

SKIPPACK CREEK WATERSHED MULTI-MUNICIPAL POLLUTION REDUCTION PLAN



Participating Communities:

Hatfield Township
Lower Providence Township
Skippack Township

Towamencin Township
Worcester Township



Prepared for:
Pennsylvania Department of Environmental Protection

Skippack Creek Watershed Pollution Reduction Plan

Prepared for:

Hatfield Township
Lower Providence Township
Skippack Township
Towamencin Township
Worcester Township

Prepared by:

AEGIS ENGINEERING & PLANNING

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KEY TERMS

NUTRIENTS | ARE ELEMENTS THAT ARE ESSENTIAL FOR PLANT GROWTH. THEY INCLUDE NITROGEN (N), PHOSPHORUS (P), POTASSIUM (K), CALCIUM (CA), MAGNESIUM (MG), SULFUR (S) AND SILICON (SI). N, P AND K ARE CONSIDERED PRIMARY NUTRIENTS. N AND P ARE THE MAJOR LIMITING NUTRIENTS IN MOST AQUATIC ENVIRONMENTS

SEDIMENT, SILTATION & SUSPENDED SOLIDS | ALL REFER TO INORGANIC SOLIDS AND ARE HEREINAFTER REFERRED TO AS “SEDIMENT”

MS4 PLANNING AREA OR “PLANNING AREA” | REFERS TO ALL THE STORM SEWERSHEDS THAT AN MS4 MUST CALCULATE EXISTING LOADS AND PLAN LOAD REDUCTIONS FOR

BASELINE LOAD | POLLUTANT LOAD DISCHARGED BY AN MS4 AS REPORTED IN A TMDL. PER PADEP INSTRUCTIONS (3800-PM-BCW0200D REV. 3/2017), A BASELINE LOAD CAN BE REVISED BY 1) CONDUCTING A NEW MODELING EFFORT THAT UTILIZES THE LAND USE/LAND COVER INFORMATION FROM THE ORIGINAL TMDL AND 2) BY CONSIDERING THE REDUCTIONS ACHIEVED THROUGH STRUCTURAL BMPS INSTALLED PRIOR TO APPROVAL OF A TMDL THAT WERE NOT CONSIDERED DURING DEVELOPMENT OF THE TMDL

EXISTING LOAD | REFERS TO THE POLLUTANT LOAD THAT THE MS4 ESTIMATES IS DRAINING TO IMPAIRED WATERS FROM THE PLANNING AREA AT THE TIME OF TMDL PLAN SUBMISSION. THE EXISTING LOAD WILL BE THE SAME AS THE BASELINE LOAD (REGARDLESS OF WHETHER OR NOT THE BASELINE LOAD IS REVISED) UNLESS THE MS4 ACCOUNTS FOR REDUCTIONS FROM STRUCTURAL BMPS INSTALLED BETWEEN THE DATE OF TMDL APPROVAL AND TMDL PLAN SUBMISSION.

SKIPPACK CREEK WATERSHED ALLIANCE (SCWA) | MEMBERS OF THIS MULTI-MUNICIPAL ALLIANCE ALSO REFERRED TO IN THIS DOCUMENT AS THE “ALLIANCE”.

ACRONYMS

AVGWLF | ARCVIEW GENERALIZED

WATERSHED LOADING FUNCTION

BMP | BEST MANAGEMENT PRACTICE

DEM | DIGITAL ELEVATION MODEL

DEP | DEPARTMENT OF ENVIRONMENTAL
PROTECTION (PA)

EPA | ENVIRONMENTAL PROTECTION
AGENCY

ESRI | ENVIRONMENTAL SYSTEM
RESEARCH INSTITUTE

FEMA | FEDERAL EMERGENCY
MANAGEMENT AGENCY

FIRM | FLOOD INSURANCE RATE MAP

FIS | FLOOD INSURANCE STUDY

GIS | GEOGRAPHIC INFORMATION
SYSTEMS

GPS | GLOBAL POSITIONING SYSTEM

GWLF-E | GENERALIZED WATERSHED
LOADING FUNCTION ENHANCED.

LID | LOW IMPACT DEVELOPMENT

LIDAR | LIGHT DETECTION AND RANGING

MEP | MAXIMUM EXTENT PRACTICABLE

MCM | MINIMUM CONTROL MEASURE

MRLC | MULTI-RESOLUTION LAND
CHARACTERISTICS CONSORTIUM

MS4 | MUNICIPAL SEPARATE STORM
SEWER SYSTEM

NAD 83 | NORTH AMERICAN DATUM OF
1983

NPDES | NATIONAL POLLUTANT
DISCHARGE ELIMINATION SYSTEM

PASDA | PENNSYLVANIA SPATIAL DATA
ACCESS

PRP | POLLUTION REDUCTION PLAN

SCWA | SKIPPACK CREEK WATERSHED
ALLIANCE

SSURGO | SOIL SURVEY GEOGRAPHIC
DATABASE

TMDL | TOTAL MAXIMUM DAILY LOAD

TP | TOTAL PHOSPHORUS

TSS | TOTAL SUSPENDED SEDIMENT

WLA | WASTELOAD ALLOCATION

EXECUTIVE SUMMARY

The Skippack Creek watershed is approximately 55.5 square miles and encompasses drainage areas from twelve (12) municipalities. As is already known, the State’s Department of Environmental Protection (PADEP) has required these twelve MS4 communities, with impaired waterways, to outline steps that must be taken to reduce sediment load currently discharging to (and from) the Skippack Creek by way of TMDL Plans. For the Skippack Creek, DEP/EPA is requiring a reduction of 18% or 1,662,465 lbs/yr cumulatively, by the five municipalities participating in this multi-municipal plan. Pollution load reduction on this scale presents a significant challenge to individual municipalities who may look to achieve these numbers on their own. As the professionals working towards this goal can attest, the path to addressing these reduction numbers individually have proven difficult and cost prohibitive. Consequently, the purpose of this study was to evaluate the potential of planning on a “regional” or watershed basis versus on a “project” (municipal) basis. In looking at the overall watershed, this study sought to evaluate the potential for a greater magnitude of sediment reduction by planning collectively, and on a much larger scale, in order to identify potential projects which could potentially allow for pollution reductions much greater than many of the municipalities would be able to accomplish on their own. Another aspect of this evaluation was to identify compliance with these permit goals in a more cost-effective way. After reviewing a large cross-section of potential programs, the field of projects was narrowed down to thirteen (13) programs which, if executed, could provide approximately 10% of the required 18% reduction of sediment and 5% reduction of phosphorus in permit term one. This plan is submitted as a pollution reduction plan as it is deemed infeasible to meet the full reduction of 18% in only five years. As currently planned, the remaining 8% (18%, cumulatively) will be addressed in subsequent permit terms (permit terms typically represent a 5-year cycle).

SECTION 1 | GENERAL INFORMATION

1.1 | Key Terms

“Key Terms” have been summarized on page iii.

1.2 | Pollutants of Concern

Pursuant to Pennsylvania Department of Environmental Protection instructions for “TMDL Plan Instructions” page 1, section I, subsection B,

PA DEP Requirement:

“Pollutant(s) of Concern: The pollutant(s) of concern for TMDL Plans will be based on the following:

- ***If a WLA has been established in a TMDL for sediment, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment.***

- *If WLAs have been established in a TMDL for sediment and nutrients, the MS4 is expected to develop the TMDL Plan based on the reduction of sediment and TP, unless the MS4 chooses to utilize a presumptive approach for TP. DEP will allow MS4s to calculate loads and pollutant reductions based on sediment, under the assumption that the achievement of the TMDL Plan objectives for sediment will also achieve the objectives for TP. MS4s must identify use of the presumptive approach in its TMDL Plan if chosen.*
- *If a WLA has been established in a TMDL for nutrients alone (or surrogates for nutrients such as “excessive algal growth” and “organic enrichment/low D.O.”), the MS4 is expected to develop the TMDL Plan based on the reduction of TP, unless the presumptive approach is chosen, as described above.*

The Skippack Creek Watershed is impaired for sediment and phosphorus. Per PADEP instructions, under bullet point 2, this plan will prescribe a quantitative approach with reducing sediment thereby significantly reducing phosphorous loads i.e. a “presumptive” approach with mitigating phosphorous through the control of sediment loads.

SECTION 2 | OBJECTIVES

2.1 | Introduction

The Skippack Creek Watershed is impaired for sediment and phosphorus. As a result, a Total Maximum Daily Load (TMDL) Implementation Plan is required to address these impairments. This document follows DEP 3800-FM-BPNPSM0493 Commonwealth of Pennsylvania MS4 TMDL Instructions and provides a prescriptive approach for reduction of known sources of impairments to receiving waterbodies within the Skippack Creek Watershed. The document serves as a joint PRP reduction plan for a group of municipalities within the Skippack Creek with the purpose of outlining actions being taken to achieve sediment and phosphorus reductions to meet EPA clean water standards for the Skippack Creek. A TMDL was issued for Skippack Creek in 2005. Since compliance with these goals in a five-year period not feasible, this plan is issued as a pollution reduction plan meant to define a path to achieve a 10% reduction for sediment and 5% reduction of phosphorous over a 5-year period.

