Allocation of Conowingo Infill Nutrient and Sediment Loads: Comparing Cost Effectiveness in Different Phosphorus Load Allocation Scenarios among Jurisdictional Partners

Introduction

The Susquehanna River basin, situated at the headwaters of Chesapeake Bay, is the Bay's largest watershed and drains an area of about 27,000 mi^2, or 43 percent of Chesapeake Bay's total watershed (Linker et al., 2016a). The Susquehanna River delivers about 25 percent of the phosphorus loads to the tidal Bay on an annual average basis (Linker et al., 2016b).

There is a series of three hydropower dams located at the lower end of the Susquehanna River. These three dams (Safe Harbor, Holtwood, and Conowingo) form three reservoirs (Lake Clarke, Lake Aldred, and Conowingo Reservoir), which have been trapping sediment and nutrients (phosphorus and nitrogen) since they were constructed (Safe Harbor in 1931, Holtwood in 1910, and Conowingo in 1929). Safe Harbor dam is thought to have reached its capacity to store sediment in the early 1950s and Holtwood Dam reached its capacity to store sediment in the mid-1920s. As of 2011, Conowingo Reservoir was estimated to have reached approximately 92 percent of its sediment storage capacity and is now thought to have reached a state of dynamic equilibrium (Langland, 2015). Thus, the dam no longer has capacity to trap phosphorus, along with nitrogen and sediment. The states' Watershed Implementation Plans (WIPs) developed to meet the *2010 Chesapeake Bay TMDL for Nitrogen, Phosphorus and Sediment* (EPA, 2010) assumed continued trapping of nutrients and sediment by the dam. New research shows that an additional load is being delivered to the Chesapeake Bay, and will need to be reduced to meet the TMDL.

At a December 13, 2016 meeting, the Chesapeake Bay Program Partnership Principals' Staff Committee (PSC) was briefed on the Conowingo infill and asked to identify additional information that would facilitate decisions about addressing: 1) who is responsible for additional load reductions, 2) how responsibility is assigned, and 3) when the additional reductions will be required to be met. The PSC decided that the Modeling Workgroup would take the lead in providing additional information. This report provides information on cost-effective approaches to offset increased delivery of phosphorus from the Susquehanna River.

Approach

Amount of increased load

The increased load from the Susquehanna River, assuming a state of dynamic equilibrium at the three dams that make up the lower Susquehanna River system, has been assessed using multiple hydrologic

and statistical models. The Beta 3 Phase 6 Watershed Model estimates that the net annual transport of phosphorus to the Chesapeake Bay is about 2 million pounds more than was estimated in the 2010 allocation (Linker et al., 2016b). The Beta 3 Phase 6 Watershed Model is the most recent version that evaluated nutrient and sediment trapping by the lower Susquehanna River system reservoirs. The Phase 6 Watershed Model integrates multiple models and multiple lines of evidence, including the USGS's statistical method Weighted Regressions on Time, Discharge, and Season (WRTDS), the Phase 5.3.2 Watershed Model, and the USGS SPARROW model.

To determine the costs of the BMPs required to reduce the increased phosphorus load, the management tool Chesapeake Assessment Scenario Tool (CAST) was used. CAST is based on the Phase 5.3.2 Watershed Model and includes cost estimates associated with BMPs. To use a Phase 6 load reduction estimate in the Phase 5.3.2 model context, it is appropriate to use the relative change in load rather than absolute pounds of phosphorus reduced. The relevant result from the Beta 3 Phase 6 model is a **38 percent increase in phosphorus from the changed condition of dynamic equilibrium of the three reservoirs**. The delivery ratios in the TMDL allocations were altered to accommodate this 38 percent increase in delivered phosphorus from the Susquehanna River. The percent reduction is consistent across different models and model versions, although the reduction in absolute pounds depends on the model and version.

Scenarios

Three scenarios were evaluated. Each represents different levels of BMP implementation among states. All three meet the phosphorus load reduction that offsets the increased phosphorus from the infill of the lower Susquehanna River system reservoirs. Scenario 1 assigns responsibility for the increased load only to the states that drain to the lower Susquehanna River reservoir system. Scenario 2 assigns additional responsibility to Maryland and Virginia because, as downstream states, they have the most to gain from controlling the loads from the Susquehanna. Scenario 3 is the method that would have been used to assign allocations in the Chesapeake Bay TMDL if it had been clear by 2010 that the Conowingo was in dynamic equilibrium.

Scenario 1: Upstream States: Susquehanna River basins in New York, Pennsylvania, Maryland
Scenario 2: Upstream states plus additional allocation for Maryland and Virginia
Scenario 3: Divided among all jurisdictions, which follows the allocation rules used in the TMDL

Best cost effectiveness of phosphorus reduction strategies is the criterion in reducing the load. All sectors are evaluated for contributing toward the reduction. The scenarios assume implementation by 2025. Costs are for a single year of implementation, not accrued over a period of years. Climate change effects are not considered as part of this analysis. The Everything by Everyone, Everywhere (E3) scenario was not used as a maximum limit of implementation.

The additional reduction to decrease the Susquehanna River basin load to the Phase II WIP amount with the revised delivery factors is 28 percent, which is the reduction goal for Scenario 1. Two other scenarios for meeting the allocation were considered in addition to reducing the load in the area that drains to the Conowingo dam. These two scenarios generated the same impact on the Chesapeake Bay, but allocated loads to other states and river basins. These reduction factors were determined by examining the original TMDL allocation information. The No Action and Everything, Everywhere by Everyone (E3) scenario loads that were used to inform the 2010 Bay TMDL allocations were adjusted to account for the

38% increase in Susquehanna River Basin load due to reservoir infill. The reduction goal for Scenario 2 is: 16% for Maryland, 11% for New York, 14% for Pennsylvania, and 9% for Virginia. The reduction goal for Scenario 3 is: 3% for the District of Columbia, 20% for Delaware, 14% for Maryland, 10% for New York, 14% for Pennsylvania, 8% for Virginia, and 11% for West Virginia. Between Scenarios 2 and 3, the reductions for Maryland, New York and Virginia decrease while Pennsylvania remains constant. These state percent reductions are a weighted percent based on land area. Total P loads are lower for allocation methods that include non-Susquehanna basins because those basins are less effective at raising dissolved oxygen levels.

Scenario development method

The Phase 5 CAST tool is used to evaluate costs and loads. Each scenario developed was compared to the Phase 2 WIP available in CAST. The delivery factors are adjusted for the Susquehanna to include the 38 percent increase in delivery resulting from the dynamic equilibrium of the reservoirs. The comparison is of the Phase 2 WIP and the allocation options represented by the three scenarios. The revised delivery factors are used in the WIP and the three scenarios.

The BMP costs are specific to each state. The costs are estimated in 2010 dollars and represent a single year of cost, rather than the cost over the entire lifespan of the practice. Costs are those incurred by both public and private entities. Default costs were prepared for EPA using existing data. Bay jurisdictions were provided with the opportunity to review and amend these unit costs. CAST does not directly model WWTP costs. The WWTP costs were provided by MDE (Dalmasey, MDE, personal communication 2017). The costs used in this analysis are in Appendix A.

The BMPs selected for each scenario vary depending on the scenario. Selections were made using an analysis that previously was conducted to show the cost of BMPs per pound of phosphorus reduced. In that analysis, each BMP was isolated and the impact on the loads was determined. This allowed for the cost per pound of phosphorus reduction to be identified for each BMP in the 2014 progress review. This information helped to inform the least expensive and most effective BMPs used in these scenarios. Appendix A shows the cost per unit of BMP without considering the BMP reduction effect. Appendix C provides a summary of the cost and implementation level of the BMPs in the three scenarios.

In each of the three scenarios, the least expensive and most effective BMPs were added to address the *additional* reduction required by the reservoir infill. Changes were made to WIP BMPs in three situations:

1. BMPs additional to the WIP could not be stacked with the WIP BMPs. For example, the new Nutrient Management Plan cannot be added to a scenario with the retired Manure Incorporation BMP. This required a change to the WIP BMPs.
2. Manure transport was increased, which reduced the total amount of manure. Other BMPs that manage manure stay at the same percent implementation, but the actual amount, and associated costs, decrease since there is less manure. Example: Animal Waste Management Systems.
3. Implementation of buffers and other land use change BMPs reduce the acres available for other land uses, and the BMPs on that other land. While the percent implementation remains the same, the actual amount, and associated costs, decrease.

4. Some urban BMPs that are most expensive and least effective were removed. Examples are Dry Ponds and Dry Extended Ponds, Filtering Practices (Pennsylvania, Maryland, Virginia) and Impervious Surface Reduction in the District of Columbia. Urban grass buffers were removed since it is a BMP with no effect. Only Pennsylvania included urban grass buffers in the WIP.

Results of scenarios compared to the WIP

To reduce loads from the Phase 2 WIP, the least expensive and most effective BMPs were selected. The comparison of costs and phosphorus delivered loads among the WIP and the three scenarios are described in the following sections.

Costs

Costs represent a single year of cost rather than the cost over the entire lifespan of the practice. Capital and opportunity costs are amortized over the BMP lifespan and added to annual operations and maintenance (O&M) costs for a total **annualized** cost. The interest rate for capital and opportunity costs is five percent. Cost estimates would be different if the entire capital cost is paid in the first year. If the cost is needed over a period of time, such as five years, it would be inappropriate to multiply these annualized costs by five because the lifespans of the BMPs vary from one to 75 years.

The cost of the Phase 2 WIP implementation in the Chesapeake Bay Watershed is estimated in CAST as $6.5 billion. The increased investment required to accommodate the reservoirs' infill in Scenario 1 is **8 percent**, or about $495 million. The increased investment required in Scenario 2 is **6 percent**, or about $380 million. The increased investment required in Scenario 3 is **1 percent**, or about $82 million (Table 1). The decrease in animal costs in Scenarios 2 and 3 are due to higher implementation of dairy precision feeding which has a cost savings (negative cost) as well as the removal of the most expensive urban BMPs in the WIPs (ponds and filtering practices).

Table 1: Cost of Phase 2 WIP and additional increase required for each scenario.

		Increased Cost from WIP		
Sector	**WIP-all CBWS**	**Scenario 1**	**Scenario 2**	**Scenario 3**
All Sectors	***$6,530,226,012***	***$495,098,643***	***$380,299,858***	***$81,953,671***
Land and septic	$6,059,405,938	$478,981,537	$362,250,459	$76,392,397
Animal	$457,103,828	$2,240,606	-$1,979,765	-$14,467,890
Manure transport	$13,716,246	$13,876,500	$20,029,164	$20,029,164

In Scenario 1, the cost increase from the WIP is highest for Pennsylvania (88 percent). In Scenario 2, the cost increase from the WIP is highest in Maryland (40 percent). The Scenario 2 design allocated more responsibility to Maryland and Virginia. In Scenario 3, the cost increase from the WIP is highest in Virginia (37 percent). Scenario 3 shows a cost decrease from the WIP in Pennsylvania of $170 million due to dairy precision feeding and phytase, which have a cost reduction for implementation and the removal of ineffective urban practices and reduction of the most expensive urban BMPs (Figure 1, Figure 2 and Figure 3). Considering the land area provides a more comparable comparison of the costs. Pennsylvania comprises 76 percent of the area in the Susquehanna River basin, while New York comprises only 23 percent and Maryland a mere 1 percent.

In general, BMPs on developed land are more costly than those on agricultural land (Appendix A). Additional cost reductions could be made by making more significant changes to developed BMPs that each state had in the WIP and replacing with more cost effective BMPs. For example, replacing all of the filtering practices and impervious surface reduction with more cost effective BMPs like bioswales reduces costs while keeping the load reduction at a comparable level. These scenarios only reduced those WIP BMPs; more changes could make the WIPs and the three scenarios that built from the WIPs more cost effective.

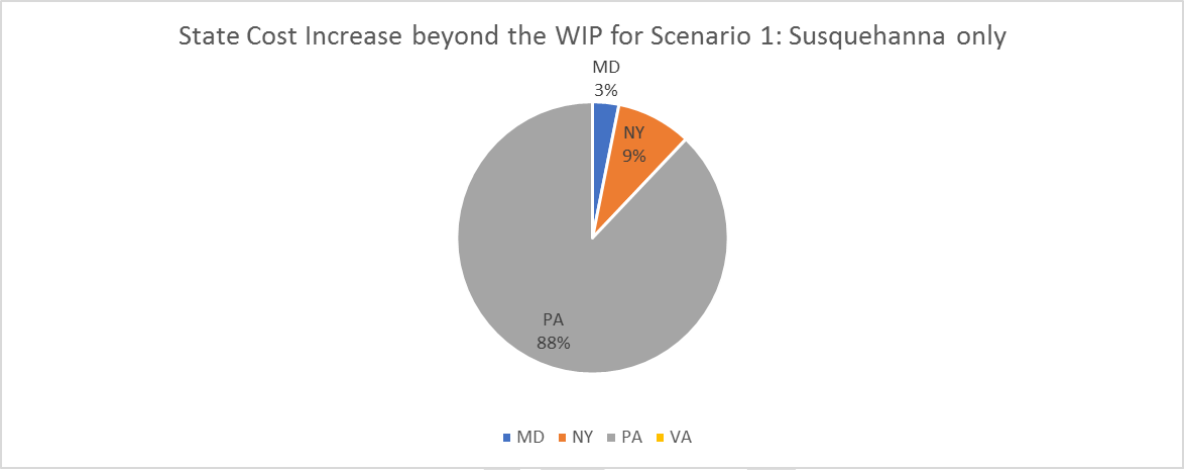

Figure 1: The increased costs in each state for remediating the increased load due to infill of the Susquehanna River system reservoirs. This is for Scenario 1, which allocates a portion to each of the states in the Susquehanna (MD, NY, and PA). The increase is calculated by subtracting the scenario costs from the WIP costs.

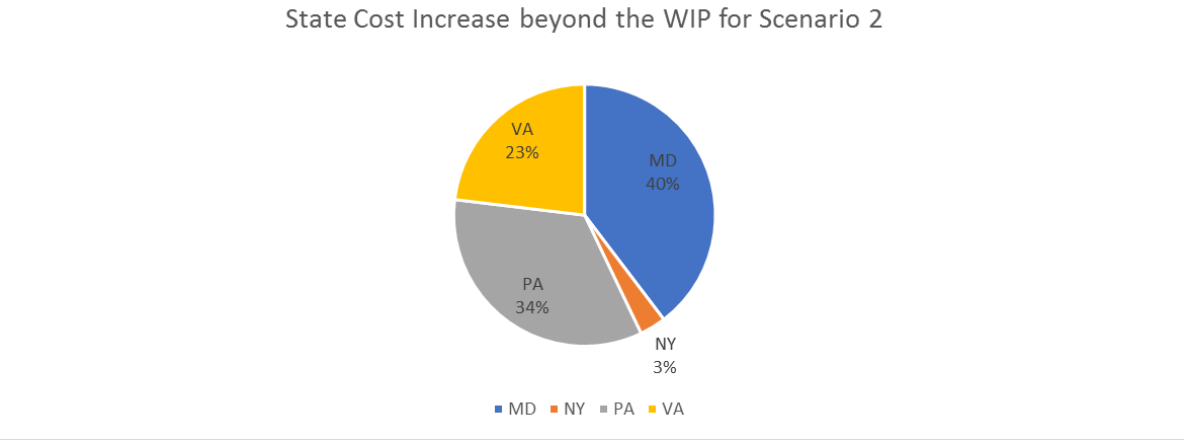

Figure 2: The increased costs in each state for remediating the increased load due to infill of the Susquehanna River system reservoirs. This is for Scenario 2, which allocates a portion to each of the states in the Susquehanna (MD, NY, and PA) plus additional allocation for MD and VA. The increase is calculated by subtracting the scenario costs from the WIP costs.

