through a filter bed or manufactured cartridges of either sand or an organic media. There are various filter designs, such as above ground, below ground, perimeter, etc.

**Impervious Surface Reduction:** Reducing existing impervious surfaces to promote infiltration and percolation of runoff storm water.

**Infiltration Practices:** A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. A sand layer and vegetation may be included. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in A or B soil types.

**Permeable Pavement:** Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain.

**Storm Drain Cleanout:** Removal of sediment and organic matter from catch basins in a targeted manner that focuses on water quality improvements.

**Urban Filter Strips:** Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions.

**Urban Forest Buffer:** Forest buffers are linear wooded areas that help filter nutrients, sediments and other pollutants from runoff as well as remove nutrients from groundwater. The recommended buffer width is 100 feet, with 35 feet minimum width required.

**Urban Forest Planting:** Urban forest planting includes trees planted in a contiguous area to establish forest-like conditions, with minimal mowing as needed to aid tree and understory establishment. Do not include plantings used to establish riparian forest buffers. Trees are planted on existing pervious areas.

**Urban Nutrient Management:** An urban nutrient management plan is a written, site-specific plan which addresses how the major plant nutrients (nitrogen, phosphorus and potassium) are to be annually managed for expected turf and landscape plants and for the protection of water quality.

**Urban Tree Planting/Canopy:** Tree plantings on developed land (turf grass or impervious) that result in an increase in tree canopy but are not intended to result in forest-like conditions. 300 trees equivalent to one acre.

**Vegetated Open Channel:** Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed. Runoff passes through either vegetation in the channel, subsoil matrix and/or is infiltrated into the underlying soils.

**Wetland Ponds and Wetlands:** A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics.

**Septic Practices**

**Septic Connection:** This is when septic systems get converted to public sewer. This reduces the number of systems because the waste is sent into the sewer and treated at a wastewater treatment plant.

**Septic Denitrification (Conventional):** The septic system should employ a 50% denitrification unit for pre-treatment of waste with no enhanced in situ treatment system within the soil treatment unit. This BMP should be used only for systems that employ recirculating media filters (RMF) or integrated fixed-film activated sludge (IFAS) pre-treatment technologies, but do not employ enhanced in situ treatment systems. There are also Advanced and Enhanced versions of this BMP with differing specifications.

**Septic Effluent (Enhanced):** The septic system must be designed to reduce 38% TN by employing an enhanced in situ treatment system within the soil treatment unit with no secondary treatment or enhanced denitrification technology. This system must employ shallow-placed, pressure-dosed dispersal units or elevated sand mounds with pressure-dosed dispersal for in situ treatment within the soil treatment unit. There is also an Advanced version of this BMP with differing specifications.

**Septic Pumping:** Septic systems achieve nutrient reductions through several types of management practices, including frequent maintenance and pumping. On average, septic tanks need to be pumped once every three to five years to maintain effectiveness. The pumping of septic tanks is one of several measures that can be implemented to protect soil absorption systems from failure.

**Septic Secondary Treatment (Conventional):** The septic system should employ a technology for pretreatment of waste with no enhanced in situ treatment system within the soil treatment unit. This BMP should be used only for systems that employ certified, NFS 40 Class I or equivalent technologies, intermittent media filters (IMF) or constructed wetlands for pre-treatment designed to produce a gross 20% TN reduction. There are also Advanced and Enhanced versions of this BMP with differing specifications.

**Natural Practices**

**Forest Harvesting Practices:** Forest harvesting practices are a suite of BMPs that minimize the environmental impacts of forest road building, log removal, site preparation and forest management. These practices help reduce suspended sediments and associated nutrients that can result from forest operations.

**Oyster Reef Restoration:** Restoration of oyster reefs in tidal areas of the Chesapeake Bay or its tributaries using hatchery-produced oysters and/or using substrate addition to enhance oyster biomass in areas where removal (harvest) is not permitted.

**Shoreline Management:** Practices with a vegetated area along tidal shorelines that prevent and/or reduces tidal sediments to the Bay. Shoreline practices can include living shorelines, revetments and/or breakwater systems.

**Stream Restoration:** Stream restoration is a change to the stream corridor that improves the stream ecosystem by restoring the natural hydrology and landscape of a stream and helps improve habitat and water quality conditions in degraded streams.

**Nitrogen Reducing Bioreactor:** Diversion of surface or sub-surface flow through a carbon-source filter to enhance conversion of nitrate to nitrogen gas that volatilizes, thereby reducing pass through nitrogen loads.

For additional information on these practices, see the Bay Program BMP Quick Reference Guide.