This plan is submitted on behalf of the member municipalities of the Skippack Creek Watershed Alliance. It is understood that the reductions required for compliance with the Skippack Creek TMDL will require multiple permit periods. Therefore, it is recommended by PADEP that this report be submitted as a pollution reduction plan for meeting reductions required for the Skippack Total Maximum Daily Load (TMDL) over multiple permit periods. This section outlines methods and planning required to meet the TMDL requirement. This document follows the Pennsylvania Department of Environmental Protection document 3800-FM-BPNPSM043 “MS4 TMDL Plan” which requires a prescriptive approach for planning and project execution to address impairments in the form of best management practices (BMPs) including their location, project type and estimated wasteload reduction value. In a selection of BMP sites, preference was given to publicly owned sites because public ownership will allow for more rapid

implementation. Some private land sites that were well suited for cost effective BMP implementation or BMP enhancements were also considered and included.

It is understood that this plan will be updated in the future to reflect any changed conditions and permit requirements.

NOTE: This document contains information providing background site conditions, existing and future stormwater management strategies, and additional data required for supporting overall TMDL compliance. The plan is submitted to address critical information required by PADEP on the TMDL Instructions 3800-FM-BPNPSM0493 form and Pollutant Reduction Plan (PRP) Instructions 3800-PM-BCW0100K form.

2.2 | Program Overview

This document provides a full description of the planning and direction the Skippack Creek Watershed Alliance (SCWA) is taking to restore natural streams, improve water quality and address historical damage caused by urban stormwater runoff. Watershed restoration is a regulatory requirement of the Township’s National Pollutant Discharge Elimination System (NPDES) that is administered through its Municipal Separate Storm Sewer System (MS4) Permit.

Through this Implementation Plan, pollutant loads from point and nonpoint sources must be reduced through implementation of a variety of best management practices (BMPs). As a condition of the renewed NPDES permit, the permittee must make progress towards implementation of these measures in order to achieve quantifiable waste load reductions that can be credited towards the wasteload reduction percentages established by EPA.

Figure 2.1 below depicts the communities who are participating in this multi-municipal alliance. Member municipalities are outlined in yellow.

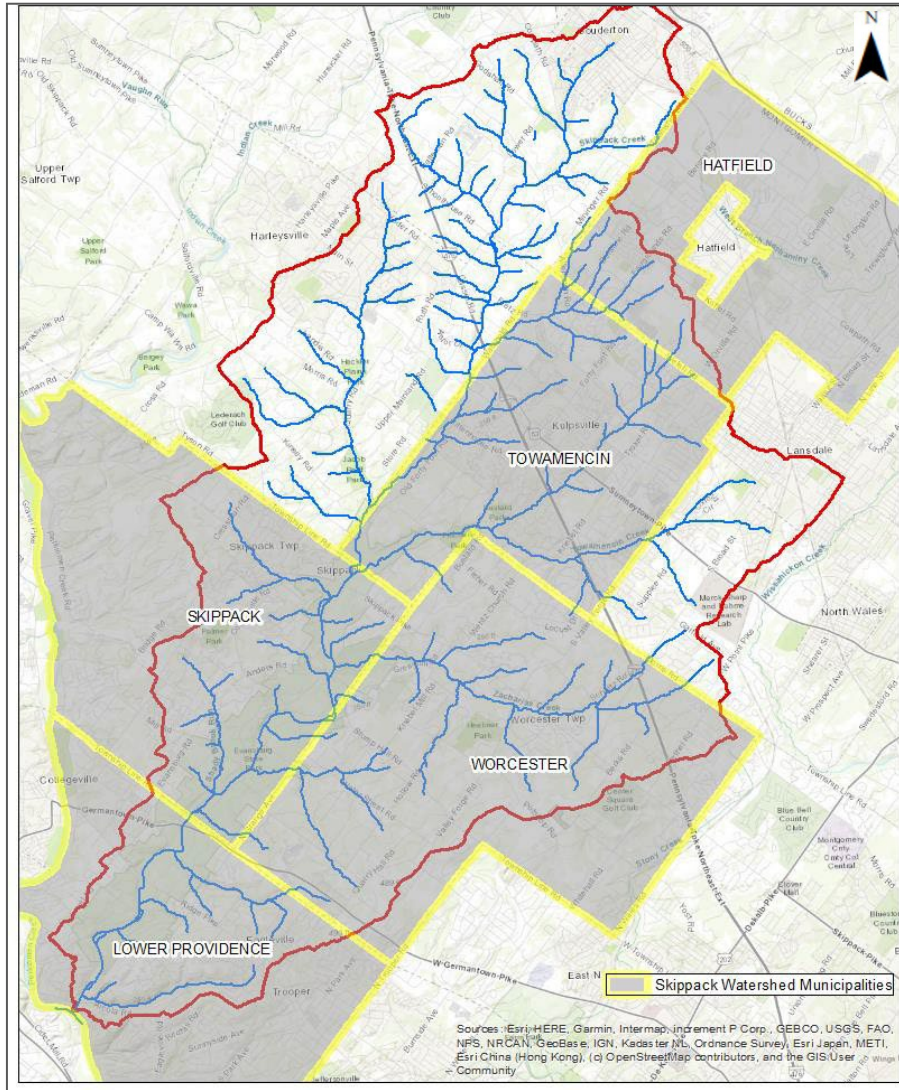


Figure 2.1: Skippack Creek Watershed Alliance Multi-Municipal Permit Group

Within this document, a description of goals and strategies for complying with watershed-specific restoration and water quality standards that are described under the current MS4 permit will be provided to serve as the planning basis for the group to:

- Meet Total Maximum Daily Load (TMDL) Wasteload Allocations (WLAs) by addressing *reduction percentages* approved by EPA;
 - Educate and involve residents, businesses, and stakeholder groups in achieving measurable water quality improvements;
 - Establish a reporting and verification framework to be used for annual reporting as required in the Group’s NPDES MS4 Permits; and
 - Identify necessary organizational infrastructure changes and partnerships required to implement this Strategy.

SECTION 3 | PUBLIC PARTICIPATION

3.1 | Stakeholder Outreach

To address the goals of this program a coordinated effort took place starting in late summer of 2017, in which the communities contacted residents, private businesses as well as, utility and transportation agencies, through letters and emails, to inform and invite individuals and organizations to a series of stakeholder discussions which would lay the groundwork for the analysis of potential sediment load reducing projects which could be considered under this analysis. Overall, a series of three meetings took place, beginning on June 21, 2017, until October 26, 2017 when the final meeting was held. These meetings, in addition to the participating municipalities, were attended by representatives of:

- **Aqua** (Now known as Essential Utilities)
- **Meadowood** (A senior living community in Worcester Township)
- **Montgomery County Conservation District**
- **Montgomery County Planning Agency**
- **PennDOT**
- **Perkiomen Watershed Conservancy**

For potential projects discussed, project data was gathered from the various township representatives and stakeholders so that these could be quantified and counted towards sediment reduction. In addition, potential candidate sites were also discussed. After gathering location and mapping data from the municipalities' engineers and stakeholders, an assessment of potential projects was conducted. During this first phase of this planning effort, a cross-section of potential projects was selected based on a variety of factors, including land ownership rights, size of site, area of tributary lands, location in watershed, etc. From approximately twenty-seven (27) potential projects, the field was narrowed down to which projects would likely provide the highest benefit versus cost towards meeting the sediment and phosphorus reduction goals of this program and those projects were made part of the short-term sediment and phosphorus reduction projects described in Section 6.3.2 of this report.

3.2 | Public Notification

PA DEP Requirement: “The applicant shall make a complete copy of the PRP available for public review”

A complete copy of this TMDL Plan is available for review by the public at the following locations:

- Hatfield Township Administration Building
- Worcester Township Administration Building
- Towamencin Township Administration Building
- Lower Providence Township Administration Building
- Skippack Township Administration Building

PA DEP Requirement: “The applicant shall publish, in a newspaper of general circulation in the area, a public notice containing a statement describing the plan, where it may be reviewed by the public, and the length of time the permittees will provide for the receipt of comments. The public notice must be published at least 45 days prior to the deadline for submission of the PRP to DEP. Attach a copy of the public notice to the PRP”.

The required public notice will be printed in the local paper in April of 2022. A copy of the public notice and proof of publishing will be attached in **Appendix F**.

PA DEP Requirement: “The applicant shall accept written comments for a minimum of 30 days from the date of public notice. Attach a copy of all written comments received from the public to the PRP.”

Written comments will be received from April to May of 2022. A copy of the written comments received from the public will be attached in **Appendix F**.

PA DEP Requirement: “The applicant shall accept comments from any interested member of the public at a public meeting or hearing, which may include a regularly scheduled meeting of the governing body of the municipality or municipal authority that is the permittee.”

Verbal comments will be accepted from the public at the regularly scheduled Township Board of Supervisors meetings during the month of April & May 2022. A copy of the verbal comments will be attached in **Appendix F**.

PA DEP Requirement: “The applicant shall consider and make a record of the consideration of each timely comment received from the public during the public comment period concerning the plan, identifying any changes made to the plan in response to the comment. Attach a copy of the permittees’ record of consideration of all timely comment received in the public comment period to the PRP.”

All written and verbal public comments will be considered and a written response to each comment will be attached in the **Appendix F**.