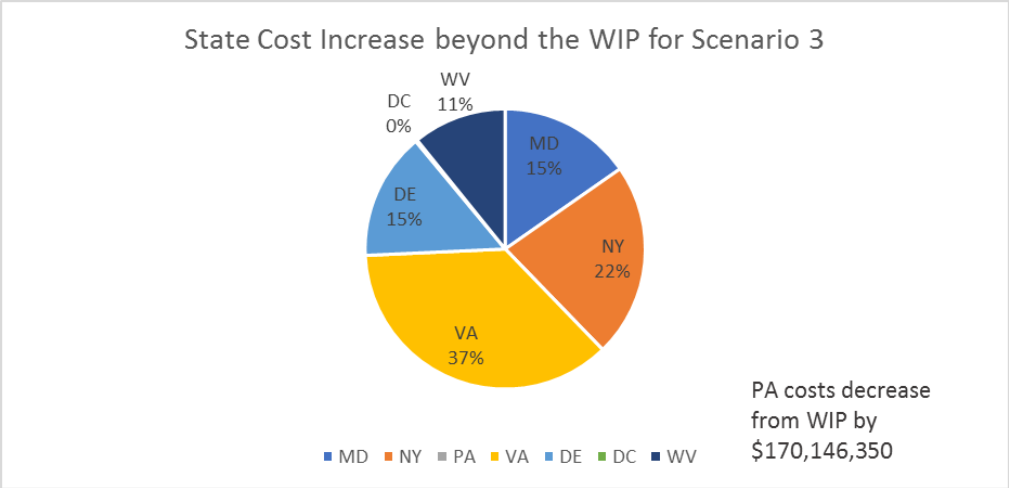

Figure 3: The increased costs in each state for remediating the increased load due to infill of the Susquehanna River system reservoirs. This is for Scenario 3, which allocates a portion to each of the states in the Chesapeake Bay watershed. The increase is calculated by subtracting the scenario costs from the WIP costs.

Phosphorus loads

Table 2 shows the phosphorus load decreased from the WIP by sector for each scenario. All scenarios meet the required reduction to achieve the TMDL goals. The total reduction varies among scenarios because each river basin has a different impact on Bay water quality. The allocation strategy for each scenario attributes some portion to different state basins. In all scenarios, the greatest load reduction comes from agriculture. Generally, agriculture has the greatest land area and the least expensive BMPs, making agriculture the most cost-effective sector in which to reduce loads.

Pennsylvania is the largest contributor of phosphorus (Figure 4, Figure 5 and Figure 5). When considering the load *per acre*, the highest value is from Maryland, due to the load on animal feeding areas. There is more animal agriculture in the few Maryland counties that drains to the Susquehanna compared to the larger area of Pennsylvania that drains to the Susquehanna. While Pennsylvania has certain counties with intensive animal agriculture, there are other areas of Pennsylvania that have few animals in the Susquehanna catchment. The loading rate in Scenario 1 from Pennsylvania is 0.18 and from Maryland is 0.25 pounds per acre. The loading rate in Scenario 2 from Pennsylvania is 0.22 and from Maryland and Virginia is 0.27 pounds per acre. The loading rate in Scenario 3 is highest in the District of Columbia at 0.52 pounds per acre.

Table 2: Comparison of the reductions from the Phase 2 WIP. Reduction is calculated by subtracting the WIP load from the scenario load. All three scenarios have the same impact on Bay water quality. Total reductions vary among scenarios because the various river basins have different effects on water quality in the Bay.

Phosphorus Load Reduction from Phase 2 WIP (Lbs)

Sector	**Scenario 1**	**Scenario 2**	**Scenario 3**
Total	(2,199,722)	(1,266,851)	(1,323,776)
Agriculture	(1,059,053)	(1,204,774)	(1,235,776)
Natural	(1,491)	4,703	6,926
Urban	(78,634)	(66,780)	(94,406)

The load reductions required to meet Chesapeake Bay water quality goals vary among the scenarios because each river basin has a different impact on water quality. Moving from Scenario 1 with the reduction only in the Susquehanna to Scenarios 2 and 3 where reductions occur in the Susquehanna plus other basins will necessarily change the overall load required to be reduced. All three scenarios meet Bay water quality goals.

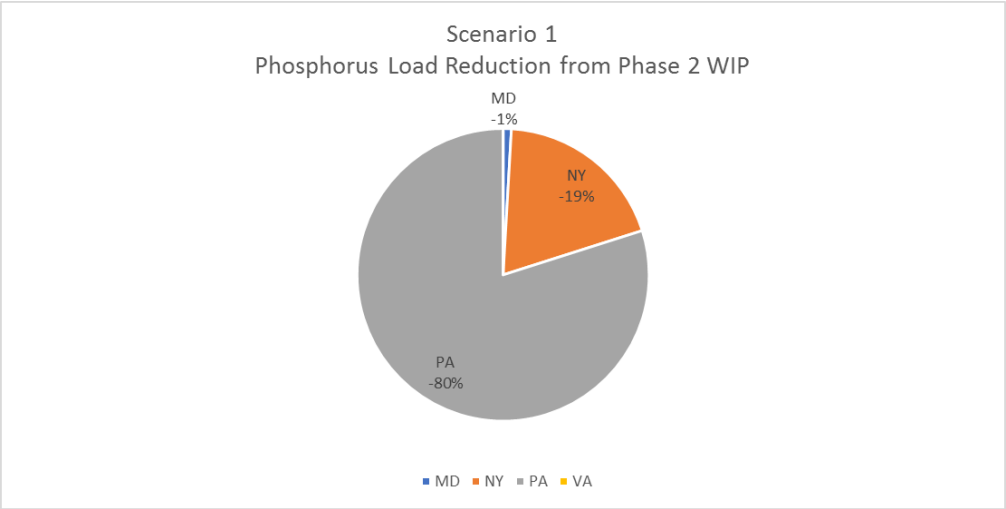

Figure 4: Percent decrease for each state of delivered load in Scenario 1 compared to the WIP. Scenario 1 represents changes only to the Susquehanna portion of the Bay Watershed.

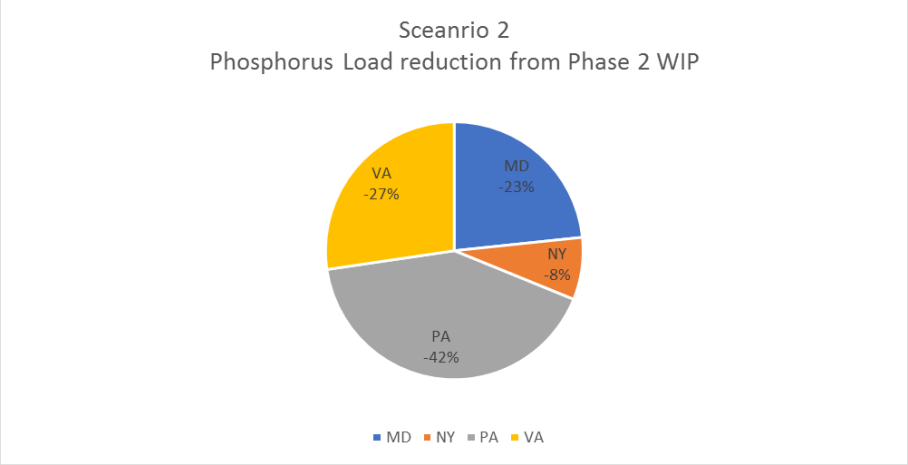

Figure 5: Percent decrease for each state of delivered load in Scenario 2 compared to the WIP. Scenario 2 represents changes to the Susquehanna portion of the Bay Watershed plus additional allocation from Maryland and Virginia.

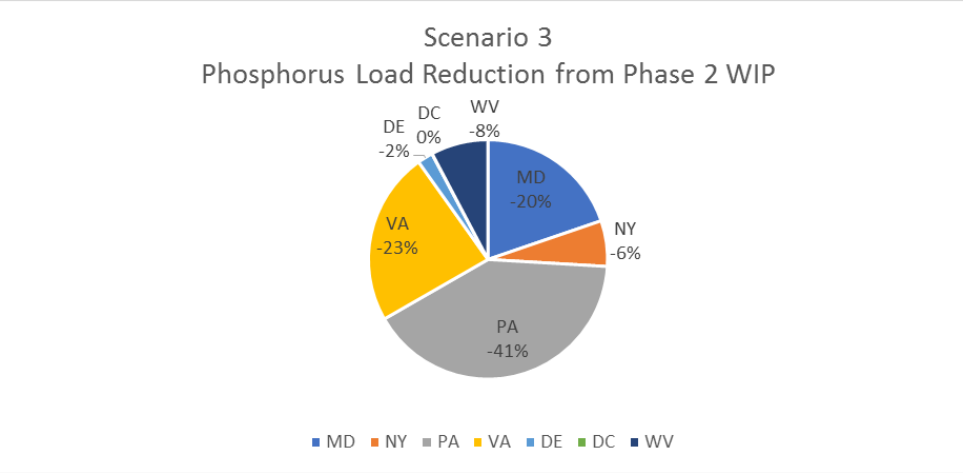

Figure 6: Percent decrease for each state of delivered load in Scenario 3 compared to the WIP. Scenario 3 represents an allocation to all states in the Chesapeake Bay watershed. This is the method of allocation that would have been used for the 2010 Bay TMDL had it the infill of the lower Susquehanna River reservoirs been known.

Additional considerations or recommendations

When weighing the cost of various solutions, there are several factors to consider that may not be directly quantifiable.

Managing the increase in phosphorus due to infill of the lower Susquehanna River system reservoirs through BMPs assumes that the planned BMPs are implemented and maintained. It is known that progress toward achieving the WIP reductions has been uneven across states and sectors. There is no certainty of implementation or operations and maintenance of BMPs.

The costs of BMP implementation include both public and private costs. The entity that bears the burden of the costs should include some consideration.

To achieve the additional reduction beyond those already achieved in the Phase 2 WIP, forest buffers were increased to 20 percent in Scenario 1. This level of implementation was chosen because forest buffers are one of the least costly BMPs when considering the phosphorus reduction. Manure transport out of the Chesapeake Bay Watershed also was implemented at 20 percent of available manure in Scenario 1. While costly, this BMP removes a portion of one of the major sources of phosphorus. The implementation levels of other BMPs also were increased to reduce the load beyond the Phase 2 WIP allocation.

The area of land that borders a stream and provides the maximum benefit for buffers has recently been determined through an analysis conducted by Lindsey Gordon, Chesapeake Research Consortium (April 2017). She determined that the average area of agricultural land that is available to be buffered in the Susquehanna portion of Maryland ranges from 0.89 percent in Cecil County to 2.78 percent in Baltimore County. This was determined by mapping the agricultural land adjacent to streams that does not already have forest cover. This new information indicates that streamside agricultural land is not available to have buffers implemented. BMPs other than buffers should be investigated to achieve the reductions necessary.

Scenario 2 includes a number of changes to BMPs (see Appendix C: BMP summary). Some of these levels of implementation may be easier to achieve than others. For example, there is an increase in alternative crops, like switchgrass. This is a change that is cost-effective, but may be difficult to implement. Scenario 2 includes buffers at 15 percent, which is more reasonable than Scenario 1, but is still a high rate. Scenario 2 also includes land retirement at 20 percent in many areas. There may not be the agreement within the agricultural community to implement at such a relatively high level.

The level of implementation required to achieve the load reductions is greater than the level of implementation in the Everything by Everyone Everywhere scenario (E3). The E3 scenario is considered the maximum possible implementation. Assuming that implementation is higher than E3 is illogical and suggests that these scenarios may not be feasible.

Working with source sectors may create different scenarios that do not exceed E3 and can be reasonably implemented.

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Appendix A: Annualized costs

Table 3: BMP costs from CAST, not including BMPs applied to animals. Costs are estimated in 2010 dollars. Capital and opportunity costs are amortized over the BMP lifespan and added to annual operations and maintenance (O&M) costs for a total annualized cost. The interest rate for capital and opportunity costs is 5 percent. Costs are those incurred by both public and private entities. Costs represent a single year of cost rather than the cost over the entire lifespan of the practice.

Sector	BMP	Total Annualized Cost	Unit
Agriculture	Stream Access Control with Fencing	5306.56	$/acre/year
Urban	Abandoned Mine Reclamation	615.88	$/acre/year
Agriculture	Soil Conservation and Water Quality Plans	1.94	$/acre/year
Urban	Advanced Grey Infrastructure Nutrient Discovery Program	8.52	$/acre/year
Agriculture	Forest Buffers	245.21	$/acre/year
Agriculture	Wetland Restoration	460.05	$/acre/year
Agriculture	Tree Planting	84.06	$/acre/year
Agriculture	Land Retirement to hay without nutrients (HEL)	168.69	$/acre/year
Agriculture	Grass Buffers	204.05	$/acre/year
Urban	Forest Conservation	0	$/acre/year
Urban	Impervious Surface Reduction	14297.38	$/acre/year
Urban	Urban Growth Reduction	0	$/acre/year
Urban	Forest Buffers	91.9	$/acre/year
Agriculture	Land Retirement to pasture (HEL)	168.69	$/acre/year
Urban	Grass Buffers	55.69	$/acre/year
Agriculture	Alternative Crops	18.24	$/acre/year
Agriculture	Streamside Forest Buffers	245.21	$/acre/year
Urban	Stream Restoration	60.4	$/feet/year
Agriculture	Stream Restoration	6.84	$/feet/year
Forest	Stream Restoration	6.84	$/feet/year
Agriculture	Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	0.83	$/feet/year
Urban	Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	0.83	$/feet/year
Forest	Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	0.83	$/feet/year
Urban	Shoreline Management	6.84	$/feet/year
Urban	Street Sweeping Pounds	0.23	$/lbs/year
Agriculture	Continuous No Till	0	$/acre/year
Agriculture	Off Stream Watering Without Fencing	29.5	$/acre/year
Agriculture	Precision Intensive Rotational/Prescribed Grazing	14.67	$/acre/year
Agriculture	Horse Pasture Management	21.77	$/acre/year
Agriculture	Shoreline Management	6.84	$/feet/year
Forest	Shoreline Management	6.84	$/feet/year
Agriculture	Water Control Structures	17.72	$/acre/year

Sector	BMP	Total Annualized Cost	Unit
Urban	Wet Ponds and Wetlands	428.73	$/acre treated/year
Urban	Dry Detention Ponds and Hydrodynamic Structures	758.92	$/acre treated/year
Urban	Dry Extended Detention Ponds	379.93	$/acre treated/year
Urban	Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	1268.01	$/acre treated/year
Urban	Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	1268.01	$/acre treated/year
Urban	Filtering Practices	2155.64	$/acre treated/year
Urban	MS4 Permit-Required Stormwater Retrofit	1568.1	$/acre treated/year
Forest	Forest Harvesting Practices	64.01	$/acre/year
Urban	Street Sweeping 25 times a year-acres	916.44	$/acre/year
Agriculture	Cover Crop Early Other Wheat	68	$/acre/year
Agriculture	Cover Crop Standard Other Wheat	68	$/acre/year
Agriculture	Commodity Cover Crop Early Other Wheat	66.67	$/acre/year
Agriculture	Commodity Cover Crop Standard Other Wheat	66.67	$/acre/year
Agriculture	Cover Crop Early Drilled Rye	68	$/acre/year
Agriculture	Cover Crop Standard Other Rye	68	$/acre/year
Agriculture	Cover Crop Standard Other Barley	68	$/acre/year
Agriculture	Cover Crop Standard Drilled Wheat	68	$/acre/year
Agriculture	Cover Crop Standard Drilled Rye	68	$/acre/year
Agriculture	Cover Crop Standard Drilled Barley	68	$/acre/year
Urban	Filter Strip Runoff Reduction	1268.01	$/acre treated/year
Urban	Filter Strip Stormwater Treatment	1268.01	$/acre treated/year
Urban	Tree Planting	84.63	$/acre/year
Forest, Agriculture, and Urban	Dirt & Gravel Road Erosion & Sediment Control - with Outlets	0.83	$/feet/year
Forest, Agriculture, and Urban	Dirt & Gravel Road Erosion & Sediment Control - Outlets only	0.83	$/feet/year
Agriculture	Narrow Grass Buffer	55.69	$/acre/year
Agriculture	Narrow Forest Buffer	91.9	$/acre/year
Agriculture	Barnyard Runoff Control	446.24	$/acre/year
Agriculture	Loafing Lot Management	1940.48	$/acre/year