## APPENDIX B. SWIP CAST BMP IMPLEMENTATION SCENARIO

| Agriculture Practices | Unit | Potomac | Rappahannock | York | James | Eastern Shore | Bay Total |
|---|---|---|---|---|---|---|---|
| Conservation Tillage | Acres | 699 | 784 | 730 | 2,456 | 217 | 4,886 |
| Cover Crop | Acres | 699 | 784 | 730 | 2,456 | 217 | 4,886 |
| Forest Buffers | Acres in Buffers | 38 | 42 | 39 | 133 | 12 | 264 |
| Forest Buffers on Fenced Pasture Corridor | Acres in Buffers | 166 | 32 | 39 | 247 | 0 | 483 |
| Nutrient Application Management Core Nitrogen | Acres | 3,670 | 1,347 | 1,408 | 6,844 | 218 | 13,486 |
| Nutrient Application Management Core Phosphorus | Acres | 3,670 | 1,347 | 1,408 | 6,844 | 218 | 13,486 |
| Prescribed Grazing | Acres | 2,989 | 583 | 697 | 4,450 | 7 | 8,725 |
| Soil and Water Conservation Plan | Acres | 3,670 | 1,347 | 1,408 | 6,844 | 218 | 13,486 |
| Wetland Enhancement and Rehabilitation | Acres | 2 | 1 | 1 | 13 | - | 16 |

| Urban/Suburban Practices | Unit | Potomac | Rappahannock | York | James | Eastern Shore | Bay Total |
|---|---|---|---|---|---|---|---|
| BioRetention | Acres Treated | 80 | 23 | 26 | 98 | 4 | 231 |
| BioSwale | Acres Treated | 19 | 5 | 6 | 23 | 1 | 54 |
| Conservation Landscaping Practices | Acres Treated | 697 | 261 | 296 | 793 | 40 | 2,086 |
| Extended Dry Ponds | Acres Treated | 249 | 72 | 80 | 304 | 11 | 716 |
| Filtering Practices | Acres Treated | 92 | 27 | 29 | 112 | 4 | 264 |
| Impervious Surface Reduction | Acres | 56 | 16 | 18 | 68 | 2 | 160 |
| Infiltration Practices | Acres Treated | 124 | 36 | 40 | 151 | 5 | 356 |
| Permeable Pavement | Acres Treated | 12 | 4 | 4 | 15 | 1 | 36 |
| Storm Drain Cleanout | Lbs of Sediment | - | - | - | - | - | - |
| Urban Filter Strips | Acres Treated | - | 0 | 1 | 2 | - | 3 |
| Urban Forest Buffers | Acres in Buffers | 174 | 8 | 24 | 98 | 2 | 306 |
| Urban Forest Planting | Acres | 121 | 59 | 60 | 248 | 33 | 521 |
| Urban Nutrient Management | Acres | 7,081 | 2,645 | 3,001 | 8,047 | 405 | 21,179 |
| Urban Tree Planting | Acres | 424 | 92 | 97 | 326 | 21 | 960 |
| Vegetated Open Channel | Acres Treated | 6 | 2 | 2 | 8 | 0 | 18 |
| Wet Ponds & Wetlands | Acres Treated | 396 | 115 | 127 | 485 | 17 | 1,140 |

| Septic Practices | Unit | Potomac | Rappahannock | York | James | Eastern Shore | Bay Total |
|---|---|---|---|---|---|---|---|
| Septic Connections | Number of Systems | 68 | 24 | 80 | 159 | 10 | 341 |
| Septic Denitrification | Number of Systems | 144 | 34 | 125 | 188 | 19 | 510 |
| Septic Effluent | Number of Systems | 0 | 0 | 0 | 0 | - | 0 |
| Septic Pumping | Number of Systems | 287 | 116 | 156 | 298 | 19 | 877 |
| Septic Secondary Treatment | Number of Systems | 29 | 10 | 11 | 14 | 1 | 65 |

| Natural Sector Practices | Unit | Potomac | Rappahannock | York | James | Eastern Shore | Bay Total |
|---|---|---|---|---|---|---|---|
| Forest Harvesting Practices | Acres | 653 | 449 | 590 | 1,774 | 24 | 3,489 |
| Oyster Reef Restoration | Acres | - | 138 | 165 | 40 | - | 343 |
| Shoreline Management | Feet | 2,242 | 4,239 | 4,513 | 2,542 | 2,463 | 16,000 |
| Stream Restoration | Feet | 8,447 | 934 | 2,165 | 8,335 | 119 | 20,000 |
| Nitrogen Reducing Bioreactor | Lbs of Nitrogen | | | | | | 9,600 |