SECTION 4 | **MAPPING**

4.1 | **Primary Mapping**

PA DEP Requirement: “Attach a map that identifies land uses and/or impervious/pervious surfaces and the storm sewershed boundary associated with each MS4 outfall that discharges to impaired surface waters, or surface waters draining to the Chesapeake Bay (see note below), and calculate the storm sewershed area that is subject to Appendix D and/or Appendix E. In addition, the map must identify the proposed location(s) of structural BMP(s) that will be implemented to achieve the required pollutant load reductions.” “The MS4 may display the storm sewershed for each MS4 outfall or just the PRP Planning Area, at its discretion.”

A map showing the MS4 planning area and current land covers is included in **Appendix E**. For discussion purposes, elements of the full-sized maps are also represented in **Sections 4 and 6** of this plan. A map showing the planning area and the locations of structural BMPs proposed to meet the minimum required reductions in pollutant loading for this planning period is provided in **Figure 6.3** and **Figure 6.4**.

4.2 | **Supplementary Mapping & Description**

Skippack Watershed

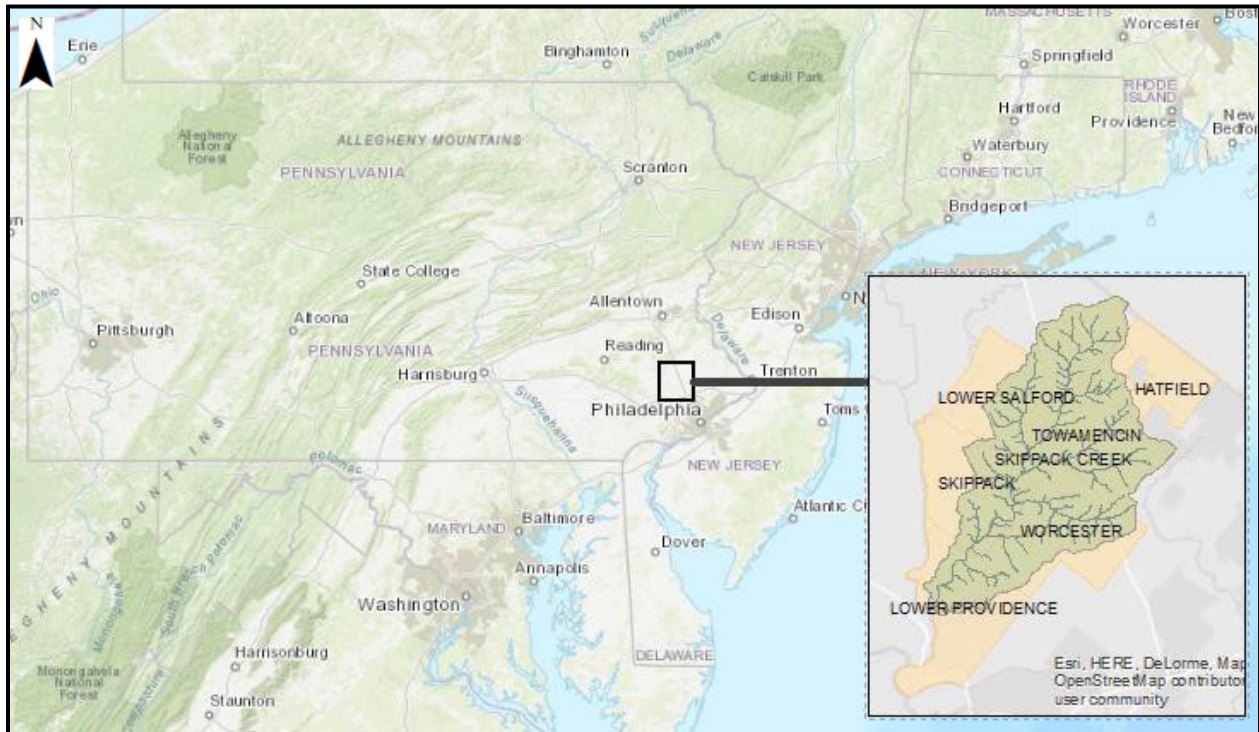


Figure 4.1: Skippack Creek Watershed Location Map

The Skippack Creek is a major tributary of the Perkiomen Creek located primarily in Montgomery County, Pennsylvania with some small areas within Bucks County. The watershed contributes to approximately 106.5 miles of streams and tributaries and encompasses a 55.8 square-mile area. Historically, the Skippack Creek watershed served as a productive farming region. Over the last 50 years the area has rapidly transitioned to residential and commercial areas. Much of the wetlands, streams, and meadows that once dominated this landform providing water recharge, stormwater controls, and animal habitats have been replaced by residential and commercial development.

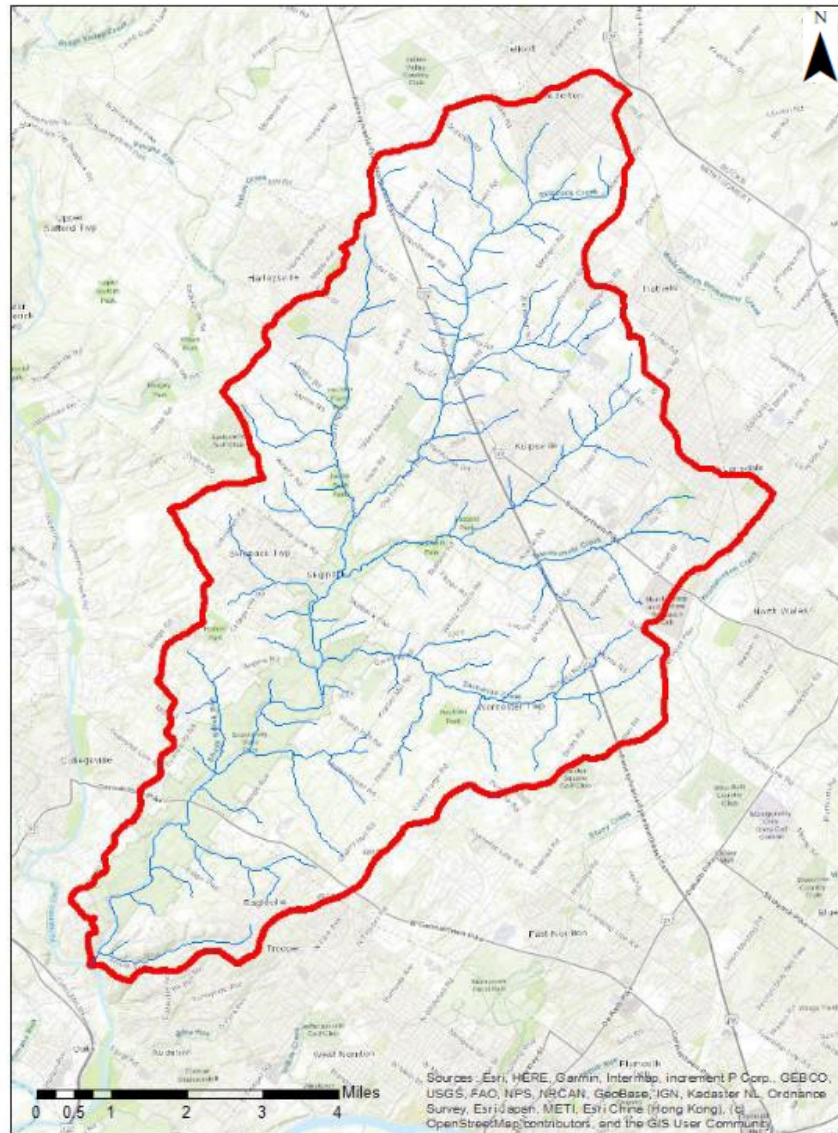


Figure 4.2: Skippack Creek Watershed

Agricultural soils of statewide importance are concentrated along the Skippack Creek which supported early farming settlements, and about one-third of the Skippack Creek watershed remains in agricultural use today. In addition, the 3,278 acres of the Evansburg State Park is home to a small population of plant species of special concern.