Sector	BMP	Total Annualized Cost	Unit
Agriculture	Winter Killed Oats, Early, Drilled	68	$/acre/year
Agriculture	Winter Killed Oats, Early, Other	68	$/acre/year
Urban	Bioretention/raingardens - A/B soils, underdrain	1221.73	$/acre treated/year
Urban	Bioswale	1067.42	$/acre treated/year
Urban	Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	14297.38	$/acre treated/year
Urban	Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	14297.38	$/acre treated/year
Urban	Vegetated Open Channels - A/B soils, no underdrain	817.83	$/acre treated/year
Agriculture	Precision Intensive Rotational Grazing	93.33	$/acre/year
Agriculture	Winter Killed Oats, Early, Aerial, After Soy	68	$/acre/year
Urban	Land transition - construction to nonregulated pervious urban	0	$/acre/year
Agriculture	Winter Killed Oats, Early, Aerial	68	$/acre/year
Agriculture	Winter Hardy Brassica, Early, Drilled	68	$/acre/year
Agriculture	Commodity Cover Crop Early Drilled Wheat	66.67	$/acre/year
Agriculture	Cover Crop Late Other Wheat	68	$/acre/year
Agriculture	Cover Crop Early Other Rye	68	$/acre/year
Agriculture	Commodity Cover Crop Early Other Rye	66.67	$/acre/year
Urban	Stormwater to the Maximum Extent Practicable (SW to the MEP)	3436.18	$/acres treated/year
Agriculture	Cover Crop Early Drilled Wheat	68	$/acre/year
Agriculture	Winter Hardy Brassica, Early, Other	68	$/acre/year
Agriculture	Irrigation Water Capture Reuse	970.24	$/acre/year
Agriculture	Cover Crop Early-Planting Other Barley	68	$/acre/year
Agriculture	Commodity Cover Crop Standard Other Rye	66.67	$/acre/year
Agriculture	Commodity Cover Crop Standard-Planting Other Barley	66.67	$/acre/year
Agriculture	Commodity Cover Crop Early-Planting Other Barley	66.67	$/acre/year
Agriculture	Sorbing Materials in Ag Ditches	125	$/acre/year
Agriculture	Poultry Litter Injection	60	$/acre/year
Agriculture	Dairy Manure Injection	60	$/acre/year
Agriculture	Commodity Cover Crop Standard-Planting Drilled Wheat	66.67	$/acre/year
Agriculture	Commodity Cover Crop Standard-Planting Drilled Barley	66.67	$/acre/year
Agriculture	Commodity Cover Crop Late-Planting Drilled Wheat	66.67	$/acre/year
Agriculture	Cover Crop Late-Planting Drilled Wheat	68	$/acre/year

Sector	BMP	Total Annualized Cost	Unit
Agriculture	Cover Crop Early-Planting Drilled Barley	68	$/acre/year
Agriculture	Cover Crop Late-Planting Other Rye	68	$/acre/year
Agriculture	Conservation Tillage - Total Acres	0	$/acre/year
Agriculture	Conservation Tillage - Additional Acres	0	$/acre/year
Agriculture	Winter Hardy Brassica, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Winter Hardy Brassica, Early, Aerial	68	$/acre/year
Urban	Erosion and Sediment Control on Extractive	144.5	$/acre treated/year
Agriculture	Cropland Irrigation Management	135.27	$/acre/year
Agriculture	Streamside Grass Buffers	204.05	$/acre/year
Agriculture	Streamside Wetland Restoration	460.05	$/acre/year
Urban	Stormwater Management by Era 1985 to 2002 MD	2245.06	$/acre treated/year
Urban	Stormwater Management by Era 2002 to 2010 MD	2245.06	$/acre treated/year
Urban	Nutrient Management Plan	19.03	$/acre/year
Urban	Nutrient Management Plan High Risk Lawn	19.03	$/acre/year
Urban	Nutrient Management Plan Low Risk Lawn	19.03	$/acre/year
Urban	Nutrient Management Maryland Commercial Applicators	19.03	$/acre/year
Urban	Nutrient Management Maryland DIY	19.03	$/acre/year
Agriculture	Commodity Cover Crop Early Arial Rye	66.67	$/acre/year
Agriculture	Commodity Cover Crop Early Arial Wheat	66.67	$/acre/year
Agriculture	Commodity Cover Crop Early Drilled Barley	66.67	$/acre/year
Agriculture	Commodity Cover Crop Early Drilled Rye	66.67	$/acre/year
Agriculture	Commodity Cover Crop Standard Drilled Rye	66.67	$/acre/year
Agriculture	Cover Crop Early Arial Barley	68	$/acre/year
Agriculture	Cover Crop Early Arial Rye	68	$/acre/year
Agriculture	Cover Crop Early Arial Wheat	68	$/acre/year
Agriculture	Commodity Cover Crop Early-Planting Aerial Corn Barley	66.67	$/acre/year
Agriculture	Cover Crop Late Drilled Rye	68	$/acre/year
Agriculture	Commodity Cover Crop Early-Planting Aerial Soy Barley	66.67	$/acre/year
Agriculture	Commodity Cover Crop Early-Planting Aerial Soy Rye	66.67	$/acre/year
Urban	Street Sweeping 25 times a year-lbs	0.23	$/lbs/year
Agriculture	Commodity Cover Crop Early-Planting Aerial Soy Wheat	66.67	$/acre/year
Agriculture	Commodity Cover Crop Late Other Wheat	66.67	$/acre/year
Agriculture	Commodity Cover Crop Late-Planting Drilled Rye	66.67	$/acre/year

Sector	BMP	Total Annualized Cost	Unit
Agriculture	Commodity Cover Crop Late-Planting Other Rye	66.67	$/acre/year
Agriculture	Cover Crop Early-Planting Aerial Soy Barley	68	$/acre/year
Agriculture	Cover Crop Early-Planting Aerial Soy Rye	68	$/acre/year
Agriculture	Cover Crop Early-Planting Aerial Soy Wheat	68	$/acre/year
Agriculture	Continuous High Residue Till	0	$/acre/year
Agriculture	Conservation Till Without Nutrients	0	$/acre/year
Urban	Vegetated Open Channels - C/D soils, no underdrain	817.83	$/acre treated/year
Urban	Permeable Pavement w/o Sand, Veg. - A/B soils, no underdrain	14297.38	$/acre treated/year
Urban	Permeable Pavement w/o Sand, Veg. - C/D soils, underdrain	14297.38	$/acre treated/year
Urban	Permeable Pavement w/ Sand, Veg. - A/B soils, no underdrain	14297.38	$/acre treated/year
Urban	Permeable Pavement w/ Sand, Veg. - C/D soils, underdrain	14297.38	$/acre treated/year
Urban	Bioretention/raingardens - A/B soils, no underdrain	1221.73	$/acre treated/year
Urban	Bioretention/raingardens - C/D soils, underdrain	1221.73	$/acre treated/year
Agriculture	Nutrient Application Management, Tier 2 Field Level, TN	102.89	$/acre/year
Agriculture	Nutrient Application Management, Tier 2 Field Level, TP	59.5	$/acre/year
Agriculture	Nutrient Application Management, Tier 2 Field Level, TN and TP	102.89	$/acre/year
Agriculture	Nutrient Application Management, Tier 3, TN	103.89	$/acre/year
Septic	Denitrification-Enhanced	0	$/system/year
Septic	Secondary Treatment Enhanced	0	$/system/year
Septic	Denitrification-Conventional	0	$/system/year
Septic	Effluent - Enhanced	0	$/system/year
Septic	Secondary Treatment Conventional	0	$/system/year
Septic	Connection	526.51	$/system/year
Septic	Pumping	93	$/system/year
Septic	Denitrification	1369.56	$/system/year

Sector	BMP	Total Annualized Cost	Unit
Urban	Erosion and Sediment Control Level 1	529.12	$/acre treated/year
Urban	Erosion and Sediment Control Level 2	529.12	$/acre treated/year
Urban	Erosion and Sediment Control Level 3	529.12	$/acre treated/year
Agriculture	Nutrient Application Management, Tier 1 Crop Group	59.5	$/acre/year
Agriculture	Decision Agriculture Efficiency Version	21.67	$/acre/year
Agriculture	Enhanced Nutrient Application Management Efficiency Version	3.63	$/acre/year
Agriculture	Forage Radish, Early, Drilled	68	$/acre/year
Agriculture	Forage Radish, Early, Other	68	$/acre/year
Agriculture	Forage Radish, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Forage Radish, Early, Aerial	68	$/acre/year
Agriculture	Forage Radish + Grass , Early, Drilled	68	$/acre/year
Agriculture	Forage Radish + Grass, Early, Other	68	$/acre/year
Agriculture	Forage Radish + Grass, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Forage Radish + Grass, Early, Aerial	68	$/acre/year
Agriculture	Forage Radish + Grass, Standard, Drilled	68	$/acre/year
Agriculture	Forage Radish + Grass, Standard, Other	68	$/acre/year
Agriculture	Annual Legume, Early, Drilled	68	$/acre/year
Agriculture	Annual Legume, Early, Other	68	$/acre/year
Agriculture	Annual Legume, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Annual Legume, Early, Aerial	68	$/acre/year
Agriculture	Annual Legume, Standard, Drilled	68	$/acre/year
Agriculture	Annual Legume, Standard, Other	68	$/acre/year
Agriculture	Annual Legume + Grass, Early, Drilled	68	$/acre/year
Agriculture	Annual Legume + Grass, Early, Other	68	$/acre/year
Agriculture	Annual Legume + Grass, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Annual Legume + Grass, Early, Aerial	68	$/acre/year
Agriculture	Annual Legume + Grass, Standard, Drilled	68	$/acre/year
Agriculture	Annual Legume + Grass, Standard, Other	68	$/acre/year
Agriculture	Triticale, Early, Drilled	68	$/acre/year
Agriculture	Triticale, Early, Other	68	$/acre/year
Agriculture	Triticale, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Triticale, Early, Aerial	68	$/acre/year
Agriculture	Triticale, Standard, Drilled	68	$/acre/year
Agriculture	Triticale, Standard, Other	68	$/acre/year
Agriculture	Triticale, Late, Drilled	68	$/acre/year
Agriculture	Triticale, Late, Other	68	$/acre/year

Sector	BMP	Total Annualized Cost	Unit
Agriculture	Annual Ryegrass, Early, Drilled	68	$/acre/year
Agriculture	Annual Ryegrass, Early, Other	68	$/acre/year
Agriculture	Annual Ryegrass, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Annual Ryegrass, Early, Aerial	68	$/acre/year
Agriculture	Annual Ryegrass, Standard, Drilled	68	$/acre/year
Agriculture	Annual Ryegrass, Standard, Other	68	$/acre/year
Agriculture	Winter Hardy Oats, Early, Drilled	68	$/acre/year
Agriculture	Winter Hardy Oats, Early, Other	68	$/acre/year
Agriculture	Winter Hardy Oats, Early, Aerial, After Soy	68	$/acre/year
Agriculture	Winter Hardy Oats, Early, Aerial	68	$/acre/year
Agriculture	Winter Hardy Oats, Standard, Drilled	68	$/acre/year
Agriculture	Winter Hardy Oats, Standard, Other	68	$/acre/year
Urban	Stream Restoration Protocols	83.76	$/feet/year
Agriculture	Stream Restoration Protocols	32840.65	$/feet/year
Forest	Stream Restoration Protocols	83.76	$/feet/year
Agriculture	Shoreline Management Non-Vegetated	111.74	$/feet/year
Forest	Shoreline Management Non-Vegetated	111.74	$/feet/year
Agriculture	Shoreline Management Vegetated	10.67	$/feet/year
Forest	Shoreline Management Vegetated	10.67	$/feet/year
Urban	Shoreline Management Non-Vegetated	111.74	$/feet/year
Urban	Shoreline Management Vegetated	10.67	$/feet/year
Agriculture	Heavy Use Poultry Area Concrete Pads	76518.75	$/acres/year
Urban	Stormwater Performance Standard-Stormwater Treatment	1483.74	$/acre treated/year
Urban	Stormwater Performance Standard-Runoff Reduction	2747.72	$/acre treated/year

Table 4: Wastewater Costs used Maryland's BRF information. Annualized over a 20 year lifespan. The cost for upgrading a small WWTP is somewhat less than the cost for upgrading a large plant. However, the load from a large plant is much greater, resulting in more cost effectiveness for upgrading a large plant. The cost difference between BNR and ENR for TP is fairly close, but varies for TN, which is not shown in this table. Table provided by Dinorah Dalmasey, MDE. Wastewater was not adjusted in any of the three scenarios.

WWTP Capacity	**$/lb. removed (discharge, at edge of stream)**	**$/lb. removed (delivered to the Bay)**	**Description**
	TP	TP	
over 50 MGD	98	98	Upgrading from Secondary Treatment and BNR to ENR
0.5 to 50 MGD	569	759	Upgrading from Secondary Treatment and BNR to ENR
below 0.5 MGD	360	371	Upgrading from Secondary treatment to ENR

Table 5: Annualized costs of animal BMPs from CAST. Costs are estimated in 2010 dollars. Capital and opportunity costs are amortized over the BMP lifespan and added to annual operations and maintenance (O&M) costs for a total annualized cost. The interest rate for capital and opportunity costs is 5 percent. Costs are those incurred by both public and private entities. Costs represent a single year of cost rather than the cost over the entire lifespan of the practice. Animal units (AU) represent 1,000 pounds of live animal.

BMP	Animal Group	Total Annualized Cost	Unit
Manure Transport	All Animals	27.53	$/Ton/year
Mortality Composters	turkeys	399.32	$/AU/Year
Mortality Composters	beef	109.19	$/AU/Year
Mortality Composters	dairy	216.9	$/AU/Year
Mortality Composters	horses	109.19	$/AU/Year
Mortality Composters	layers	108.42	$/AU/Year
Mortality Composters	other cattle	109.19	$/AU/Year
Mortality Composters	sheep and lambs	109.19	$/AU/Year
Mortality Composters	Goats	109.19	$/AU/Year
Mortality Composters	Chickens	654.96	$/AU/Year
Mortality Composters	Swine	437.09	$/AU/Year
Poultry Phytase	Poultry	-60.71	$/AU/Year
Swine Phytase	Swine	-40.61	$/AU/Year
Dairy Precision Feeding and/or Forage Management	dairy	-9.95	$/AU/Year
Poultry Litter Treatment (alum, for example)	Poultry	44.54	$/AU/Year
Biofilters	Poultry	44.54	$/AU/Year
Lagoon Covers	Swine	44.54	$/AU/Year
Lagoon Covers	Cattle	44.54	$/AU/Year
Animal Waste Management System	Poultry	66.78	$/AU/Year
Animal Waste Management System	Livestock	181.37	$/AU/Year

Appendix B: Wastewater loads for Pennsylvania from the TMDL allocations

The wastewater loads for the entire state of Pennsylvania are provided in Table 67. Wastewater data is not included for other states. All major plants in Maryland are upgraded to ENR, or will be by 2025. Reductions available to be made in Maryland are insignificant. Wastewater loads were not adjusted in any of the three scenarios.

Table 6: Wastewater loads for Pennsylvania provided by Ning Zhou. These are for the entire state, not only the Susquehanna River basin.

Option to Reduce Loads	TN (lbs./yr.)			TP (lbs./yr.)		
	WLA	Change	Resulting Load	WLA	Change	Resulting Load
1. Phase II WIP concentrations applying current flow.	7,057,714	-2,232,634	4,825,080	543,698	-221,707	321,991
2. Phase II WIP concentrations down to WV levels (5 m/L TN and .5 mg/L TP) keeping at Phase II WIP design flow.	7,057,714	-1,172,637	5,885,077	543,698	-159,913	383785
3. Phase II WIP concentrations down to ENR levels (4 mg/L TN, 0.3 mg/L TP) keeping at Phase II WIP design flow.	7,057,714	-2,349,652	4,708,062	543,698	-313,427	230,271
4. Phase II WIP concentrations down to limit of technology - LOT levels (3 mg/L TN, .1 mg/L) keeping at Phase II WIP design flow.	7,057,714	-3,526,668	3,531,046	543,698	-466,941	76,757
5. Phase II WIP concentrations down to WV levels (5 m/L TN and .5 mg/L TP) applying current flow.	7,057,714	-3,584,761	3,472,953	543,698	-318,749	224,949

6. Phase II WIP concentrations down to ENR levels (4, 0.3) applying current flow.	7,057,714	-4,279,352	2,778,362	543,698	-408,728	134,970
7. Phase II WIP concentrations down to LOT levels (3, 0.1) applying current flow	7,057,714	-4,973,943	2,083,771	543,698	-498,708	44,990

Appendix C: BMP summary

Scenario 1 BMP Summary

Table 7: Maryland BMP summary from Scenario 1. Includes land BMPs. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

Maryland BMP	Unit	Cost		Credit		Percent Implementation	
		WIP2	Scenario 1	WIP2	Scenario 1	WIP 2	Scenario 1
Alternative Crops	acres	$-	$107,927	-	5,917	-	20.0
Barnyard Runoff Control	acres	$45,267	$47,765	101	107	85.3	90.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$6,297	$1,107,982	5	907	0.0	3.0
Bioswale	acres treated	$44,285	$968,039	41	907	0.1	3.0
Connection	septic systems	$48,631	$48,631	92	92	24.1	24.1
Conservation Tillage - Total Acres	acres	$-	$-	22,189	25,728	77.6	90.0
Continuous High Residue Till	acres	$-	$-	-	20,582	-	80.0
Cover Crop Early Drilled Wheat	acres	$-	$199,774	-	2,938	-	76.2
Cover Crop Standard Drilled Wheat	acres	$793,887	$809,790	11,675	11,909	42.6	44.7
Cropland Irrigation Management	acres	$67,728	$71,410	501	528	1.8	1.9
Dairy Manure Injection	acres	$103,851	$-	1,731	-	3.8	-
Decision Agriculture Efficiency Version	acres	$417,693	$-	19,275	-	70.3	-
Denitrification	septic systems	$16,748,056	$16,748,056	12,229	12,229	79.4	79.4
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$1,280,899	$1,280,899	1,688	1,688	5.6	5.6
Dry Extended Detention Ponds	acres treated	$258,401	$258,401	680	680	2.2	2.2
Enhanced Nutrient Application Management Efficiency Version	acres	$28,167	$-	7,759	-	97.5	-
Erosion and Sediment Control Level 1	acres treated	$472,741	$472,741	893	893	10.6	13.9
Erosion and Sediment Control on Extractive	acres treated	$18,667	$18,667	129	129	90.2	90.2