## APPENDIX C. LOAD REDUCTION TARGET CALCULATIONS

| Potomac River Basin | Sum of Acres | MS4 | Unregulated Acres | N Reduction/unit | P Reduction/unit | Total N Target | Total P Target |
|---|---|---|---|---|---|---|---|
| Impervious | 44,126 | 26,863 | 17,263 | 1.09 | 0.104 | 18,890 | 1,789 |
| Pervious | 7,944 | 14,843 | 7,944 | 0.55 | 0.116 | 4,374 | 918 |
| Cropland | 755 | - | 755 | 4.64 | 0.318 | 3,500 | 240 |
| Pasture | 3,312 | - | 3,312 | 0.24 | 0.064 | 807 | 213 |
| Harvested/Disturbed | 61 | - | 61 | 0.31 | - | 19 | - |
| Natural | 33,581 | - | 33,581 | - | - | - | - |
| **Total** | **89,778** | **41,706** | **62,915** | | | **27,589** | **3,158** |

| Rappahannock River Basin | Sum of Acres | MS4 | Unregulated Acres | N Reduction/unit | P Reduction/unit | Total N Target | Total P Target |
|---|---|---|---|---|---|---|---|
| Impervious | 12,506 | 2,308 | 10,199 | 1.48 | 0.052 | 15,145 | 528 |
| Pervious | 2,597 | 1,477 | 2,597 | 0.73 | 0.081 | 1,892 | 211 |
| Cropland | 847 | - | 847 | 5.11 | 0.050 | 4,331 | 42 |
| Pasture | 646 | - | 646 | 1.28 | 0.054 | 830 | 35 |
| Harvested/Disturbed | 33 | - | 33 | 0.34 | - | 11 | - |
| Natural | 19,619 | - | 19,619 | - | - | - | - |
| **Total** | **36,248** | **3,784** | **33,941** | | | **22,209** | **817** |

| York River Basin | Sum of Acres | MS4 | Unregulated Acres | N Reduction/unit | P Reduction/unit | Total N Target | Total P Target |
|---|---|---|---|---|---|---|---|
| Impervious | 14,285 | 2,776 | 11,509 | 1.10 | 0.052 | 12,663 | 596 |
| Pervious | 2,423 | 1,383 | 2,423 | 0.61 | 0.081 | 1,485 | 197 |
| Cropland | 788 | - | 788 | 2.65 | 0.050 | 2,089 | 39 |
| Pasture | 772 | - | 772 | 0.39 | 0.054 | 303 | 42 |
| Harvested/Disturbed | 1,458 | - | 1,458 | 0.13 | - | 189 | - |
| Natural | 34,334 | - | 34,334 | - | - | - | - |
| **Total** | **54,060** | **4,159** | **51,284** | | | **16,729** | **874** |

| Eastern Shore of Chesapeake Bay | Sum of Acres | MS4 | Unregulated Acres | N Reduction/unit | P Reduction/unit | Total N Target | Total P Target |
|---|---|---|---|---|---|---|---|
| Impervious | 1,897 | - | 1,897 | 2.90 | 0.128 | 5,500 | 242 |
| Pervious | 380 | - | 380 | 1.59 | 0.168 | 603 | 64 |
| Cropland | 234 | - | 234 | 7.10 | 0.382 | 1,662 | 89 |
| Pasture | 7 | - | 7 | 3.60 | 0.123 | 26 | 1 |
| Harvested/Disturbed | 1 | - | 1 | 4.77 | 0.101 | 7 | 0 |
| Natural | 9,714 | - | 9,714 | - | - | - | - |
| **Total** | **12,234** | - | **12,234** | | | **7,798** | **397** |

| James River Basin | Sum of Acres | MS4 | Unregulated Acres | N Reduction/unit | P Reduction/unit | Total N Target | Total P Target |
|---|---|---|---|---|---|---|---|
| Impervious | 50,928 | 17,441 | 33,487 | 0.82 | 0.081 | 27,303 | 2,713 |
| Pervious | 12,730 | 11,308 | 12,730 | 0.54 | 0.104 | 6,913 | 1,325 |
| Cropland | 2,652 | - | 2,652 | 3.28 | 0.145 | 8,697 | 383 |
| Pasture | 4,931 | - | 4,931 | 0.78 | 0.069 | 3,864 | 339 |
| Harvested/Disturbed | 2,209 | - | 2,209 | 0.20 | - | 436 | - |
| Natural | 174,406 | - | 174,406 | - | - | - | - |
| **Total** | **247,856** | **28,749** | **230,415** | | | **47,213** | **4,759** |