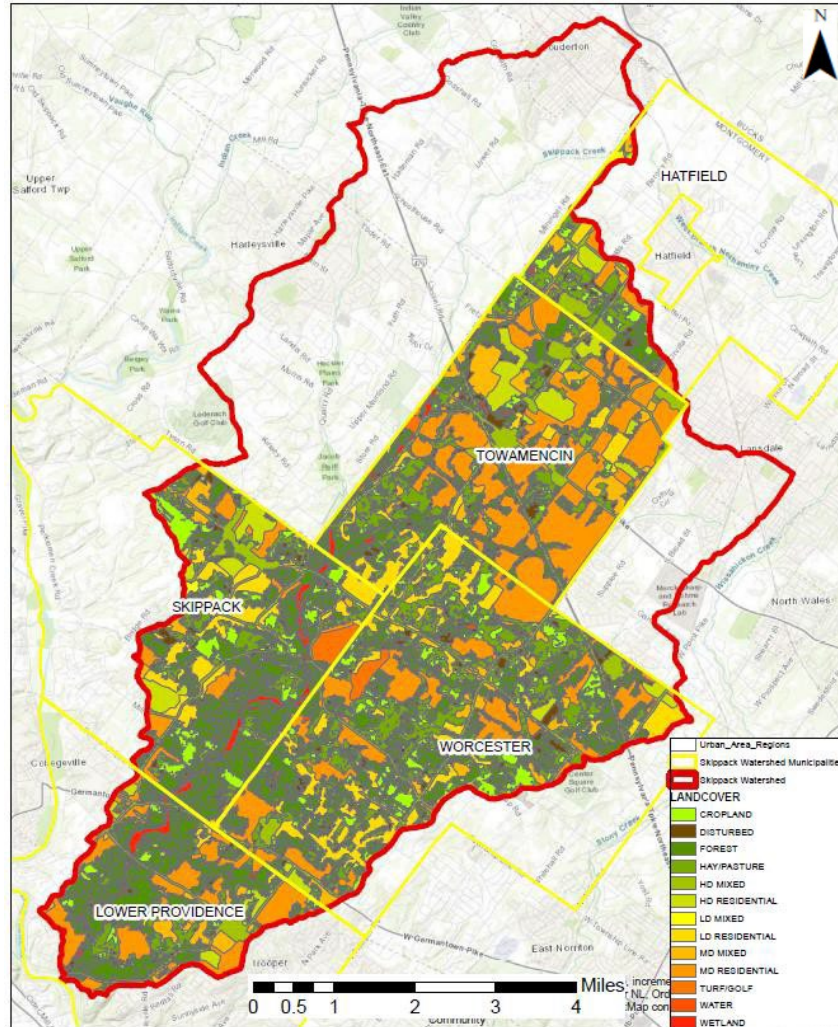


Figure 4.3: 2006 Land Cover Data per Multi-Resolution Land Characteristics (MRLC) consortium

Human activities have had widespread impacts on the Skippack and Perkiomen Creeks, including increasing pollution, sedimentation, and erosion associated with stormwater runoff from urbanizing landscapes, as well as point sources of discharge. Dams, created to enhance industrial development more than a century ago, still impact the creek through impoundment, flow alteration, and flow variability. While Evansburg State Park’s intact forests protect about half of the main stem of the Skippack Creek, loss of forest cover in the headwater and upstream segments of the creek exacerbates point and non-point source pollutants from land uses and stream erosion.

SECTION 5 | TMDL ASSESSMENT

5.1 | Pollutant of Concern

PA DEP Requirement: “Identify pollutant of concern”

Skipack Creek is designated as Trout Stock Fishery. The Skipack Creek main stem and tributaries are listed as impaired for siltation/sediment and has a Siltation/Sediment TMDL, which was issued by US EPA in 2005.

Skipack Creek was also initially regulated by TMDL for Phosphorus. However, this requirement was withdrawn shortly after acceptance of the 2005 study. Currently, reductions to phosphorous is being required through PRP as it is listed in the PADEP Integrated Water Quality Report with lower reaches of the Creek having been designated for impairment by nutrients, since 1996.

5.2 | Past Reported TMDL

Title of TMDL: U.S. Environmental Protection Agency, Region 3, Total Maximum Daily Load for Skipack Creek, Montgomery County, Pennsylvania, April 8, 2005.

Watershed Name: Schuylkill Watershed HUC: 02040203

MS4 Permittees subject to TMDL:

Table 5.1. Municipalities Subject to Skipack Creek TMDL within HUC 0204020

Municipality	County
Franconia Township	Montgomery
Hatfield Township	Montgomery
Hilltown Township	Bucks
Lansdale Borough	Montgomery
Lower Providence Township	Montgomery
Lower Salford Township	Montgomery
Skipack Township	Montgomery
Souderton Borough	Montgomery
Telford Borough	Montgomery
Towamencin Township	Montgomery
Upper Gwynedd Township	Montgomery
Worchester Township	Montgomery

(Note: Municipalities in bold are participants of this plan)

Skipack Creek Watershed Alliance Waste Load Allocations and Required Reduction:

Table 5.2 shows the sediment load allocated to selected municipalities with MS4s in the Skipack watershed, as well as the estimated current sediment load being discharged from the 2005 TMDL Report.

Table 5.2. Existing Pollutant Loads for Alliance Communities in the Skippack Watershed¹

Component/Source	Allocated Sediment Load (lbs/yr)	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	1,742,235	2,126,160	18%	383,925
Lower Providence	1,694,657	2,067,511	18%	372,854
Skippack	2,242,531	2,735,864	18%	493,333
Towamencin	11,009,513	13,545,558	18%	2,536,045
Worcester	3,740,010	4,563,192	18%	823,182
Total	20,428,946	25,038,285	18%	4,609,339

¹ Summary table reflects sediment baseline load from the original TMDL Report for Skippack Creek (2005).

Counties Subject to TMDL within HUC: Montgomery & Bucks County

Allocated Pollutant Loadings: Refer to Table 5.2 and Section 5.2.

Reductions in Pollutant Loadings Necessary to Meet WLA: Refer to Table 5.2 and Section 5.2.

List of Control Measures to Meet the TMDL: Refer to Section 6.0.

Analysis of Pollutant Load Reductions and Implementation Timeline: Refer to Section 6.0.

5.3 | Updated Baseline Sediment Loads & Reductions

5.3.1 MapShed

From “NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) INDIVIDUAL PERMIT TO DISCHARGE STORMWATER FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s) TMDL PLAN INSTRUCTIONS” 3800-PM-BCW0200d Rev. 3/2017:

“MS4s may choose to calculate existing load(s) for a TMDL Plan through a new modeling effort using the MapShed model developed by the Pennsylvania State University (www.mapshed.psu.edu) or a comparable, or more robust, continuous simulation model. Any new modeling effort must focus on the TMDL Planning Area and account for overland flow as well as downstream channel and bank erosion; therefore, modeling must be done at a scale that allows for the quantification of both impacts. New modeling must utilize the same land use/land cover information that was used to develop the TMDL or other quality assured land use/land cover data from the time of TMDL approval. DEP recommends that prior to and/or during any new modeling effort that MS4s contact DEP’s Bureau of Clean Water, Water Quality Division, TMDL Section at (717) 787-5017 for guidance.”

Baseline sediment loads in the Skippack Creek watershed were recalculated using the MapShed modeling tool. MapShed was utilized in this plan because: 1) It is understood that MapShed is the preferred platform by PADEP to support TMDL planning and compliance in the Commonwealth; 2)

MapShed allows for consistency in the calculation of reduction benefit within the same tool used to calculate reduction targets; and 3) This approach is consistent with the approach of other MS4s in the Commonwealth, including by nearby municipalities with shared TMDL responsibilities.

MapShed was developed by Dr. Barry Evans of Penn State University in collaboration with PADEP, which has also funded the development of the model. The MapShed modeling tool was used to inform this strategy (Version 1.5.0) includes an enhanced version of the core Generalized Watershed Loading Function model (GWLF). The predecessor to the GWLF model, AVGWLF, was previously used in determining the waste load allocations that were published in the TMDLs. In August 2011, the AVGWLF model algorithm was replaced by GWLF-E, which provides additional capabilities not included in the older program. Of note, the enhanced GWLF-E model more effectively simulates waste load generation from streambank erosion. Also to note, version 1.5.0 incorporates methodology recommended by the Chesapeake Bay Expert Panel Report for determining variable wasteload reduction rates. This methodology was used to determine BMP reduction percentages described within this plan.

Baseline sediment loads were recalculated for the entire Skippack watershed. Dr. Evans supported in the modeling effort, providing source data and consultation. Each of the Municipalities’ contribution to baseline sediment loading was calculated using MapShed’s Urban Area Viewer tool. The results of updated baseline sediment load modeling each of the members of the Alliance are provided in **Appendix B**. MapShed output documentation for updated baseline sediment load calculations for both the entire watershed and for the group is also included in **Appendix B**. This documentation includes the breakdown of sediment loads from overland sources and sediment loads from streambank erosion within the overall watershed.

Table 5.3. New Pollutant Loads for Alliance Communities in the Skippack Watershed as calculated in MapShed²

Component/Source	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	1,213,633	18%	218,450
Lower Providence	2,259,855	18%	406,774
Skippack	2,218,150	18%	399,267
Towamencin	5,530,290	18%	995,452
Worcester	3,793,281	18%	682,791
Total	19,243,757	18%	2,702,734

² Summary table reflects newly calculated baseline totals using same landuse information as the original adopted study.

5.3.2 Parsing & Final Determination of Wasteload Reduction Figures

Per guidance provided by EPA and PADEP, it was noted in the original TMDL report that *"MS4s will be responsible for evaluating and mapping out areas that are draining to or discharging to storm sewers."*

From “SKIPPACK CREEK WATERSHED TMDL” (EPA, 2005)

“At this time, EPA cannot determine what portion of the municipalities are designated/used for collection or conveying stormwater, as opposed to portions that are truly nonpoint sources. As part of the Phase II stormwater permit process, MS4s will be responsible for evaluating and mapping out areas that are draining to or discharging to storm sewers. Since these systems have not yet been delineated, the TMDL lumps nonpoint source loadings into the WLA portion of the TMDL. Once these delineations are available, the nonpoint source loadings can then be separated out of the WLAs and moved under the LA. Until that time, the WLAs have been broken down by land uses.”