Maryland BMP	Unit	Cost		Credit		Percent Implementation	
		WIP2	Scenario 1	WIP2	Scenario 1	WIP 2	Scenario 1
Filtering Practices	acres treated	$26,446,232	$26,446,232	12,268	12,268	40.6	40.6
Forest Buffers - Agriculture	acres in buffers	$175,430	$2,362,635	715	9,635	1.4	20.0
Forest Buffers - Urban	acres in buffers	$115,346	$919	2,510	20	4.6	0.0
Forest Conservation	acres	$-	$-	2,324	2,324	9.5	9.5
Forest Harvesting Practices	acres	$46,353	$58,201	724	909	79.6	100.0
Grass Buffers - Agriculture	acres in buffers	$109,537	$491,514	537	2,409	1.1	5.0
Horse Pasture Management	acres	$1,242	$1,242	57	57	0.5	0.5
Impervious Surface Reduction	acres	$14,380,362	$14,380,362	1,006	1,006	17.3	17.3
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$16,790	$16,790	13	13	0.0	0.0
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$309,997	$309,997	244	244	0.8	0.8
Irrigation Water Capture Reuse	acres	$85,344	$118,045	88	122	57.8	80.0
Land Retirement to hay without nutrients (HEL)	acres	$101,478	$1,625,354	602	9,635	1.2	20.0
Land Retirement to pasture (HEL)	acres	$650,238	$610,027	3,855	3,616	9.6	9.6
Loafing Lot Management	acres	$27,400	$23,078	14	12	11.9	10.0
MS4 Permit-Required Stormwater Retrofit	acres treated	$800,529	$800,529	511	511	1.7	1.7
Nutrient Application Management, Tier 1 Crop Group	acres	$1,029,738	$-	17,307	-	44.7	-
Nutrient Management Plan	acres	$301,982	$464,881	15,869	24,429	65.0	100.0
Off Stream Watering Without Fencing	acres	$180,704	$180,704	6,126	6,126	57.6	57.6
Poultry Litter Injection	acres	$20,976	$-	350	-	3.4	-
Precision Intensive Rotational Grazing	acres	$9,987	$-	107	-	1.2	-
Precision Intensive Rotational/Prescribed Grazing	acres	$11,493	$132,551	783	9,036	7.4	85.0
Pumping	septic systems	$8,356	$8,356	90	90	23.5	23.5

Maryland BMP	Unit	Cost		Credit		Percent Implementation	
		WIP2	Scenario 1	WIP2	Scenario 1	WIP 2	Scenario 1
Soil Conservation and Water Quality Plans	acres	$80,520	$93,756	41,505	48,328	85.0	100.0
Sorbing Materials in Ag Ditches	acres	$7,262	$22,087	58	177	0.6	1.9
Stormwater Management by Era 1985 to 2002 MD	acres treated	$5,296,703	$5,296,703	2,359	2,359	7.8	7.8
Stormwater Management by Era 2002 to 2010 MD	acres treated	$4,984,909	$4,984,909	2,220	2,220	7.3	7.3
Stream Access Control with Fencing	acres	$198,895	$182,116	37	34	98.3	90.0
Stream Restoration - Agriculture	feet	$10,792	$10,061	1,578	1,471	NA	NA
Stream Restoration - Urban	feet	$256,740	$256,740	4,251	4,251	NA	NA
Streamside Forest Buffers	acres in buffers	$-	$653,197	-	2,664	-	100.0
Street Sweeping Pounds	lbs	$45,633	$45,633	198,405	198,405	NA	NA
Tree Planting - Agriculture	acres	$56,914	$54,029	677	643	1.3	1.3
Tree Planting -Urban	acres	$17,678	$17,678	209	209	0.9	0.9
Vegetated Open Channels - A/B soils, no underdrain	acres treated	$177,858	$177,858	217	217	0.7	0.7
Water Control Structures	acres	$1,188	$1,132	67	64	0.2	0.2
Wet Ponds and Wetlands	acres treated	$358,391	$358,391	836	836	2.8	2.8
Wetland Restoration	acres	$75,797	$72,456	330	315	0.3	0.3
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$1,107,982	-	907	-	3.0
Erosion and Sediment Control Level 3	acres treated	$-	$281,750	-	532	-	100.0
Animal Waste Management System	percent of animals	$12,756,749	$12,756,749	75724.42	75724.42	-	-
Dairy Precision Feeding and/or Forage Management	percent of animals	$-	$(127,360)	0	12800	0	0
Mortality Composters	percent of dead animals	$35,692	$655,219	305.06	4872.74	0	0
Poultry Litter Treatment (alum, for example)	percent of animals	$113,984	$113,984	2559.14	2559.14	0	0
Poultry Phytase	percent of animals	$(517,822)	$(517,822)	8529.42	8529.42	0	0

Maryland BMP	Unit	Cost WIP2	Cost Scenario 1	Credit WIP2	Credit Scenario 1	Percent Implementation WIP 2	Percent Implementation Scenario 1
Manure transport	Tons	$60,786	$30,718	2208	1115.8	NA	NA

Table 8: New York BMP summary from Scenario 1. Includes land BMPs. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

New York BMP	Unit	Cost WIP2	Cost Scenario 1	Credit WIP2	Credit Scenario 1	Percent Imp WIP 2	Percent Imp Scenario 1
Alternative Crops	acres	$-	$659,730	-	36,169	-	20.0
Barnyard Runoff Control	acres	$169,419	$624,362	380	1,399	21.7	80.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$8,688,699	-	7,112	-	3.0
Bioswale	acres treated	$-	$7,591,278	-	7,112	-	3.0
Commodity Cover Crop Early Other Wheat	acres	$124,434	$-	1,866	-	1.0	-
Conservation Tillage - Total Acres	acres	$-	$-	49,435	147,946	30.1	90.0
Continuous High Residue Till	acres	$-	$-	9,590	118,357	19.4	80.0
Cover Crop Early Drilled Wheat	acres	$-	$1,789,796	-	26,321	-	80.0
Cover Crop Standard Drilled Rye	acres	$1,952,559	$672,314	28,714	9,887	15.9	6.7
Dairy Manure Injection	acres	$1,832,234	$-	30,537	-	21.0	-
Decision Agriculture Efficiency Version	acres	$1,583,935	$-	73,093	-	13.8	-
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$17,564,256	$17,541,185	21,161,755	21,133,958	NA	NA
Dry Extended Detention Ponds	acres treated	$84,644	$80,333	223	211	0.1	0.1
Enhanced Nutrient Application Management Efficiency Version	acres	$818,123	$-	225,378	-	42.5	-
Erosion and Sediment Control Level 1	acres treated	$39,356	$39,109	74	74	0.4	0.2
Filtering Practices	acres treated	$4,535,801	$4,304,845	2,104	1,997	0.8	0.8
Forest Buffers - Agriculture	acres in buffers	$2,123,720	$35,405,244	8,661	144,387	1.0	20.0

New York BMP	Unit	Cost WIP2	Cost Scenario 1	Credit WIP2	Credit Scenario 1	Percent Imp WIP 2	Percent Imp Scenario 1
Forest Buffers - Urban	acres in buffers	$-	$1,588,253	-	34,565	-	8.2
Forest Harvesting Practices	acres	$448,523	$1,847,881	7,007	28,869	24.3	100.0
Grass Buffers - Agriculture	acres in buffers	$5,402,059	$7,243,066	26,474	35,497	3.7	5.0
Horse Pasture Management	acres	$43,188	$43,188	1,984	1,984	1.1	1.1
Impervious Surface Reduction	acres	$1,977,213	$1,894,646	138	133	0.2	0.2
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$14,344,882	$13,614,465	11,313	10,737	4.5	4.5
Irrigation Water Capture Reuse	acres	$-	$965,266	-	995	-	80.0
Land Retirement to hay without nutrients (HEL)	acres	$1,967,045	$23,951,631	11,661	141,986	1.6	20.0
Loafing Lot Management	acres	$736,719	$678,762	380	350	21.7	20.0
Nutrient Application Management, Tier 1 Crop Group	acres	$2,104,033	$-	35,362	-	6.7	-
Nutrient Management Plan	acres	$-	$3,124,399	-	164,183	-	95.0
Off Stream Watering Without Fencing	acres	$243,845	$243,845	8,266	8,266	4.6	4.6
Poultry Litter Injection	acres	$5,669,506	$-	94,492	-	13.3	-
Precision Intensive Rotational/Prescribed Grazing	acres	$2,153,604	$2,246,748	146,803	153,153	81.5	85.0
Soil Conservation and Water Quality Plans	acres	$830,107	$1,402,971	427,890	723,181	51.8	100.0
Stream Restoration - Agriculture	feet	$2,311,916	$2,311,916	337,999	337,999	NA	NA
Stream Restoration - Urban	feet	$1,600,597	$1,600,597	26,500	26,500	NA	NA
Streamside Forest Buffers	acres in buffers	$300,987	$25,536,508	1,227	104,141	1.2	100.0
Streamside Grass Buffers	acres in buffers	$2,443,009	$2,449,995	11,973	12,007	96.5	95.1
Street Sweeping 25 times a year-acres	acres	$5,060,466	$4,849,119	5,522	5,291	7.2	7.2
Tree Planting - Agriculture	acres	$139,994	$140,007	1,665	1,666	0.2	0.2
Wet Ponds and Wetlands	acres treated	$3,948,072	$3,747,043	9,209	8,740	3.7	3.7

New York BMP	Unit	Cost WIP2	Cost Scenario 1	Credit WIP2	Credit Scenario 1	Percent Imp WIP 2	Percent Imp Scenario 1
Wetland Restoration	acres	$5,894,253	$5,894,254	25,624	25,624	1.6	1.8
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$8,688,699	-	7,112	-	3.0
Erosion and Sediment Control Level 3	acres treated	$-	$244,717	-	463	-	100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$30,540,676	-	513,289	-	100.0
Animal Waste Management System	percent of animals	$53,955,771	$50,044,153	299,716	278,143	-	-
Dairy Precision Feeding and/or Forage Management	percent of animals	$(1,712,731)	$(2,660,081)	172,134	267,345	-	-
Lagoon Covers	percent of animals	$8,759	$8,759	197	197	-	-
Mortality Composters	percent of dead animals	$4,795,449	$6,185,194	27,348	35,210	-	-
Poultry Litter Treatment (alum, for example)	percent of animals	$105	$58	2	1	-	-
Poultry Phytase	percent of animals	$(465,652)	$(465,027)	7,670	7,660	-	-
Swine Phytase	percent of animals	$(83,944)	$(79,065)	2,067	1,947	-	-
Manure transport	Tons	$-	$588,999	-	21,395	NA	NA

Table 9: Pennsylvania BMP summary from Scenario 1. Includes land BMPs. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

Pennsylvania BMP	Unit	Cost WIP2	Cost Scenario 1	Credit WIP2	Credit Scenario 1	Percent Imp WIP 2	Percent Imp Scenario 1
Abandoned Mine Reclamation	acres	$9,322,718	$9,322,718	15,137	15,137	5.1	5.1
Alternative Crops	acres	$1,663,979	$4,801,041	91,227	263,215	6.9	20.0
Barnyard Runoff Control	acres	$2,380,015	$3,165,349	5,333	7,093	59.8	80.0

Pennsylvania BMP	Unit	Cost WIP2	Scenario 1	Credit WIP2	Scenario 1	Percent Imp WIP 2	Scenario 1
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$39,713,317	-	32,506	-	2.7
Bioswale	acres treated	$-	$33,732,003	-	31,601	-	2.6
Combined Sewer Overflow area eliminated	acres	$-	$-	3,789	3,789	33.3	33.3
Commodity Cover Crop Early Other Wheat	acres	$5,966,759	$-	89,497	-	7.1	-
Commodity Cover Crop Standard Other Wheat	acres	$5,802,480	$-	87,033	-	6.9	-
Connection	septic systems	$67,804,876	$67,804,876	128,782	128,782	27.4	27.4
Conservation Tillage - Total Acres	acres	$-	$-	784,497	1,114,567	63.3	90.0
Continuous High Residue Till	acres	$-	$-	55,492	891,653	7.1	80.0
Cover Crop Early Drilled Wheat	acres	$-	$71,594,470	-	1,052,860	-	80.0
Cover Crop Early Other Wheat	acres	$26,439,852	$-	388,821	-	30.9	-
Dairy Manure Injection	acres	$1,493,488	$-	24,891	-	2.0	-
Decision Agriculture Efficiency Version	acres	$3,373,659	$-	155,683	-	7.1	-
Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	feet	$1,357,689	$1,358,471	1,635,770	1,636,712	18.1	17.5
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$3,210,397	$3,213,971	3,867,948	3,872,255	43.0	41.7
Dirt & Gravel Road Erosion & Sediment Control - with Outlets	feet	$1,357,689	$1,358,475	1,635,770	1,636,717	18.2	17.6
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$30,082,169	$-	39,638	-	3.0	-
Dry Extended Detention Ponds	acres treated	$15,013,465	$-	39,516	-	3.0	-
Enhanced Nutrient Application Management Efficiency Version	acres	$5,273,573	$-	1,452,775	-	66.4	-
Erosion and Sediment Control Level 1	acres treated	$2,791,034	$2,777,172	5,275	5,249	36.7	5.4

Pennsylvania BMP	Unit	Cost WIP2	Scenario 1	Credit WIP2	Scenario 1	Percent Imp WIP 2	Scenario 1
Erosion and Sediment Control on Extractive	acres treated	$19,207,562	$19,207,562	132,924	132,924	92.5	92.5
Filtering Practices	acres treated	$843,998,290	$779,720,060	391,530	361,712	29.9	30.0
Forest Buffers - Agriculture	acres in buffers	$34,399,507	$128,829,732	140,286	525,385	4.8	20.0
Forest Buffers - Urban	acres in buffers	$1,464,621	$8,838,866	31,874	192,358	1.4	8.5
Forest Harvesting Practices	acres	$1,502,346	$5,675,922	23,470	88,672	26.5	100.0
Grass Buffers - Agriculture	acres in buffers	$8,614,502	$26,800,150	42,218	131,341	2.4	5.0
Grass Buffers - Urban	acres in buffers	$433,693	$-	7,788	-	0.8	-
Horse Pasture Management	acres	$661,648	$1,027,944	30,393	47,218	6.9	10.7
Impervious Surface Reduction	acres	$30,831,571	$30,831,571	2,156	2,156	0.6	0.6
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$646,547,290	$614,427,841	509,891	484,561	39.5	40.2
Irrigation Water Capture Reuse	acres	$1,119,082	$5,795,687	1,153	5,973	15.5	80.0
Land Retirement to hay without nutrients (HEL)	acres	$44,987,000	$88,623,730	266,684	525,364	10.2	20.0
Land Retirement to pasture (HEL)	acres	$18,350,592	$18,350,592	108,783	108,783	8.3	8.3
Loafing Lot Management	acres	$-	$3,532,033	-	1,820	-	20.4
Nutrient Application Management, Tier 1 Crop Group	acres	$24,740,204	$-	415,802	-	94.5	-
Nutrient Management Plan	acres	$6,265,466	$17,387,749	329,242	913,702	34.2	95.0
Off Stream Watering Without Fencing	acres	$2,296,355	$2,296,355	77,843	77,843	17.7	17.7
Poultry Litter Injection	acres	$373,370	$-	6,223	-	0.5	-
Precision Intensive Rotational Grazing	acres	$23,952,384	$-	256,642	-	58.3	-
Precision Intensive Rotational/Prescribed Grazing	acres	$1,889,015	$5,487,397	128,767	374,056	29.3	85.0
Soil Conservation and Water Quality Plans	acres	$4,950,171	$5,110,723	2,551,635	2,634,393	87.0	100.0

Pennsylvania BMP	Unit	Cost WIP2	Scenario 1	Credit WIP2	Scenario 1	Percent Imp WIP 2	Scenario 1
Sorbing Materials in Ag Ditches	acres	$-	$746,683	-	5,973	-	80.0
Stream Access Control with Fencing	acres	$68,337,567	$67,701,151	12,878	12,758	85.7	84.9
Stream Restoration - Agriculture	feet	$3,393,214	$2,913,587	496,084	425,963	4.7	4.1
Stream Restoration - Urban	feet	$3,071,106	$3,071,106	50,846	50,846	4.2	4.2
Streamside Forest Buffers	acres in buffers	$1,063,883	$76,434,073	4,339	311,709	1.4	100.0
Streamside Grass Buffers	acres in buffers	$22,606	$21,278	111	104	5.2	6.2
Street Sweeping 25 times a year-acres	acres	$39,696,997	$39,696,997	43,317	43,317	12.4	12.4
Tree Planting – Agriculture	acres	$5,603,841	$950,566	66,665	11,308	2.3	0.4
Tree Planting - Urban	acres	$113,363	$113,363	1,340	1,340	0.1	0.1
Urban Growth Reduction	acres	$-	$-	294	294	0.0	0.0
Wet Ponds and Wetlands	acres treated	$67,273,400	$62,564,955	156,913	145,931	12.0	12.1
Wetland Restoration	acres	$26,846,426	$26,747,084	116,711	116,279	2.0	2.2
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$39,914,848	0	32670.76	-	2.7
Erosion and Sediment Control Level 3	acres treated	$-	$6,318,512	0	11941.56	0	100
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$125,490,807	0	2109089.18	0	100
Animal Waste Management System	percent of animals	$248,603,458	$239,023,923	1514967.24	1458741.86	0	0
Dairy Precision Feeding and/or Forage Management	percent of animals	$(4,752,191)	$(5,039,444)	477607.11	506476.76	0	0
Lagoon Covers	percent of animals	$599,116	$599,116	13451.19	13451.19	0	0

Pennsylvania BMP	Unit	Cost WIP2	Scenario 1	Credit WIP2	Scenario 1	Percent Imp WIP 2	Scenario 1
Mortality Composters	percent of dead animals	$6,941,745	$21,798,644	30755	100004.6	0	0
Poultry Litter Treatment (alum, for example)	percent of animals	$1,695,600	$1,566,835	38069.01	35178	0	0
Poultry Phytase	percent of animals	$(15,177,514)	$(14,832,235)	250000.17	244312.82	0	0
Swine Phytase	percent of animals	$(5,413,478)	$(5,407,898)	133304.07	133166.69	0	0
Manure transport	Tons	$6,666,858	$19,984,427	242167.03	725914.54	0	0

Scenario 2 BMP Summary

Table 10: Scenario 2 BMP summary for Maryland. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Abandoned Mine Reclamation	acres	$1,135,345	$1,135,345	1,843	1,843	36.2	36.2
Alternative Crops	acres	$15,139	$3,466,024	830	190,023	0.3	20.0
Barnyard Runoff Control	acres	$623,105	$922,353	1,396	2,067	60.8	90.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$41,853,540	$81,101,813	34,258	66,383	2.8	4.9
Bioswale	acres treated	$19,357,176	$39,497,743	18,135	37,003	1.6	2.9
Combined Sewer Overflow area eliminated	acres	$-	$-	22,017	22,017	97.8	97.8
Connection	septic systems	$22,101,685	$22,101,445	41,978	41,977	22.3	22.3
Conservation Tillage - Total Acres	acres	$-	$-	756,251	938,236	72.5	90.0
Continuous High Residue Till	acres	$-	$-	-	20,582		80.0
Cover Crop Early Drilled Wheat	acres	$-	$181,999	-	2,676		69.4
Cover Crop Standard Drilled Wheat	acres	$28,837,796	$31,122,607	424,085	457,685	40.3	43.9
Cropland Irrigation Management	acres	$16,195,478	$17,330,525	119,727	128,118	11.4	12.1
Dairy Manure Injection	acres	$1,577,745	$-	26,296	-	2.2	
Decision Agriculture Efficiency Version	acres	$12,953,598	$-	597,766	-	56.8	
Denitrification	septic systems	$232,640,812	$232,640,023	169,865	169,865	45.3	45.3

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$35,969,822	$1,280,724	47,396	1,688	3.5	5.6
Dry Extended Detention Ponds	acres treated	$9,445,652	$258,686	24,862	681	1.9	2.3
Enhanced Nutrient Application Management Efficiency Version	acres	$658,166	$-	181,313	-	97.2	
Erosion and Sediment Control Level 1	acres treated	$18,364,907	$-	34,708	-	14.6	
Erosion and Sediment Control on Extractive	acres treated	$1,117,931	$1,527,914	7,737	10,574	72.6	74.7
Filtering Practices	acres treated	$631,260,810	$680,768,334	292,841	315,808	22.0	23.5
Forest Buffers -Agriculture	acres in buffers	$5,510,210	$56,689,342	22,471	231,187	1.5	15.0
Forest Buffers - Urban	acres in buffers	$2,146,584	$8,951,347	46,716	194,806	2.0	8.3
Forest Conservation	acres	$-	$-	81,515	84,461	8.3	8.5
Forest Harvesting Practices	acres	$1,532,089	$1,843,284	23,935	28,797	83.2	100.0
Grass Buffers - Agriculture	acres in buffers	$10,208,250	$44,362,085	50,028	217,408	3.5	15.0
Horse Pasture Management	acres	$108,625	$75,159	4,990	3,452	4.0	2.8
Impervious Surface Reduction	acres	$427,695,185	$427,676,256	29,914	29,913	9.2	9.2
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$3,232,979	$189,928,467	2,550	149,785	0.2	12.0
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$37,762,489	$38,038,778	29,781	29,999	2.3	2.2
Irrigation Water Capture Reuse	acres	$2,173,336	$4,577,006	2,240	4,717	62.9	95.0

MARYLAND BMP	Unit	Cost		Credit		Percent implementation	
		WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Land Retirement to hay without nutrients (HEL)	acres	$3,406,338	$48,899,383	20,193	289,877	1.4	20.0
Land Retirement to pasture (HEL)	acres	$6,240,422	$6,986,389	36,993	41,416	3.2	3.3
Loafing Lot Management	acres	$387,403	$445,619	200	230	9.5	10.0
MS4 Permit-Required Stormwater Retrofit	acres treated	$105,825,656	$104,791,105	67,487	66,827	5.1	5.2
Nutrient Application Management, Tier 1 Crop Group	acres	$29,615,878	$-	497,746	-	36.2	
Nutrient Management Plan	acres	$8,750,994	$18,810,449	459,853	988,463	46.5	99.0
Off Stream Watering Without Fencing	acres	$1,282,899	$1,282,776	43,488	43,484	24.4	24.3
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	acres treated	$5,004,212	$4,994,575	350	349	1.1	1.1
Poultry Litter Injection	acres	$9,277,694	$-	154,628	-	12.8	
Precision Intensive Rotational Grazing	acres	$260,101	$-	2,787	-	2.8	
Precision Intensive Rotational/Prescribed Grazing	acres	$268,478	$2,226,880	18,301	151,798	10.2	85.0
Pumping	septic systems	$5,357,950	$5,357,896	57,612	57,612	54.9	54.9
Soil Conservation and Water Quality Plans	acres	$2,177,855	$2,999,651	1,122,606	1,546,212	74.1	100.0
Sorbing Materials in Ag Ditches	acres	$645,271	$1,597,849	5,162	12,783	1.5	1.7
Stormwater Management by Era 1985 to 2002 MD	acres treated	$198,468,203	$198,471,952	88,402	88,404	7.0	7.2

MARYLAND BMP	Unit	Cost WIP2	Cost Scenario 2	Credit WIP2	Credit Scenario 2	Percent implementation WIP2	Percent implementation Scenario 2
Stormwater Management by Era 2002 to 2010 MD	acres treated	$135,517,609	$127,967,044	60,363	56,999	4.8	4.6
Stream Access Control with Fencing	acres	$3,972,777	$3,846,895	749	725	92.9	90.0
Stream Restoration	feet	$505,989	$505,258	73,975	73,868	NA	NA
Stream Restoration	feet	$124,702,288	$126,342,606	2,064,607	2,091,765	NA	NA
Streamside Forest Buffers	acres in buffers	$-	$653,197	-	2,664		100.0
Street Sweeping 25 times a year-acres	acres	$8,278,115	$21,895,872	9,033	23,892	10.0	10.4
Street Sweeping Pounds	lbs	$2,214,543	$2,214,543	9,628,448	9,628,448		
Tree Planting – agriculture	acres	$1,539,426	$14,197,056	18,313	168,892	1.2	11.0
Tree Planting – urban	acres	$1,269,438	$1,863,940	15,000	22,025	1.7	2.2
Vegetated Open Channels - A/B soils, no underdrain	acres treated	$23,136,671	$23,138,997	28,290	28,293	2.6	2.6
Water Control Structures	acres	$304,755	$47,866	17,198	2,701	2.0	0.8
Wet Ponds and Wetlands	acres treated	$29,128,926	$29,128,497	67,942	67,941	5.1	5.1
Wetland Restoration	acres	$5,858,362	$18,520,645	25,468	80,516	0.8	2.6
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$1,846,636	-	1,511		5.0
Erosion and Sediment Control Level 3	acres treated	$-	$281,750	-	532		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$13,843,969	-	232,672		80.0
Animal Waste Management System	percent of animals	$66,567,973	$53,590,630	463,931	392,321	NA	NA

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Dairy Precision Feeding and/or Forage Management	percent of animals	$(256,670)	$(158,211)	25,796	15,901	NA	NA
Lagoon Covers	percent of animals	$1,291	$521	29	12	NA	NA
Mortality Composters	percent of dead animals	$2,962,040	$4,661,836	6,813	13,529	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$2,953,541	$3,090,062	66,312	69,377	NA	NA
Poultry Phytase	percent of animals	$(9,314,361)	$(11,178,099)	153,424	184,123	NA	NA
Swine Phytase	percent of animals	$(28,126)	$(21,177)	693	521	NA	NA
Manure transport	Tons	$1,763,628	$2,242,933	64,062	81,472	NA	NA

Table 11: Scenario 2 BMP summary for Virginia. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Abandoned Mine Reclamation	acres	$18,012,592	$18,012,117	29,247	29,246		82.1
Barnyard Runoff Control	acres	$2,145,535	$2,810,980	4,808	6,299	68.7	90.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$27,307,736	$61,699,196	22,352	50,502	1.3	3.0
Bioswale	acres treated	$1,220,992	$27,896,903	1,144	26,135	0.1	3.0
Combined Sewer Overflow area eliminated	acres	$-	$-	549	549	100.0	100.0
Commodity Cover Crop Early Drilled Wheat	acres	$5,043,690	$5,990,225	75,652	89,849	9.5	11.3
Commodity Cover Crop Early Other Wheat	acres	$32,981	$-	495	-	0.1	
Connection	septic systems	$21,766,256	$21,765,256	41,341	41,339	8.9	8.9
Conservation Till Without Nutrients	acres	$-	$-	36,052	36,053	67.0	67.0
Conservation Tillage - Total Acres	acres	$-	$-	514,380	667,356	69.4	90.0
Continuous High Residue Till	acres	$-	$-	304,371	533,885	59.2	80.0
Cover Crop Early Drilled Rye	acres	$9,665	$8,903	142	131	0.0	0.0
Cover Crop Early Drilled Wheat	acres	$6,842,653	$20,050,786	100,627	294,865	12.7	37.1
Cover Crop Early Other Rye	acres	$673,560	$868,762	9,905	12,776	1.7	1.8
Cover Crop Early Other Wheat	acres	$673,915	$-	9,911	-	1.7	
Cover Crop Standard Drilled Barley	acres	$134,574	$148,350	1,979	2,182	0.2	0.3
Cover Crop Standard Drilled Rye	acres	$1,389,829	$3,176,614	20,439	46,715	2.6	7.0
Cover Crop Standard Drilled Wheat	acres	$4,995,397	$22,135,454	73,462	325,521	9.2	43.9
Cover Crop Standard Other Rye	acres	$673,560	$868,762	9,905	12,776	1.7	1.8
Cover Crop Standard Other Wheat	acres	$392,025	$454,281	5,765	6,681	0.7	0.8
Decision Agriculture Efficiency Version	acres	$3,421,027	$-	157,869	-	11.0	
Denitrification	septic systems	$109,171,983	$109,176,442	79,713	79,716	17.2	17.2

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	feet	$2,181	$2,182	2,629	2,629	NA	NA
Dirt & Gravel Road Erosion & Sediment Control - with Outlets	feet	$1,807	$1,807	2,178	2,178	NA	NA
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$64,928,806	$-	85,554	-	5.1	
Dry Extended Detention Ponds	acres treated	$61,123,308	$-	160,880	-	9.6	
Enhanced Nutrient Application Management Efficiency Version	acres	$245,803	$-	67,715	-	4.7	
Erosion and Sediment Control Level 1	acres treated	$15,845,956	$-	29,948	-	5.2	
Erosion and Sediment Control on Extractive	acres treated	$429,779	$429,844	2,974	2,975	46.8	46.8
Filtering Practices	acres treated	$141,986,926	$108,863,052	65,868	50,502	3.9	3.0
Forest Buffers - agriculture	acres in buffers	$19,571,127	$58,993,949	79,814	240,585	2.9	9.2
Forest Buffers – urban	acres in buffers	$378,180	$11,412,479	8,230	248,367	0.3	8.4
Forest Conservation	acres	$-	$-	14,128	14,147	2.3	2.3
Forest Harvesting Practices	acres	$5,588,360	$5,901,023	87,304	92,189	15.8	100.0
Grass Buffers - agriculture	acres in buffers	$22,247,927	$48,122,436	109,032	235,836	4.2	9.1
Horse Pasture Management	acres	$512,899	$512,772	23,560	23,554	2.0	2.0
Impervious Surface Reduction	acres	$354,267,831	$354,329,066	24,779	24,783	5.6	5.6
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$5,498	$-	4	-	0.0	

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$87,648,168	$106,727,338	69,123	84,169	4.1	5.0
Irrigation Water Capture Reuse	acres	$2,981,094	$2,851,203	3,073	2,939	83.6	80.0
Land Retirement to hay without nutrients (HEL)	acres	$17,296,484	$79,566,526	102,534	471,673	3.9	18.2
Nutrient Application Management, Tier 1 Crop Group	acres	$55,781,063	$-	937,497	-	36.2	
Nutrient Management Plan	acres	$9,839,592	$23,047,145	517,057	1,211,095	41.6	97.5
Off Stream Watering Without Fencing	acres	$410,538	$410,244	13,917	13,907	1.2	1.2
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	acres treated	$528,831	$289,021	37	20	0.0	0.0
Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	acres treated	$210,843	$348,956	15	24	0.0	0.0
Precision Intensive Rotational/Prescribed Grazing	acres	$7,837,666	$14,428,415	534,265	983,532	46.2	85.0
Pumping	septic systems	$6,230,007	$6,229,857	66,989	66,988	14.4	14.4
Soil Conservation and Water Quality Plans	acres	$3,630,467	$5,091,525	1,871,375	2,624,497	67.4	100.0
Sorbing Materials in Ag Ditches	acres	$-	$269,773	-	2,158		58.8
Stream Access Control with Fencing	acres	$127,900,466	$129,267,388	24,102	24,360	39.6	40.0
Stream Restoration - agriculture	feet	$652,864	$714,971	95,448	104,528	NA	NA
Stream Restoration - urban	feet	$7,030,461	$7,030,472	116,398	116,399	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$4,811,844	$42,736,823	19,623	174,287	11.3	100.0
Streamside Grass Buffers – urban	acres in buffers	$6,357,443	$7,083,165	31,156	34,713	84.7	95.0
Street Sweeping 25 times a year-acres	acres	$22,031,476	$22,032,771	24,040	24,042	5.4	5.4
Tree Planting – agriculture	acres	$9,002,600	$11,816,965	107,097	140,578	3.9	5.4
Tree Planting – urban	acres	$67,628	$67,121	799	793	0.1	0.1

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Vegetated Open Channels - A/B soils, no underdrain	acres treated	$2,685,055	$2,670,841	3,283	3,266	0.2	0.2
Water Control Structures	acres	$12,325	$13,139	696	742	0.3	1.0
Wet Ponds and Wetlands	acres treated	$76,216,386	$76,218,423	177,772	177,777	10.6	10.6
Wetland Restoration	acres	$8,839,654	$34,336,446	38,429	149,273	0.7	2.8
Animal Waste Management System	percent of animals	$125,844,066	$125,844,066	782,501	782,501	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(790,850)	$(790,850)	79,482	79,482	NA	NA
Mortality Composters	percent of dead animals	$5,592,315	$5,592,315	14,939	14,939	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$3,740,694	$3,740,694	83,985	83,985	NA	NA
Poultry Phytase	percent of animals	$(10,841,016)	$(10,841,016)	178,570	178,570	NA	NA
Swine Phytase	percent of animals	$(975,739)	$(975,739)	24,027	24,027	NA	NA
Manure transport	Tons	$5,285,760	$5,285,760	192,000	192,000	NA	NA