From “NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) INDIVIDUAL PERMIT TO DISCHARGE STORMWATER FROM SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS (MS4s) TMDL PLAN INSTRUCTIONS” 3800-PM-BCW0200d Rev. 3/2017:

“Parsing may also be undertaken where a TMDL utilized the entire land area of a municipality instead of the storm sewershed of outfalls discharging to TMDL waters (TMDL Planning Area). In such cases the MS4 is not required to take responsibilities for pollutant loads generated outside of the TMDL Planning Area and may therefore parse out that area.”

Over the course of 2019, delineation of drainage areas which were tributary to municipally owned sewer systems was carefully conducted. This process was performed under extensive coordination and supervision by PADEP to assure that any areas parsed from study area was done so pursuant to guidance provided under PADEP’s TMDL Plan Instructions, last revision 2017. Detailed mapping of regulated sewersheds for the multi-municipal permit group can be found in **Appendix E**. A summary of the subsequent reductions evaluated in MapShed from parsing is below in **Table 5.4**.

Table 5.4. New Pollutant Loads for Alliance Communities in the Skippack Watershed After Parsing³

Component/Source	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	479,986	18%	86,398
Lower Providence	1,414,072	18%	254,533
Skippack	1,660,750	18%	298,935
Towamencin	3,574,083	18%	643,335
Worcester	2,107,028	18%	379,265
Total	9,235,919	18%	1,662,465

³ Summary table reflects newly calculated baseline totals using same landuse information as adopted study and restricted to the regulated sewersheds (planning areas) of the Skippack Creek Watershed Alliance permit group.

SECTION 6 | ANALYSIS OF TMDL PLAN OBJECTIVES

A Total Maximum Daily Load (TMDL) for the Skippack Creek was established and accepted by PADEP and EPA in April 8, 2005. The establishment of a TMDL resulted from the Skippack creek being listed as not meeting minimum water quality standards based on impairment by sediment contribution to (and within) the waterway. In the TMDL report, thresholds were established which notates the maximum amount of sediment the watercourse can naturally attenuate. These limits are known formally as, wasteload allocations (WLAs). These WLAs also represent the maximum amount of sediment the permittees' is allowed to discharge from their municipal separate storm sewer systems (MS4s.)

In the previous section, this was discussed in terms of required reductions prescribed by the 2005 TMDL Report, recalculation of the TMDL, and in terms of the assignment of the portion of the overall TMDL which this group is responsible for, known as its planning area.

This section discusses the background of the TMDL study and highlights the planning tools and methodology used to identify potential projects which were evaluated and ultimately prioritized in this restoration plan.

6.1 | Background of the Skippack Creek Watershed TMDL

The required reduction of 18% was determined by a reference watershed study. A reference watershed study compares two watersheds with similar characteristics including area, land use distribution, underlying geology, and soils. One, representing what can be characterized as a more ideal watershed, with minimal impairments, which is used to understand and predict the exceedance of wasteload beyond what would meet EPA clean water standards in the subject watershed. Using AVGWLF, a calculation using a Generalized Watershed Loading Function (GWLF) was used to determine the amount of sediment generated from the watershed using similar inputs as the original model used to establish the TMDL for Skippack which was the program (Arc View Generalized Watershed Loading Function or AVGWLF). A process that compared the sediment loads from each watershed, from those calculations conducted for the 2005 TMDL report, it was determined that a reduction of 18% to the current load from the impaired watershed was required to mitigate the impairment. Then, an Equal Percent Marginal Reduction (EPMR) was applied to each pollutant source to provide reductions from each landuse in the impaired watershed that would equate to the ultimate reduction of 18% watershed wide. Finally, the wasteloads were allocated to each municipality based on the area of each landuse within their municipal boundary.

In 2014, based on input from PADEP, it was suggested that while the overall reduction percentage that was calculated in the original reference watershed study described above, that the watershed be restudied using a newer version of the AVGWLF program (MapShed). For the purposes of complying with current permitting requirements, in 2015 it was decided that baseline loading would be recalculated using MapShed.

6.2 | Analysis of Potential Impairment Sources

Having employed MapShed as a recommended modeling tool by PADEP, as both an analysis tool for recalculation of pollution reduction targets and assessment of potential reduction from BMPs; a pre-assessment of areas within the watershed was conducted to determine which areas have been most impacted from urbanization. In addition, an analysis in GIS was conducted to assess two circumstances. One, the density of impervious area within the Skippack, by Sub-Shed and two, the degree of which development has directly impacted and encroached upon the natural floodplains of the Skippack.

This analytical method was originally proposed in the paper *Using GIS for Prioritization in Subwatershed Restoration* by Horvath & Bishop of Pennsylvania State University. This analysis provided a means of leveraging GIS data to assess areas most likely to be impaired from past development activity and along with land ownership rights and cost, was used as a factor in determining which projects and regions within the watershed would be prioritized for restoration planning. 1 meter resolution landcover data from Pennsylvania Spatial Data Access (PASDA) was used as source data this analysis and data was discretized based on sub-sheds within the Skippack. Sub-sheds identified as having greater impervious areas were given greater priority for future project planning.

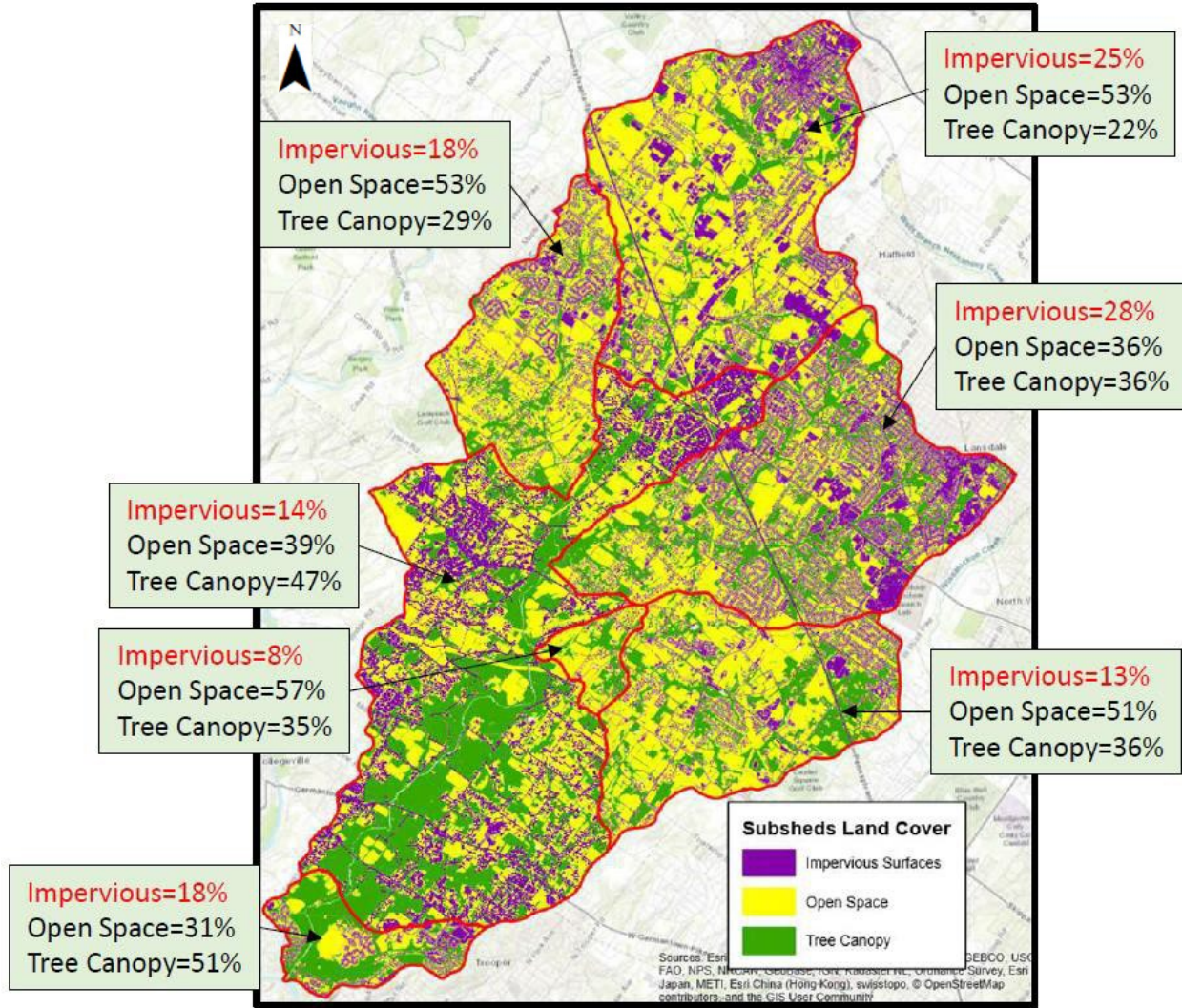


Figure 6.1: Impervious Area by Sub-Shed Analysis

Based on procedures derived from this paper, it was determined that a more ideal circumstance for the stream corridor would be to have a wooded or vegetated condition. For this evaluation, 1M resolution land cover data was again used and applied to effective FEMA floodplain regions throughout the Skippack. For tributaries which did not have a FEMA floodplain, a 100' buffer was applied. Once the region was defined percentages for land cover types were calculated for each sub-basin as a means of evaluating which stream corridors may likely have been most impacted from past development.