Table 12: Scenario 2 BMP summary for Pennsylvania. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Abandoned Mine Reclamation	acres	$9,472,592	$9,471,022	15,381	15,378		5.4
Alternative Crops	acres	$1,824,169	$5,371,510	100,009	294,491	6.8	20.0

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Barnyard Runoff Control	acres	$2,581,222	$3,483,801	5,784	7,807	59.7	80.8
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$38,981,044	-	31,906		2.7
Bioswale	acres treated	$-	$33,014,007	-	30,929		2.6
Combined Sewer Overflow area eliminated	acres	$-	$-	3,789	3,789	33.3	33.3
Commodity Cover Crop Early Other Wheat	acres	$6,632,868	$-	99,488	-	7.0	
Commodity Cover Crop Standard Other Wheat	acres	$6,468,588	$-	97,024	-	6.9	
Connection	septic systems	$74,015,788	$74,012,949	140,578	140,573	27.3	27.3
Conservation Tillage - Total Acres	acres	$-	$-	875,496	1,107,053	63.3	80.0
Continuous High Residue Till	acres	$-	$-	60,072	885,642	6.9	80.0
Cover Crop Early Drilled Wheat	acres	$-	$71,594,411	-	1,052,859		80.0
Cover Crop Early Other Wheat	acres	$29,292,894	$-	430,778	-	30.4	
Dairy Manure Injection	acres	$1,656,000	$-	27,600	-	2.0	
Decision Agriculture Efficiency Version	acres	$3,795,964	$-	175,171	-	7.1	
Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	feet	$1,477,637	$1,478,375	1,780,286	1,781,174	NA	NA
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$3,488,140	$3,491,509	4,202,579	4,206,638	NA	NA
Dirt & Gravel Road Erosion & Sediment Control - with Outlets	feet	$1,477,637	$1,478,379	1,780,286	1,781,179	NA	NA
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$31,917,731	$-	42,057	-	3.0	
Dry Extended Detention Ponds	acres treated	$15,932,383	$-	41,935	-	3.0	

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Enhanced Nutrient Application Management Efficiency Version	acres	$5,899,609	$-	1,625,237	-	66.2	
Erosion and Sediment Control Level 1	acres treated	$3,121,070	$-	5,899	-	34.3	
Erosion and Sediment Control on Extractive	acres treated	$19,722,199	$19,722,920	136,486	136,491	92.5	92.5
Filtering Practices	acres treated	$914,354,314	$417,108,785	424,168	193,497	30.0	14.9
Forest Buffers - agriculture	acres in buffers	$37,796,469	$49,216,037	154,139	200,710	4.7	6.8
Forest Buffers – urban	acres in buffers	$1,578,844	$9,562,300	34,360	208,102	1.4	8.5
Forest Harvesting Practices	acres	$1,600,250	$6,036,145	25,000	94,300	26.5	100.0
Grass Buffers – agriculture	acres in buffers	$9,541,078	$28,877,922	46,759	141,524	2.4	5.0
Grass Buffers – urban	acres in buffers	$467,518	$-	8,395	-	0.8	
Horse Pasture Management	acres	$760,458	$760,504	34,931	34,934	7.2	9.0
Impervious Surface Reduction	acres	$32,883,988	$32,910,110	2,300	2,302	0.6	0.6
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$696,370,952	$665,231,969	549,184	524,627	39.4	40.3
Irrigation Water Capture Reuse	acres	$1,139,408	$2,241,079	1,174	2,310	15.3	30.0
Land Retirement to hay without nutrients (HEL)	acres	$49,002,060	$63,038,326	290,486	373,693	9.9	12.7
Land Retirement to pasture (HEL)	acres	$19,654,921	$19,650,854	116,515	116,491	7.9	7.9
Loafing Lot Management	acres	$-	$3,486,594	-	1,797		20.1
Nutrient Application Management, Tier 1 Crop Group	acres	$27,443,250	$-	461,231	-	94.6	
Nutrient Management Plan	acres	$6,701,708	$18,818,519	352,165	988,887	33.8	95.0

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Off Stream Watering Without Fencing	acres	$2,557,058	$2,549,934	86,680	86,438	17.8	17.7
Poultry Litter Injection	acres	$413,998	$-	6,900	-	0.5	
Precision Intensive Rotational Grazing	acres	$26,625,640	$-	285,285	-	58.5	
Precision Intensive Rotational/Prescribed Grazing	acres	$2,068,687	$3,574,642	141,015	243,670	28.9	50.0
Soil Conservation and Water Quality Plans	acres	$5,487,001	$5,243,314	2,828,351	2,702,739	86.4	91.6
Sorbing Materials in Ag Ditches	acres	$-	$374,280	-	2,994		40.1
Stream Access Control with Fencing	acres	$75,139,987	$74,950,411	14,160	14,124	85.2	85.0
Stream Restoration – agriculture	feet	$3,621,338	$3,455,075	529,435	505,128	NA	NA
Stream Restoration – urban	feet	$3,321,998	$3,321,999	55,000	55,000	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$1,140,878	$82,196,536	4,653	335,209	1.4	100.0
Streamside Grass Buffers – agriculture	acres in buffers	$25,707	$50,905	126	249	5.2	10.0
Street Sweeping 25 times a year-acres	acres	$42,339,546	$42,338,331	46,200	46,199	12.4	12.4
Tree Planting – agriculture	acres	$6,024,119	$1,024,699	71,665	12,190	2.2	0.4
Tree Planting – urban	acres	$122,204	$122,415	1,444	1,446	0.1	0.1
Urban Growth Reduction	acres	$-	$-	317	312	0.0	0.0
Wet Ponds and Wetlands	acres treated	$72,006,451	$72,004,205	167,953	167,948	11.9	11.9
Wetland Restoration	acres	$30,185,609	$32,430,093	131,228	140,985	2.0	2.4
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$39,201,325	-	32,087		2.7
Erosion and Sediment Control Level 3	acres treated	$-	$6,318,512	-	11,942		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$125,490,717	-	2,109,088		100.0

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Animal Waste Management System	percent of animals	$240,027,776	$231,341,641	1,448,255	1,397,107	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(4,583,740)	$(4,954,881)	460,677	497,978	NA	NA
Lagoon Covers	percent of animals	$597,825	$597,825	13,422	13,422	NA	NA
Mortality Composters	percent of dead animals	$6,277,323	$24,825,127	29,216	115,363	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$1,079,941	$988,813	24,246	22,200	NA	NA
Poultry Phytase	percent of animals	$(13,310,164)	$(12,964,885)	219,242	213,554	NA	NA
Swine Phytase	percent of animals	$(5,401,825)	$(5,397,748)	133,017	132,917	NA	NA
Manure transport	Tons	$6,666,858	$25,627,718	242,167	930,901	NA	NA

Table 13: Scenario 2 BMP summary for New York. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

NEW YORK		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Alternative Crops	acres	$-	$659,730	-	36,169		20.0
Barnyard Runoff Control	acres	$169,419	$624,362	380	1,399	21.7	80.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$8,688,699	-	7,112		3.0

NEW YORK		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Bioswale	acres treated	$-	$7,591,278	-	7,112		3.0
Commodity Cover Crop Early Other Wheat	acres	$124,434	$-	1,866	-	1.0	
Conservation Tillage - Total Acres	acres	$-	$-	49,435	49,315	30.1	30.0
Continuous High Residue Till	acres	$-	$-	9,590	19,726	19.4	40.0
Cover Crop Early Drilled Wheat	acres	$-	$3,242,957	-	47,691		36.3
Cover Crop Standard Drilled Rye	acres	$1,952,559	$224,010	28,714	3,294	15.9	6.7
Dairy Manure Injection	acres	$1,832,234	$-	30,537	-	21.0	
Decision Agriculture Efficiency Version	acres	$1,583,935	$-	73,093	-	13.8	
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$17,564,256	$17,541,186	21,161,755	21,133,959		
Dry Extended Detention Ponds	acres treated	$84,644	$80,267	223	211	0.1	0.1
Enhanced Nutrient Application Management Efficiency Version	acres	$818,123	$-	225,378	-	42.5	
Erosion and Sediment Control Level 1	acres treated	$39,356	$-	74	-	0.4	
Filtering Practices	acres treated	$4,535,801	$19,312,851	2,104	8,959	0.8	3.8
Forest Buffers – agriculture	acres in buffers	$2,123,720	$17,985,471	8,661	73,347	1.0	9.0
Forest Buffers – urban	acres in buffers	$-	$1,588,253	-	34,565		8.2
Forest Harvesting Practices	acres	$448,523	$1,847,881	7,007	28,869	24.3	100.0
Grass Buffers - agriculture	acres in buffers	$5,402,059	$6,236,784	26,474	30,565	3.7	4.3
Horse Pasture Management	acres	$43,188	$43,181	1,984	1,983	1.1	1.1

NEW YORK		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Impervious Surface Reduction	acres	$1,977,213	$1,976,641	138	138	0.2	0.2
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$14,344,882	$9,017,833	11,313	7,112	4.5	3.0
Irrigation Water Capture Reuse	acres	$-	$241,316	-	249		20.0
Land Retirement to hay without nutrients (HEL)	acres	$1,967,045	$14,472,302	11,661	85,792	1.6	12.1
Loafing Lot Management	acres	$736,719	$678,762	380	350	21.7	20.0
Nutrient Application Management, Tier 1 Crop Group	acres	$2,104,033	$-	35,362	-	6.7	
Nutrient Management Plan	acres	$-	$3,124,399	-	164,183		95.0
Off Stream Watering Without Fencing	acres	$243,845	$243,972	8,266	8,270	4.6	4.6
Poultry Litter Injection	acres	$5,669,506	$-	94,492	-	13.3	
Precision Intensive Rotational/Prescribed Grazing	acres	$2,153,604	$2,246,748	146,803	153,153	81.5	85.0
Soil Conservation and Water Quality Plans	acres	$830,107	$840,237	427,890	433,112	51.8	53.0
Stream Restoration – agriculture	feet	$2,311,916	$2,073,409	337,999	303,130	NA	NA
Stream Restoration – urban	feet	$1,600,597	$1,600,597	26,500	26,500	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$300,987	$2,553,651	1,227	10,414	1.2	10.0
Streamside Grass Buffers - agriculture	acres in buffers	$2,443,009	$2,450,004	11,973	12,007	96.5	95.1
Street Sweeping 25 times a year-acres	acres	$5,060,466	$4,847,697	5,522	5,290	7.2	7.2
Tree Planting	acres	$139,994	$279,848	1,665	3,329	0.2	0.4
Wet Ponds and Wetlands	acres treated	$3,948,072	$3,946,750	9,209	9,206	3.7	3.7
Wetland Restoration	acres	$5,894,253	$9,893,420	25,624	43,010	1.6	2.6

NEW YORK		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 2	WIP2	Scenario 2	WIP2	Scenario 2
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$8,688,699	-	7,112		3.0
Erosion and Sediment Control Level 3	acres treated	$-	$244,717	-	463		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$12,483,802	-	209,812		40.9
Animal Waste Management System	percent of animals	$51,315,615	$48,002,663	285,071	266,806	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(1,655,223)	$(2,513,531)	166,354	252,616	NA	NA
Lagoon Covers	percent of animals	$8,759	$576	197	13	NA	NA
Mortality Composters	percent of dead animals	$4,602,113	$9,877,848	26,177	56,616	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$105	$135	2	3	NA	NA
Poultry Phytase	percent of animals	$(455,028)	$(453,614)	7,495	7,472	NA	NA
Swine Phytase	percent of animals	$(83,944)	$(10,075)	2,067	248	NA	NA
Manure transport	Tons		$588,999		21,395	NA	NA

Scenario 3 BMP Summary

Table 14: Scenario 3 BMP summary for DC. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

DISTRICT OF COLUMBIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Combined Sewer Overflow area eliminated	acres	$-	$-	143	143	1.2	1.2
Conservation Tillage - Total Acres	acres	$-	$-	-	-		
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$665,459	$666,238	877	878	2.8	2.8
Dry Extended Detention Ponds	acres treated	$20,587	$20,605	54	54	0.7	0.7
Erosion and Sediment Control Level 1	acres treated	$92,862	$62,361	176	118	1.1	100.0
Filtering Practices	acres treated	$2,189,238	$2,192,310	1,016	1,017	3.2	3.2
Impervious Surface Reduction	acres	$48,993,290	$48,990,902	3,427	3,427	40.8	40.8
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$173,856	$234,936	137	185	0.4	0.6
Nutrient Management Plan-urban	acres	$-	$123,664	-	6,498		50.0
Stream Restoration	feet	$2,551,296	$2,551,296	42,240	42,240	NA	NA
Street Sweeping 25 times a year-acres	acres	$1,407,651	$1,408,112	1,536	1,537	9.4	9.4
Tree Planting	acres	$116,451	$116,393	1,376	1,375	7.9	7.9
Wet Ponds and Wetlands	acres treated	$42,363	$42,415	99	99	0.4	0.4

DISTRICT OF COLUMBIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$386,994	-	317		3.0

Table 15: Scenario 3 BMP summary for Delaware. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

DELAWARE		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Alternative Crops	acres	$74,428	$74,532	4,080	4,086	2.1	2.1
Barnyard Runoff Control	acres	$87,632	$87,632	196	196	100.0	100.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$40,757	$-	33	-	0.1	
Bioswale	acres treated	$364,464	$1,602,378	341	1,501	0.7	3.0
Combined Sewer Overflow area eliminated	acres	$-	$-	158	158	100.0	100.0
Commodity Cover Crop Early Drilled Wheat	acres	$1,598,311	$1,598,339	23,973	23,974	12.2	12.2
Connection	septic systems	$3,314,381	$3,314,485	6,295	6,295	31.5	31.5
Conservation Tillage - Total Acres	acres	$-	$-	177,436	177,436	100.0	100.0
Continuous High Residue Till	acres	$-	$-	58,436	177,436	32.9	100.0
Cover Crop Early Drilled Rye	acres	$4,191,931	$4,191,505	61,646	61,640	31.5	31.5
Cropland Irrigation Management	acres	$18,261,451	$18,261,975	135,000	135,004	69.0	69.0
Decision Agriculture Efficiency Version	acres	$4,382,365	$-	202,232	-	100.0	

DELAWARE BMP	Unit	Cost		Credit		Percent implementation	
		WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Denitrification	septic systems	$1,824,255	$1,824,396	1,332	1,332	8.5	8.5
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$1,234	$-	2	-	0.0	
Dry Extended Detention Ponds	acres treated	$768,561	$768,849	2,023	2,024	4.0	4.0
Erosion and Sediment Control Level 1	acres treated	$2,423,445	$-	4,580	-	12.2	
Filtering Practices	acres treated	$989,557	$5,393,301	459	2,502	0.9	5.0
Forest Buffers - agriculture	acres in buffers	$1,721,373	$5,216,034	7,020	21,272	3.3	10.0
Forest Buffers – urban	acres in buffers	$-	$360,591	-	7,847		8.8
Forest Harvesting Practices	acres	$334,132	$119,117	5,220	1,861	2.8	100.0
Grass Buffers - agriculture	acres in buffers	$1,693,002	$4,253,211	8,297	20,844	4.0	10.0
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$949,611	$1,903,497	749	1,501	1.5	3.0
Irrigation Water Capture Reuse	acres	$-	$65,221	-	67		50.0
Land Retirement to hay without nutrients (HEL)	acres	$187,752	$7,032,335	1,113	41,688	0.5	20.0
Land Retirement to pasture (HEL)	acres	$117,577	$414,841	697	2,459	0.3	1.2
Loafing Lot Management	acres	$-	$-	-	-		-
Nutrient Application Management, Tier 1 Crop Group	acres	$369,360	$-	6,208	-	100.0	