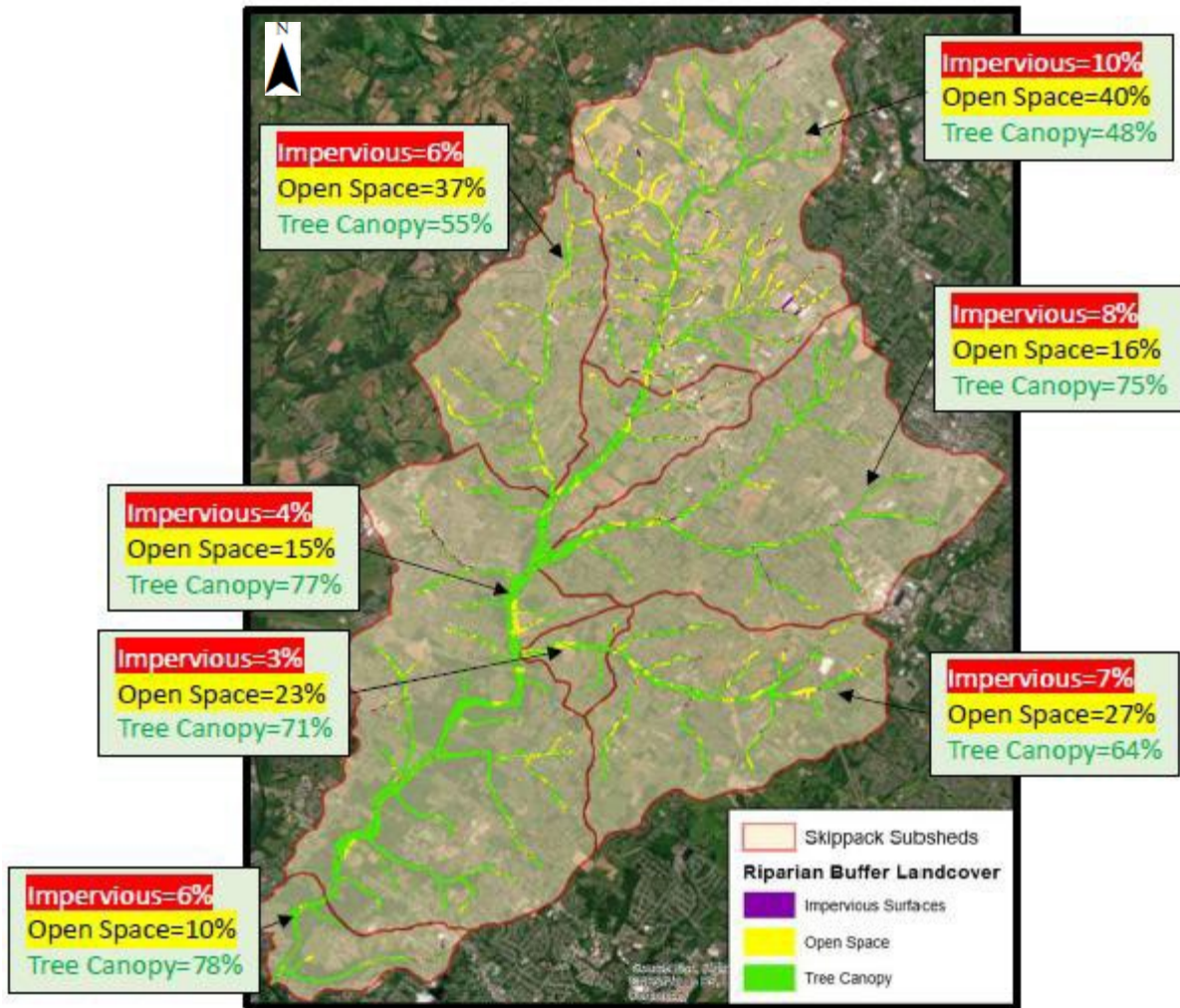


Figure 6.2: Estimated Impacts to the Stream Corridor within the Skippack Creek Watershed

6.3 | Long-Term Reductions

PA DEP Requirement: the MS4 must present, at a minimum, a conceptual plan for how the WLA(s) will be achieved, long-term

As noted, during the initial phase of planning, 27 individual projects were considered and evaluated. Cumulatively, the estimated sediment reduction value of these projects would be far greater than the 18% reduction required by the permit. The approach taken by the permit group was to evaluate within GWLF-E, all of the potential restoration BMP projects that were possible and prioritize them based on a variety of factors including cost per unit treatment, likelihood for timely execution, land rights, cost of maintenance, and others. This shortlist became the list of projects which were forwarded for execution in the next permit term and are discussed in **Section 6.4**.

6.4 | Short-Term Reductions

Pursuant to 2.F.2 of the PA DEP TMDL Plan Instructions the Alliance is electing to meet a short-term goal of 10% for sediment wasteload reduction as this is a more feasible option in terms of acquiring land access permissions and permitting necessary for the work.

Table 6.1: Short-Term Pollution Reduction Goals (10% Reduction)⁴

Component/Source	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	479,986	10%	47,999
Lower Providence	1,414,072	10%	141,407
Skippack	1,660,750	10%	166,075
Towamencin	3,574,083	10%	357,408
Worcester	2,107,028	10%	210,703
Total	9,235,919	10%	923,592

⁴ Summary table reflects newly calculated baseline totals summarized in Table 4 with a short-term goal of meeting a 10% reduction to sediment loads by the end of the next permit period (2026).

6.3.1 Method of Pollution Control

Since the US EPA’s approval of the Skippack’s TMDL, the Alliance has implemented several sediment reduction control measures throughout watershed and are planning many others to be implemented over the next and subsequent permit periods. These control measures consist of BMPs which infiltrate, filter, and that detain stormwater runoff, which reduces streambank erosion and resulting sediment and phosphorus transport.

In addition to restoration BMPs the Skippack Creek Watershed Alliance have also adopted MS4 ordinances language provided by the Montgomery County Planning Commission directed at addressing common point source pollutant activities. This language has been incorporated individually in the member municipalities’ current Subdivision and Land Development Ordinances or Stormwater Management Ordinances which can be found on the website links below.

Link to MS4 Ordinances by Township:

Hatfield Township: <https://www.ecode360.com/10504020>

Lower Providence: <https://www.ecode360.com/32932560>

Skippack Township: <https://ecode360.com/6992071>

Towamencin Township: <https://www.ecode360.com/14335850>

Worcester Township: <https://ecode360.com/33953391>

6.3.2 Future Planned Control Measures (Short-Term)

Since the US EPA's approval of the Skippack's TMDL, the Alliance has planned a number of sediment reduction control measures throughout watershed. In addition to restoration activities within the creek, these control measures also consist of BMPs that infiltrate, filter, and detain stormwater runoff, which reduces streambank erosion and the resulting transport of sediments.

For the next permit term, a combination of restoration BMPs are proposed. Including:

- Bioretention
- Regional Water Quality Basins
- Basin Retrofits
- Riparian Buffers
- Agricultural Land Retirement
- Floodplain Restoration
- Streambank Stabilization

The strategy provides a balanced approach with addressing source control issues as is the case with selecting program areas for large regional water quality basins, bioretention and reestablishment of riparian buffers, as well as directly addressing damage to the ecological system through restoration of heavily scoured riverine areas through streambank restoration and floodplain enhancement projects. Utilizing a cross-section of recommended BMPs will allow the Alliance to monitor the effectiveness of various types of BMPs to help evaluate, for subsequent permit periods, which restoration techniques should be prioritized in the future. As discussed, this section describes prescribed steps required to achieve a short-term goal of 10% reduction of the sediment load, through modeling, with a 5% phosphorus reduction being presumed through sediment reduction.

Summary of Projects Proposed in First Permit Period and Estimated Benefits of Execution:

- 22.8 Acre feet of volume storage (Regional WQ Basins, basin expansions & Bioretention)
- 5,240 LF of Stream Bank Repair
- 2 Floodplain Restoration Projects
- Riparian Buffer Restoration
- Estimated Annual Reduction of 935,600 lbs/yr of Sediment Load
- Estimated Annual Reduction of 560.1 lbs/yr of Phosphorous Load
- Program Budget for first permit term: \$3.83M