DELAWARE BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Nutrient Management Plan	acres	$746,687	$746,687	39,237	39,237	100.0	100.0
Off Stream Watering Without Fencing	acres	$9,588	$9,596	325	325	5.2	5.2
Precision Intensive Rotational Grazing	acres	$105,836	$105,850	1,134	1,134	18.3	18.3
Pumping	septic systems	$1,293,016	$1,293,053	13,903	13,904	69.7	69.7
Soil Conservation and Water Quality Plans	acres	$412,671	$412,932	212,717	212,851	100.0	100.0
Sorbing Materials in Ag Ditches	acres	$-	$11,098,124	-	88,785		50.0
Stream Restoration-agriculture	feet	$432,302	$432,302	63,202	63,202	NA	NA
Stream Restoration – urban	feet	$12,080	$12,080	200	200	NA	NA
Street Sweeping 25 times a year-acres	acres	$2,880,372	$2,880,747	3,143	3,143	29.1	29.1
Tree Planting – agriculture	acres	$78,175	$78,586	930	935	0.4	0.4
Tree Planting – urban	acres	$8,378	$57,056	99	674	1.7	1.7
Water Control Structures	acres	$192,191	$192,217	10,846	10,847	5.3	5.3
Wet Ponds and Wetlands	acres treated	$2,476,534	$2,476,245	5,776	5,776	11.5	11.5
Wetland Restoration	acres	$2,633,789	$2,631,810	11,450	11,441	2.7	2.7
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$1,834,023	-	1,501		3.0
Erosion and Sediment Control Level 3	acres treated	$-	$303,810	-	574		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$10,864,757	-	182,601		99.3

DELAWARE BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Animal Waste Management System	percent of animals	$14,307,205	$13,829,266	145,534	141,688	NA	NA
Biofilters	percent of animals	$461,322	$461,322	10,357	10,357	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(71,492)	$(71,492)	7,185	7,185	NA	NA
Mortality Composters	percent of dead animals	$3,720,739	$3,750,331	7,126	7,550	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$46,583	$477,584	1,046	10,723	NA	NA
Poultry Phytase	percent of animals	$(6,429,137)	$(6,288,035)	105,899	103,575	NA	NA
Swine Phytase	percent of animals	$(52,668)	$(52,668)	1,297	1,297	NA	NA
Manure transport	Tons	$6,953,870	$6,953,870	252,592	252,592	NA	NA

Table 16: Scenario 3 BMP summary for Maryland. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Abandoned Mine Reclamation	acres	$1,135,345	$1,135,345	1,843	1,843	36.2	36.2
Alternative Crops	acres	$15,139	$3,955,193	830	216,842	0.3	20.0
Barnyard Runoff Control	acres	$623,105	$922,353	1,396	2,067	60.8	90.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$41,853,540	$49,239,029	34,258	40,303	2.8	3.0
Bioswale	acres treated	$19,357,176	$43,019,918	18,135	40,303	1.6	3.0
Combined Sewer Overflow area eliminated	acres	$-	$-	22,017	22,017	97.8	97.8
Connection	septic systems	$22,101,685	$22,101,445	41,978	41,977	22.3	22.3
Conservation Tillage - Total Acres	acres	$-	$-	756,251	781,863	72.5	75.0
Continuous High Residue Till	acres	$-	$-	-	625,490		80.0
Cover Crop Early Drilled Wheat	acres	$-	$13,909,772	-	204,555		67.7
Cover Crop Standard Drilled Wheat	acres	$28,837,796	$29,952,342	424,085	440,476	40.3	42.3
Cropland Irrigation Management	acres	$16,195,478	$15,797,350	119,727	116,784	11.4	11.3
Dairy Manure Injection	acres	$1,577,745	$-	26,296	-	2.2	
Decision Agriculture Efficiency Version	acres	$12,953,598	$-	597,766	-	56.8	

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Denitrification	septic systems	$232,640,812	$232,640,023	169,865	169,865	45.3	45.3
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$35,969,822	$46,007,858	47,396	60,623	3.5	5.6
Dry Extended Detention Ponds	acres treated	$9,445,652	$9,317,657	24,862	24,525	1.9	2.2
Enhanced Nutrient Application Management Efficiency Version	acres	$658,166	$-	181,313	-	97.2	
Erosion and Sediment Control Level 1	acres treated	$18,364,907	$-	34,708	-	14.6	
Erosion and Sediment Control on Extractive	acres treated	$1,117,931	$1,541,545	7,737	10,668	72.6	75.3
Filtering Practices	acres treated	$631,260,810	$289,593,784	292,841	134,342	22.0	10.0
Forest Buffers – agriculture	acres in buffers	$5,510,210	$44,039,153	22,471	179,598	1.5	12.0
Forest Buffers – urban	acres in buffers	$2,146,584	$8,954,287	46,716	194,870	2.0	8.3
Forest Conservation	acres	$-	$-	81,515	84,452	8.3	8.5
Forest Harvesting Practices	acres	$1,532,089	$1,843,284	23,935	28,797	83.2	100.0
Grass Buffers – agriculture	acres in buffers	$10,208,250	$35,489,658	50,028	173,926	3.5	12.0
Horse Pasture Management	acres	$108,625	$75,159	4,990	3,452	4.0	2.8
Impervious Surface Reduction	acres	$427,695,185	$427,676,256	29,914	29,913	9.2	9.2

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$3,232,979	$136,277,975	2,550	107,474	0.2	8.0
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$37,762,489	$38,039,995	29,781	30,000	2.3	2.2
Irrigation Water Capture Reuse	acres	$2,173,336	$2,408,957	2,240	2,483	62.9	50.0
Land Retirement to hay without nutrients (HEL)	acres	$3,406,338	$48,899,383	20,193	289,877	1.4	20.0
Land Retirement to pasture (HEL)	acres	$6,240,422	$6,989,825	36,993	41,436	3.2	3.3
Loafing Lot Management	acres	$387,403	$445,486	200	230	9.5	10.0
MS4 Permit-Required Stormwater Retrofit	acres treated	$105,825,656	$105,836,465	67,487	67,493	5.1	5.3
Nutrient Application Management, Tier 1 Crop Group	acres	$29,615,878	$-	497,746	-	36.2	
Nutrient Management Plan	acres	$8,750,994	$18,810,449	459,853	988,463	46.5	99.0
Off Stream Watering Without Fencing	acres	$1,282,899	$1,282,829	43,488	43,486	24.4	24.3
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	acres treated	$5,004,212	$4,994,575	350	349	1.1	1.1
Poultry Litter Injection	acres	$9,277,694	$-	154,628	-	12.8	
Precision Intensive Rotational Grazing	acres	$260,101	$-	2,787	-	2.8	

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Precision Intensive Rotational/Prescribed Grazing	acres	$268,478	$2,226,880	18,301	151,798	10.2	85.0
Pumping	septic systems	$5,357,950	$5,357,896	57,612	57,612	54.9	54.9
Soil Conservation and Water Quality Plans	acres	$2,177,855	$2,913,130	1,122,606	1,501,614	74.1	100.0
Sorbing Materials in Ag Ditches	acres	$645,271	$2,394,137	5,162	19,153	1.5	1.3
Stormwater Management by Era 1985 to 2002 MD	acres treated	$198,468,203	$198,471,952	88,402	88,404	7.0	7.2
Stormwater Management by Era 2002 to 2010 MD	acres treated	$135,517,609	$135,540,359	60,363	60,373	4.8	4.9
Stream Access Control with Fencing	acres	$3,972,777	$3,846,895	749	725	92.9	90.0
Stream Restoration – agriculture	feet	$505,989	$505,258	73,975	73,868	NA	NA
Stream Restoration – urban	feet	$124,702,288	$126,342,611	2,064,607	2,091,765	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$-	$11,589,092	-	47,262		50.0
Street Sweeping 25 times a year-acres	acres	$8,278,115	$34,941,733	9,033	38,128	10.0	11.0
Street Sweeping Pounds	lbs	$2,214,543	$2,214,543	9,628,448	9,628,448		
Tree Planting – agriculture	acres	$1,539,426	$11,919,945	18,313	141,803	1.2	9.5
Tree Planting – urban	acres	$1,269,438	$1,860,590	15,000	21,985	1.7	2.2

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Vegetated Open Channels - A/B soils, no underdrain	acres treated	$23,136,671	$23,138,997	28,290	28,293	2.6	2.6
Water Control Structures	acres	$304,755	$100,699	17,198	5,683	2.0	0.4
Wet Ponds and Wetlands	acres treated	$29,128,926	$29,128,497	67,942	67,941	5.1	5.1
Wetland Restoration	acres	$5,858,362	$15,248,932	25,468	66,292	0.8	2.2
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$39,961,329	-	32,709		3.0
Erosion and Sediment Control Level 3	acres treated	$-	$17,466,490	-	33,010		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$21,287,305	-	357,770		80.0
Animal Waste Management System	percent of animals	$66,567,973	$53,590,630	463,931	392,321	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(256,670)	$(364,471)	25,796	36,630	NA	NA
Lagoon Covers	percent of animals	$1,291	$521	29	12	NA	NA
Mortality Composters	percent of dead animals	$2,962,040	$4,138,659	6,813	12,463	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$2,953,541	$3,188,616	66,312	71,590	NA	NA

MARYLAND		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Poultry Phytase	percent of animals	$(9,314,361)	$(9,305,804)	153,424	153,283	NA	NA
Swine Phytase	percent of animals	$(28,126)	$(38,031)	693	937	NA	NA
Manure transport	Tons	$1,763,628	$2,242,933	64,062	81,472	NA	NA

Table 17: Scenario 3 BMP summary for New York. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

NEW YORK		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Alternative Crops	acres	$-	$659,730	-	36,169		20.0
Barnyard Runoff Control	acres	$169,419	$624,362	380	1,399	21.7	80.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$5,792,466	-	4,741		2.0
Bioswale	acres treated	$-	$6,923,510	-	6,486		2.7
Commodity Cover Crop Early Other Wheat	acres	$124,434	$-	1,866	-	1.0	
Conservation Tillage - Total Acres	acres	$-	$-	49,435	49,315	30.1	30.0
Continuous High Residue Till	acres	$-	$-	9,590	19,726	19.4	40.0
Cover Crop Early Drilled Wheat	acres	$-	$2,851,721	-	41,937		31.9
Cover Crop Standard Drilled Rye	acres	$1,952,559	$224,010	28,714	3,294	15.9	6.7

NEW YORK BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Dairy Manure Injection	acres	$1,832,234	$-	30,537	-	21.0	
Decision Agriculture Efficiency Version	acres	$1,583,935	$-	73,093	-	13.8	
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$17,564,256	$17,541,186	21,161,755	21,133,959	NA	NA
Dry Extended Detention Ponds	acres treated	$84,644	$80,267	223	211	0.1	0.1
Enhanced Nutrient Application Management Efficiency Version	acres	$818,123	$-	225,378	-	42.5	
Erosion and Sediment Control Level 1	acres treated	$39,356	$-	74	-	0.4	
Filtering Practices	acres treated	$4,535,801	$13,918,664	2,104	6,457	0.8	2.7
Forest Buffers-agriculture	acres in buffers	$2,123,720	$12,061,830	8,661	49,190	1.0	6.0
Forest Buffers-urban	acres in buffers	$-	$1,588,253	-	34,565		8.2
Forest Harvesting Practices	acres	$448,523	$1,847,881	7,007	28,869	24.3	100.0
Grass Buffers -agriculture	acres in buffers	$5,402,059	$6,236,784	26,474	30,565	3.7	4.3
Horse Pasture Management	acres	$43,188	$43,181	1,984	1,983	1.1	1.1
Impervious Surface Reduction	acres	$1,977,213	$1,976,641	138	138	0.2	0.2
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$14,344,882	$13,608,281	11,313	10,732	4.5	4.5
Irrigation Water Capture Reuse	acres	$-	$241,316	-	249		20.0

NEW YORK BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Land Retirement to hay without nutrients (HEL)	acres	$1,967,045	$14,472,302	11,661	85,792	1.6	12.1
Loafing Lot Management	acres	$736,719	$678,739	380	350	21.7	20.0
Nutrient Application Management, Tier 1 Crop Group	acres	$2,104,033	$-	35,362	-	6.7	
Nutrient Management Plan	acres	$-	$3,124,399	-	164,183		95.0
Off Stream Watering Without Fencing	acres	$243,845	$243,972	8,266	8,270	4.6	4.6
Poultry Litter Injection	acres	$5,669,506	$-	94,492	-	13.3	
Precision Intensive Rotational/Prescribed Grazing	acres	$2,153,604	$2,246,748	146,803	153,153	81.5	85.0
Soil Conservation and Water Quality Plans	acres	$830,107	$844,278	427,890	435,195	51.8	53.0
Stream Restoration-agriculture	feet	$2,311,916	$2,073,409	337,999	303,130	NA	NA
Stream Restoration – urban	feet	$1,600,597	$1,600,597	26,500	26,500	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$300,987	$1,532,191	1,227	6,248	1.2	6.0
Streamside Grass Buffers – agriculture	acres in buffers	$2,443,009	$2,450,004	11,973	12,007	96.5	95.1
Street Sweeping 25 times a year-acres	acres	$5,060,466	$4,847,697	5,522	5,290	7.2	7.2
Tree Planting - agriculture	acres	$139,994	$286,851	1,665	3,412	0.2	0.4
Wet Ponds and Wetlands	acres treated	$3,948,072	$3,946,750	9,209	9,206	3.7	3.7
Wetland Restoration	acres	$5,894,253	$10,085,060	25,624	43,843	1.6	2.7
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$5,792,466	-	4,741		2.0

NEW YORK BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Erosion and Sediment Control Level 3	acres treated	$-	$220,240	-	416		90.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$12,483,802	-	209,812		40.9
Animal Waste Management System	percent of animals	$51,315,615	$42,943,213	285,071	238,896	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(1,655,223)	$(2,513,531)	166,354	252,616	NA	NA
Lagoon Covers	percent of animals	$8,759	$576	197	13	NA	NA
Mortality Composters	percent of dead animals	$4,602,113	$5,074,311	26,177	28,896	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$105	$255	2	6	NA	NA
Poultry Phytase	percent of animals	$(455,028)	$(453,614)	7,495	7,472	NA	NA
Swine Phytase	percent of animals	$(83,944)	$(8,215)	2,067	202	NA	NA
Manure transport	Tons		$588,999		21,395	NA	NA

Table 18: Scenario 3 BMP summary for Pennsylvania. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

PENNSYLVANIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Abandoned Mine Reclamation	acres	$9,472,592	$9,471,022	15,381	15,378	5.1	5.4
Alternative Crops	acres	$1,824,169	$5,371,510	100,009	294,491	6.8	20.0
Barnyard Runoff Control	acres	$2,581,222	$3,504,872	5,784	7,854	59.7	80.8
Bioretention/raingardens - A/B soils, underdrain	acres treated	$-	$42,114,191	-	34,471		2.6
Bioswale	acres treated	$-	$35,616,700	-	33,367		2.5
Combined Sewer Overflow area eliminated	acres	$-	$-	3,789	3,789	33.3	33.3
Commodity Cover Crop Early Other Wheat	acres	$6,632,868	$-	99,488	-	7.0	
Commodity Cover Crop Standard Other Wheat	acres	$6,468,588	$-	97,024	-	6.9	
Connection	septic systems	$74,015,788	$74,012,949	140,578	140,573	27.3	27.3
Conservation Tillage - Total Acres	acres	$-	$-	875,496	1,107,053	63.3	80.0
Continuous High Residue Till	acres	$-	$-	60,072	885,642	6.9	80.0
Cover Crop Early Drilled Wheat	acres	$-	$80,101,469	-	1,177,963		80.0
Cover Crop Early Other Wheat	acres	$29,292,894	$-	430,778	-	30.4	
Dairy Manure Injection	acres	$1,656,000	$-	27,600	-	2.0	
Decision Agriculture Efficiency Version	acres	$3,795,964	$-	175,171	-	7.1	
Dirt & Gravel Road Erosion & Sediment Control - Driving	feet	$1,477,637	$1,478,374	1,780,286	1,781,174	NA	NA

PENNSYLVANIA BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Surface Aggregate + Raising the Roadbed							
Dirt & Gravel Road Erosion & Sediment Control - Outlets only	feet	$3,488,140	$3,491,509	4,202,579	4,206,637	NA	NA
Dirt & Gravel Road Erosion & Sediment Control - with Outlets	feet	$1,477,637	$1,478,379	1,780,286	1,781,179	NA	NA
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$31,917,731	$-	42,057	-	3.0	
Dry Extended Detention Ponds	acres treated	$15,932,383	$-	41,935	-	3.0	
Enhanced Nutrient Application Management Efficiency Version	acres	$5,899,609	$-	1,625,237	-	66.2	
Erosion and Sediment Control Level 1	acres treated	$3,121,070	$-	5,899	-	34.3	
Erosion and Sediment Control on Extractive	acres treated	$19,722,199	$19,722,888	136,486	136,491	92.5	92.5
Filtering Practices	acres treated	$914,354,314	$417,099,520	424,168	193,492	30.0	14.8
Forest Buffers – agriculture	acres in buffers	$37,796,469	$49,216,039	154,139	200,710	4.7	6.8
Forest Buffers – urban	acres in buffers	$1,578,844	$9,562,300	34,360	208,102	1.4	8.5
Forest Harvesting Practices	acres	$1,600,250	$6,036,145	25,000	94,300	26.5	100.0
Grass Buffers– agriculture	acres in buffers	$9,541,078	$30,020,103	46,759	147,121	2.4	5.0
Grass Buffers– urban	acres in buffers	$467,518	$-	8,395	-	0.8	