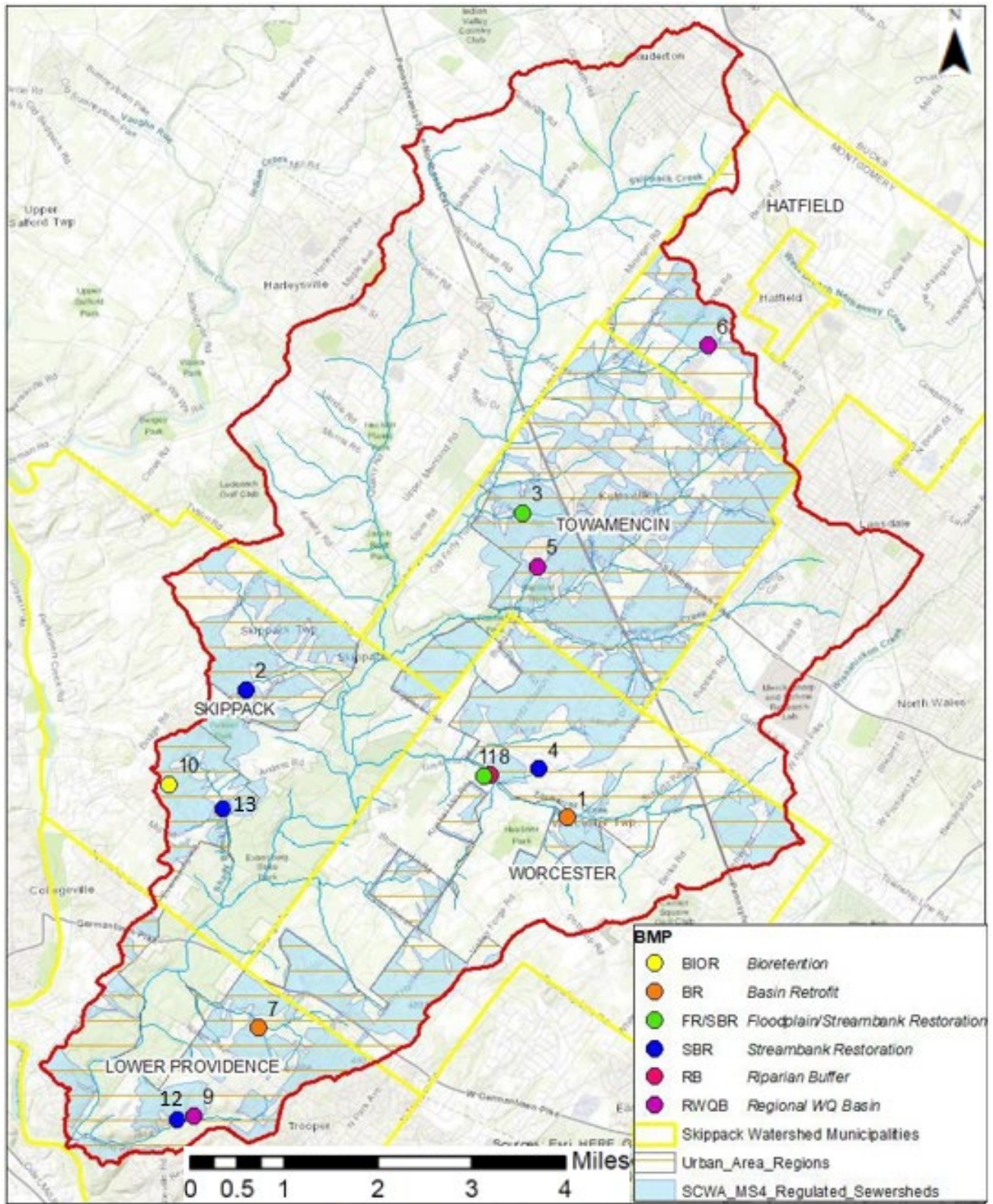


Figure 6.3: Location Map of Proposed BMP Projects (Short-Term)

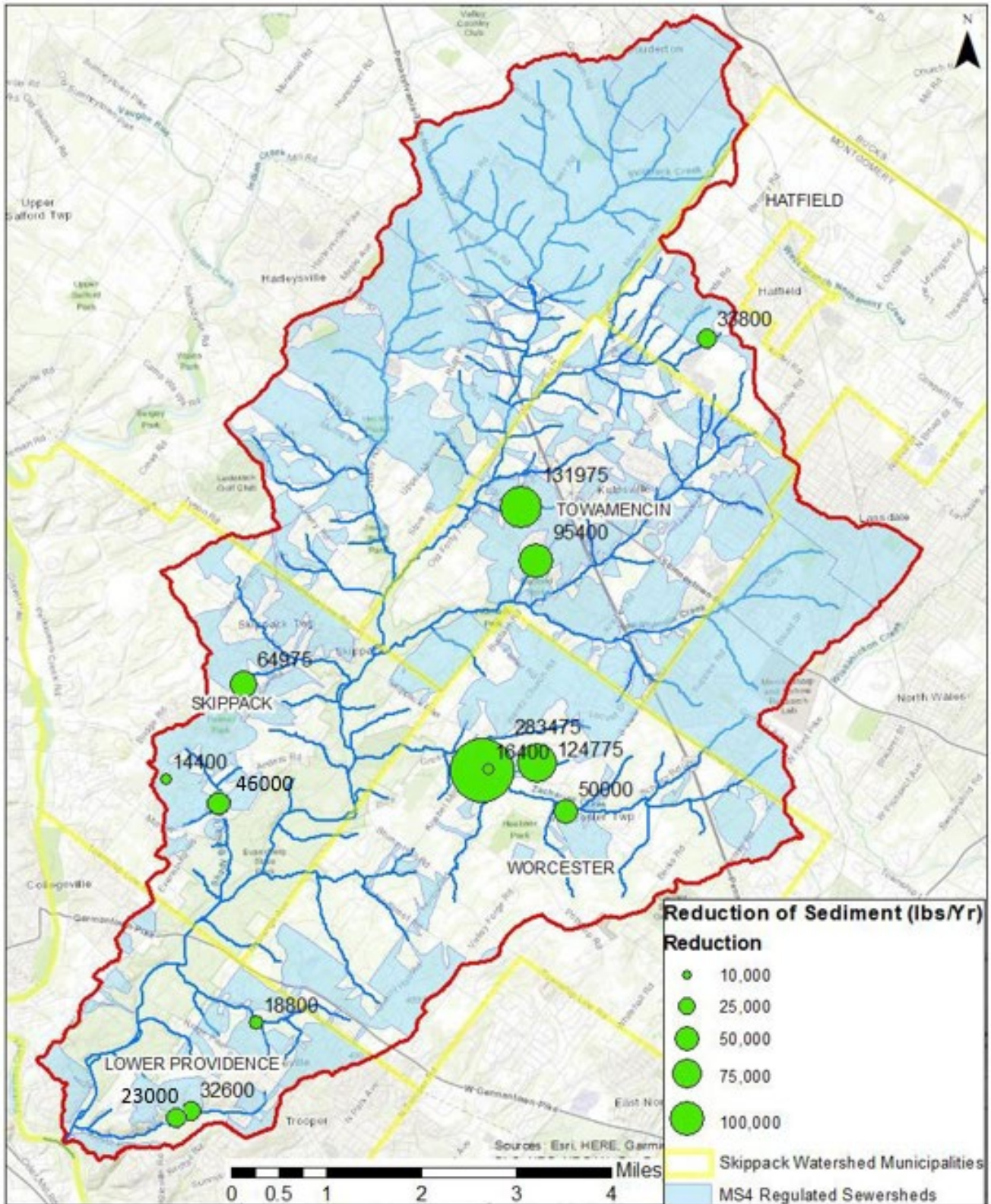


Figure 6.4: Estimate Sediment Reduction Potential by Project Location (Short-Term)

Table 6.2: Proposed (Short-Term) Restoration Best Management Practices

Project No.	Project Description (PROPOSED PROJECTS)	Lbs./Yr. (Reduction)
1	Worcester Basin Retrofit	50,000.00
2	Cholet Farms Stream Restoration Project	64,975.00
3	Towamencin Floodplain Restoration	131,975.00
4	Worcester Twp Stream Restoration Program Phase I	124,775.00
5	Nash Elementary Regional Water Quality Basin	95,400.00
6	Pennfield Middle School Regional Water Quality Basin	33,800.00
7	Lower Providence Property Basin Retrofit	18,800.00
8	Worcester Township Riparian Buffer	16,400.00
9	Eagleville Correctional Regional Water Quality Basin	32,600.00
10	Perkiomen Valley Airport Bioswales (Private)	14,400.00
11	Worcester Twp Stream Restoration Program Phase II	283,475.00
12	Visitation Road Stream Restoration Project	23,000.00
13	Shady Brook Run Stream Restoration Project	46,000.00
	Total Reduction from Proposed Projects (Primary)	935,600.00

Table 6.3: Summary of Completed and Proposed Projects

Summary	Reduction
COMBINED SED. LOAD GENERATED BY ALL MEMBER MUNICIPALITIES (lb/yr)	9,235,919
10% OF COMBINED SED. LOAD [ALL MUNICIPALITIES (LB/YR)]	923,592.00
TOTAL REDUCTION FROM NEW PROJECTS (lbs/yr)	935,600.00
Total Estimated Reduction by Completed & Proposed Projects (Short-Term)	10.13%

6.5 | Adaptive Management

Overall, the scale of these programs are quite large and will take time for benefits to be realized. No one can predict with any certainty what partnerships and cooperatives will or will not form to meet these objectives. The goal of this document is to predict the most feasible path forward with complying with EPA clean water goals. The emphasis here is that this document represents a prediction of one possible route to accomplish these goals. The hallmark of any good program is its capability to be dynamic, and adaptive enough to consider new partnerships, data, funding opportunities, technologies, and methodologies. In execution of this program, it should be noted that while this plan provides a clear path to compliance; future circumstances may necessitate some variance in initial decisions made in route to meeting these objectives. As deviations are made, it will be noted during MS4 annual reporting and updated in the current plan. During the initial phase of planning, 27 individual projects were considered and evaluated. In the event that any of the projects noted in **Section 6.3.2** may not be able to be executed in the next permit period, a listing of potential alternative projects identified in **Figure 6.5 and Table 6.4.** can be executed during this permit period either in lieu of a primary project or as a supplement or as a supplement to currently planned projects.