PENNSYLVANIA BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Horse Pasture Management	acres	$760,458	$760,504	34,931	34,934	7.2	9.0
Impervious Surface Reduction	acres	$32,883,988	$32,910,110	2,300	2,302	0.6	0.6
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$696,370,952	$665,277,016	549,184	524,662	39.4	40.1
Irrigation Water Capture Reuse	acres	$1,139,408	$2,241,079	1,174	2,310	15.3	30.0
Land Retirement to hay without nutrients (HEL)	acres	$49,002,060	$63,038,326	290,486	373,693	9.9	12.7
Land Retirement to pasture (HEL)	acres	$19,654,921	$19,653,614	116,515	116,507	7.9	7.9
Loafing Lot Management	acres	$-	$3,616,973	-	1,864		19.2
Nutrient Application Management, Tier 1 Crop Group	acres	$27,443,250	$-	461,231	-	94.6	
Nutrient Management Plan	acres	$6,701,708	$18,818,536	352,165	988,888	33.8	95.0
Off Stream Watering Without Fencing	acres	$2,557,058	$2,550,399	86,680	86,454	17.8	17.7
Poultry Litter Injection	acres	$413,998	$-	6,900	-	0.5	
Precision Intensive Rotational Grazing	acres	$26,625,640	$-	285,285	-	58.5	
Precision Intensive Rotational/Prescribed Grazing	acres	$2,068,687	$3,574,642	141,015	243,670	28.9	50.0
Soil Conservation and Water Quality Plans	acres	$5,487,001	$5,242,792	2,828,351	2,702,470	86.4	91.6
Sorbing Materials in Ag Ditches	acres	$-	$288,729	-	2,310		30.0

PENNSYLVANIA BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Stream Access Control with Fencing	acres	$75,139,987	$74,950,411	14,160	14,124	85.2	85.0
Stream Restoration – agriculture	feet	$3,621,338	$3,455,727	529,435	505,223	NA	NA
Stream Restoration – urban	feet	$3,321,998	$3,321,999	55,000	55,000	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$1,140,878	$82,196,536	4,653	335,209	1.4	100.0
Streamside Grass Buffers – agriculture	acres in buffers	$25,707	$50,910	126	250	5.2	10.0
Street Sweeping 25 times a year-acres	acres	$42,339,546	$42,342,793	46,200	46,204	12.4	12.4
Tree Planting – agriculture	acres	$6,024,119	$1,027,190	71,665	12,220	2.2	0.4
Tree Planting – urban	acres	$122,204	$123,281	1,444	1,457	0.1	0.1
Urban Growth Reduction	acres	$-	$-	317	312	0.0	0.0
Wet Ponds and Wetlands	acres treated	$72,006,451	$72,004,205	167,953	167,948	11.9	11.9
Wetland Restoration	acres	$30,185,609	$32,438,965	131,228	141,024	2.0	2.4
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$42,362,577	-	34,674		2.6
Erosion and Sediment Control Level 3	acres treated	$-	$7,002,807	-	13,235		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$126,723,306	-	2,129,803		90.0
Animal Waste Management System	percent of animals	$240,027,776	$231,341,641	1,448,255	1,397,107	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(4,583,740)	$(4,954,881)	460,677	497,978	NA	NA

PENNSYLVANIA BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Lagoon Covers	percent of animals	$597,825	$597,825	13,422	13,422	NA	NA
Mortality Composters	percent of dead animals	$6,277,323	$20,849,695	29,216	96,835	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$1,079,941	$988,813	24,246	22,200	NA	NA
Poultry Phytase	percent of animals	$(13,310,164)	$(12,964,885)	219,242	213,554	NA	NA
Swine Phytase	percent of animals	$(5,401,825)	$(5,397,748)	133,017	132,917	NA	NA
Manure transport	Tons	$6,666,858	$25,627,718	242,167	930,901	NA	NA

Table 19: Scenario 3 BMP summary for Virginia. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

VIRGINIA BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Abandoned Mine Reclamation	acres	$18,012,592	$18,012,117	29,247	29,246	82.1	82.1
Barnyard Runoff Control	acres	$2,145,535	$2,810,980	4,808	6,299	68.7	90.0
Bioretention/raingardens - A/B soils, underdrain	acres treated	$27,307,736	$61,699,196	22,352	50,502	1.3	3.0

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Bioswale	acres treated	$1,220,992	$27,896,903	1,144	26,135	0.1	3.0
Combined Sewer Overflow area eliminated	acres	$-	$-	549	549	100.0	100.0
Commodity Cover Crop Early Drilled Wheat	acres	$5,043,690	$5,991,254	75,652	89,864	9.5	11.3
Commodity Cover Crop Early Other Wheat	acres	$32,981	$-	495	-	0.1	
Connection	septic systems	$21,766,256	$21,765,256	41,341	41,339	8.9	8.9
Conservation Till Without Nutrients	acres	$-	$-	36,052	36,051	67.0	67.0
Conservation Tillage - Total Acres	acres	$-	$-	514,380	667,356	69.4	90.0
Continuous High Residue Till	acres	$-	$-	304,371	533,885	59.2	80.0
Cover Crop Early Drilled Rye	acres	$9,665	$8,974	142	132	0.0	0.0
Cover Crop Early Drilled Wheat	acres	$6,842,653	$20,047,727	100,627	294,820	12.7	37.1
Cover Crop Early Other Rye	acres	$673,560	$870,336	9,905	12,799	1.7	1.8
Cover Crop Early Other Wheat	acres	$673,915	$-	9,911	-	1.7	
Cover Crop Standard Drilled Barley	acres	$134,574	$148,506	1,979	2,184	0.2	0.3
Cover Crop Standard Drilled Rye	acres	$1,389,829	$3,176,614	20,439	46,715	2.6	7.0

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Cover Crop Standard Drilled Wheat	acres	$4,995,397	$22,135,454	73,462	325,521	9.2	43.9
Cover Crop Standard Other Rye	acres	$673,560	$870,336	9,905	12,799	1.7	1.8
Cover Crop Standard Other Wheat	acres	$392,025	$453,472	5,765	6,669	0.7	0.8
Decision Agriculture Efficiency Version	acres	$3,421,027	$-	157,869	-	11.0	
Denitrification	septic systems	$109,171,983	$109,176,442	79,713	79,716	17.2	17.2
Dirt & Gravel Road Erosion & Sediment Control - Driving Surface Aggregate + Raising the Roadbed	feet	$2,181	$2,181	2,629	2,629	NA	NA
Dirt & Gravel Road Erosion & Sediment Control - with Outlets	feet	$1,807	$1,807	2,178	2,178	NA	NA
Dry Detention Ponds and Hydrodynamic Structures	acres treated	$64,928,806	$-	85,554	-	5.1	
Dry Extended Detention Ponds	acres treated	$61,123,308	$-	160,880	-	9.6	
Enhanced Nutrient Application Management Efficiency Version	acres	$245,803	$-	67,715	-	4.7	
Erosion and Sediment Control Level 1	acres treated	$15,845,956	$-	29,948	-	5.2	
Erosion and Sediment Control on Extractive	acres treated	$429,779	$429,845	2,974	2,975	46.8	46.8

VIRGINIA BMP	Unit	Cost WIP2	Cost Scenario 3	Credit WIP2	Credit Scenario 3	Percent implementation WIP2	Percent implementation Scenario 3
Filtering Practices	acres treated	$141,986,926	$108,863,052	65,868	50,502	3.9	3.0
Forest Buffers – agriculture	acres in buffers	$19,571,127	$46,029,490	79,814	187,715	2.9	7.2
Forest Buffers– urban	acres in buffers	$378,180	$11,412,479	8,230	248,367	0.3	8.4
Forest Conservation	acres	$-	$-	14,128	14,141	2.3	2.3
Forest Harvesting Practices	acres	$5,588,360	$5,901,023	87,304	92,189	15.8	100.0
Grass Buffers – agriculture	acres in buffers	$22,247,927	$45,279,331	109,032	221,903	4.2	8.6
Horse Pasture Management	acres	$512,899	$512,772	23,560	23,554	2.0	2.0
Impervious Surface Reduction	acres	$354,267,831	$354,329,066	24,779	24,783	5.6	5.6
Infiltration Practices w/ Sand, Veg. - A/B soils, no underdrain	acres treated	$5,498	$-	4	-	0.0	
Infiltration Practices w/o Sand, Veg. - A/B soils, no underdrain	acres treated	$87,648,168	$106,727,338	69,123	84,169	4.1	5.0
Irrigation Water Capture Reuse	acres	$2,981,094	$2,851,203	3,073	2,939	83.6	80.0
Land Retirement to hay without nutrients (HEL)	acres	$17,296,484	$79,566,526	102,534	471,673	3.9	18.2
Nutrient Application Management, Tier 1 Crop Group	acres	$55,781,063	$-	937,497	-	36.2	
Nutrient Management Plan	acres	$9,839,592	$23,047,145	517,057	1,211,095	41.6	97.5

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Off Stream Watering Without Fencing	acres	$410,538	$409,612	13,917	13,885	1.2	1.2
Permeable Pavement w/ Sand, Veg. - A/B soils, underdrain	acres treated	$528,831	$289,021	37	20	0.0	0.0
Permeable Pavement w/o Sand, Veg. - A/B soils, underdrain	acres treated	$210,843	$348,956	15	24	0.0	0.0
Precision Intensive Rotational/Prescribed Grazing	acres	$7,837,666	$14,428,415	534,265	983,532	46.2	85.0
Pumping	septic systems	$6,230,007	$6,229,857	66,989	66,988	14.4	14.4
Soil Conservation and Water Quality Plans	acres	$3,630,467	$5,091,525	1,871,375	2,624,497	67.4	100.0
Sorbing Materials in Ag Ditches	acres	$-	$269,760	-	2,158		58.7
Stream Access Control with Fencing	acres	$127,900,466	$129,267,388	24,102	24,360	39.6	40.0
Stream Restoration – agriculture	feet	$652,864	$714,971	95,448	104,528	NA	NA
Stream Restoration – urban	feet	$7,030,461	$7,030,473	116,398	116,399	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$4,811,844	$42,736,823	19,623	174,287	11.3	100.0
Streamside Grass Buffers – agriculture	acres in buffers	$6,357,443	$7,083,165	31,156	34,713	84.7	95.0
Street Sweeping 25 times a year-acres	acres	$22,031,476	$22,039,294	24,040	24,049	5.4	5.4

VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Tree Planting – agriculture	acres	$9,002,600	$11,824,190	107,097	140,664	3.9	5.4
Tree Planting – urban	acres	$67,628	$67,847	799	802	0.1	0.1
Vegetated Open Channels - A/B soils, no underdrain	acres treated	$2,685,055	$2,670,841	3,283	3,266	0.2	0.2
Water Control Structures	acres	$12,325	$13,139	696	742	0.3	1.0
Wet Ponds and Wetlands	acres treated	$76,216,386	$76,218,423	177,772	177,777	10.6	10.6
Wetland Restoration	acres	$8,839,654	$34,337,680	38,429	149,278	0.7	2.8
Animal Waste Management System	percent of animals	$125,844,066	$125,844,066	782,501	782,501	NA	NA
Dairy Precision Feeding and/or Forage Management	percent of animals	$(790,850)	$(790,850)	79,482	79,482	NA	NA
Mortality Composters	percent of dead animals	$5,592,315	$5,592,315	14,939	14,939	NA	NA
Poultry Litter Treatment (alum, for example)	percent of animals	$3,740,694	$3,740,694	83,985	83,985	NA	NA
Poultry Phytase	percent of animals	$(10,841,016)	$(10,841,016)	178,570	178,570	NA	NA
Swine Phytase	percent of animals	$(975,739)	$(975,739)	24,027	24,027	NA	NA
Manure transport	Tons	$5,285,760	$5,285,760	192,000	192,000	NA	NA

Table 20: Scenario 3 BMP summary for West Virginia. NA indicates that percent implementation cannot be calculated because there is not a defined domain for the BMP implementation amount.

WEST VIRGINIA		Cost		Credit		Percent implementation	
BMP	Unit	WIP2	Scenario 3	WIP2	Scenario 3	WIP2	Scenario 3
Abandoned Mine Reclamation	acres	$8,858,815	$8,858,815	14,384	14,384	100.0	100.0
Barnyard Runoff Control	acres	$-	$315,032	-	706		50.0
Bioswale	acres treated	$-	$4,168,056	-	3,905		3.0
Combined Sewer Overflow area eliminated	acres	$-	$-	347	347	37.8	37.8
Commodity Cover Crop Standard-Planting Other Barley	acres	$162,407	$162,944	2,436	2,444	4.6	4.6
Conservation Tillage - Total Acres	acres	$-	$-	32,726	32,726	72.2	72.2
Continuous High Residue Till	acres	$-	$-	-	13,090		40.0
Cover Crop Early Other Rye	acres	$182,784	$183,338	2,688	2,696	5.1	5.1
Cover Crop Early Other Wheat	acres	$91,392	$91,669	1,344	1,348	2.6	2.6
Cover Crop Late-Planting Other Rye	acres	$74,257	$74,441	1,092	1,095	2.1	2.1
Cover Crop Late Other Wheat	acres	$57,119	$57,247	840	842	1.6	1.6
Filtering Practices	acres treated	$-	$8,417,332	-	3,905		3.0
Forest Buffers – agriculture	acres in buffers	$1,314,566	$5,585,073	5,361	22,777	1.2	5.0
Forest Buffers – urban	acres in buffers	$-	$910,500	-	19,815		8.5
Forest Harvesting Practices	acres	$1,249,878	$1,046,677	19,526	16,352	9.5	98.4
Grass Buffers – agriculture	acres in buffers	$614,191	$4,306,021	3,010	21,103	0.7	5.0

WEST VIRGINIA BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Irrigation Water Capture Reuse	acres	$-	$39,381	-	41		50.0
Land Retirement to hay without nutrients (HEL)	acres	$423,243	$7,290,567	2,509	43,219	4.8	10.0
Land Retirement to pasture (HEL)	acres	$423,243	$433,049	2,509	2,567	1.6	1.6
Land transition - construction to nonregulated pervious urban	acres	$-	$-	5,192	5,215	90.1	90.1
Loafing Lot Management	acres	$-	$273,980	-	141		10.0
Nutrient Application Management, Tier 1 Crop Group	acres	$5,355,001	$-	90,000	-	50.5	
Nutrient Management Plan	acres	$-	$1,982,510	-	104,178		100.0
Off Stream Watering Without Fencing	acres	$88,937	$90,126	3,015	3,055	1.3	1.3
Precision Intensive Rotational/Prescribed Grazing	acres	$1,824,170	$1,824,047	124,347	124,339	51.3	51.3
Soil Conservation and Water Quality Plans	acres	$545,026	$883,893	280,941	455,615	62.0	100.0
Stream Access Control with Fencing	acres	$83,445,858	$74,247,689	15,725	13,992	65.2	58.0
Stream Restoration – agriculture	feet	$134,187	$134,187	19,618	19,618	NA	NA
Streamside Forest Buffers – agriculture	acres in buffers	$384,980	$369,975	1,570	1,509	4.8	4.8
Streamside Grass Buffers – agriculture	acres in buffers	$5,917	$558,202	29	2,736	33.4	30.0
Tree Planting	acres	$427,192	$433,335	5,082	5,155	1.1	1.1

WEST VIRGINIA BMP	Unit	Cost WIP2	Scenario 3	Credit WIP2	Scenario 3	Percent implementation WIP2	Scenario 3
Wetland Restoration	acres	$186,771	$188,602	812	820	0.1	0.1
Bioretention/raingardens - A/B soils, no underdrain	acres treated	$-	$4,770,605	-	3,905		3.0
Erosion and Sediment Control Level 3	acres treated	$-	$304,361	-	575		100.0
Nutrient Application Management, Tier 2 Field Level, TP	acres	$-	$5,123,222	-	86,105		50.0
Animal Waste Management System	percent of animals	$2,494,041	$2,494,041	13,751	13,751	NA	NA
Mortality Composters	percent of dead animals	$799,530	$799,530	1,826	1,826	NA	NA
Poultry Phytase	percent of animals	$(3,565,485)	$(3,565,485)	58,730	58,730	NA	NA
Manure transport	Tons	$660,720	$660,720	24,000	24,000	NA	NA