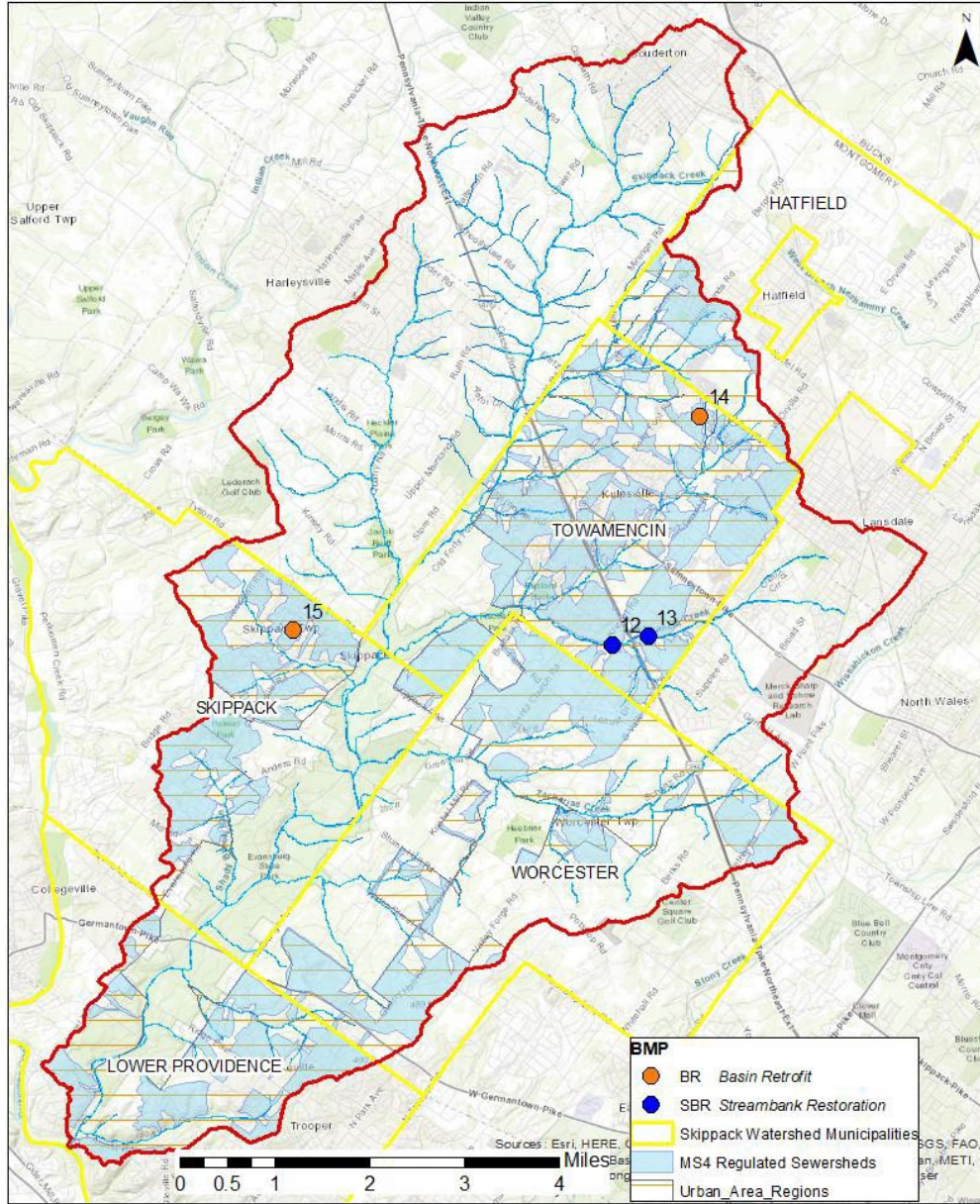


Figure 6.5: Location Map of Alternate BMP Projects (Short-Term)

Table 6.4: Proposed Alternate Best Management Practices Projects

Project No.	Project Description (PROPOSED PROJECTS)	Lbs./Yr. (Reduction)
12	Kriebel Road Stream Restoration Area	330,855.00
13	Anders Road (Downstream of PA Turnpike) Stream Bank Restoration	211,600.00
14	Grist Mill Park Basin Retrofit	8,400.00
15	Skippack Township Recreation Area Basin Retrofits	38,200.00
	Total Reduction from Alternate Projects	589,055.00

Table 6.6 provides a summary of both primary and alternate projects. Overall, it is estimated that executing all of these projects would result in a reduction of sediment load of over 16%, which is greater than the 10% required during the next permit period.

Table 6.5: Estimated Reduction Value Summary of Past, Proposed & Alternative Projects

Summary	Reduction
COMBINED SED. LOAD GENERATED BY ALL MEMBER MUNICIPALITIES (lb/yr)	9,235,919
10% OF COMBINED SED. LOAD [ALL MUNICIPALITIES (LB/YR)]	923,592.00
TOTAL REDUCTION FROM ERA 3 (NEW) PROJECTS (lbs/yr)	935,600.00
TOTAL REDUCTION FROM ALTERNATE PROJECTS (lbs/yr)	589,055.00
Estimated Reduction Value of all Planned Projects Listed (Must be > 10%)	16.51%

The Skippack Creek Watershed Alliance through continued stakeholder engagement, public outreach and education campaign will continue to look for projects and programs which will provide exceptional value to the region in terms of pollutant reduction, consensus building, and bolstering of resource capacity within the watershed. The minimum control measure plan and this Strategy describe how the Alliance has and continues to continue to foster education campaigns and public outreach with specific performance goals and deadlines. It is understood that this plan is a living document that will allow for flexibility in its execution. The projects outlined in this document represent one potential path to compliance. However, as new opportunities arise, other projects may be forwarded for execution in the future.

SECTION 7 | **FUNDING MECHANISMS**

PA DEP Requirement:

“Applicants must identify all project sponsors and partners and probable funding sources for each BMP.”

The proposed BMPs will be funded through an agreement between participating MS4 municipalities. The group will also seek out grant and financing opportunities.

The following is a list of current funding sources for the types of BMPs currently proposed:

Pennsylvania Infrastructure Investment Authority (PENNVEST) and Pennsylvania Department of Environmental Protection | Green Initiatives

PENNVEST actively funds green initiatives that promote and encourage environmental responsibility and enhance water quality. Solutions include riparian buffers, rain gardens, and floodplain and wetland restorations.

URL: <http://www.pennvest.pa.gov/Information/Funding-Programs/Pages/default.aspx>

Contact: Brion Johnson | bjohnson@pa.gov | 717-783-6798 or Steven Anspach | sanspach@pa.gov | 717-783-6589

Department of Community & Economic Development | Commonwealth Financing Authority (CFA)

The DCED-CFA was established as an independent agency of the Commonwealth to administer Pennsylvania's economic stimulus packages. DCED-CFA holds fiduciary responsibility over a variety of funding sources some of which provide funding for stormwater and stormwater-related projects, including:

- Watershed Restoration and Protection Program (riparian buffers, stream restorations, water quality basins, floodplain restoration)
- Greenways, Trails and Recreation Program (installation of green infrastructure at parks)
- Local Share Account programs

URL: <http://dced.pa.gov/programs-funding/>

Contact: <http://dced.pa.gov/download/regional-contact-information/?wpdmdl=61870>

Department of Conservation and Natural Resources | Community Conservation Partnerships Program (C2P2)

DCNR grants can be used for green/sustainable park, riparian buffers, and implementing recommendations of Rivers Conservation Plans.

URL: <http://www.dcnr.state.pa.us/brc/grants/>

Contact: <http://www.dcnr.state.pa.us/brc/aboutus/index.htm?tab=RegionalOffices#RegionalOffices>

Department of Environmental Protection | Growing Greener Watershed Protection Grants

Funding for protection and restoration of Pennsylvania’s water resources, including stream restorations and installation of stormwater BMPs in urban areas.

URL: <http://www.dep.pa.gov/Citizens/GrantsLoansRebates/Growing-Greener/Pages/default.aspx>

Contact: DEP Grants Center | GrowingGreener@pa.gov | 717-705-5400

Department of Transportation | Transportation Alternatives – Set Aside Grants

Funding for stormwater projects that decrease the negative impact of stormwater runoff from roads, including detention and sediment basins and stream channel stabilization.

URL: <https://sportal.dot.pa.gov/Planning/AppReg/TAP/Pages/default.aspx>

Contact: Chris Metka | CMetka@pa.gov | 717-787-8065

SECTION 8 | OPERATIONS & MAINTENANCE

With the exception of riparian buffer work which may be contracted to the Perkiomen Watershed Conservancy, all BMPs proposed in this plan will be the responsibility of the permittee (Skippack Creek Alliance).

Surface Infiltration (Bioretention) Basin

The following represents the recommended maintenance for surface infiltration (bioretention) basins:

- Catch Basins and Inlets (upgradient of infiltration basin) should be inspected and cleaned at least 2 times per year and after runoff events.
- The vegetation along the surface of the Infiltration basin should be maintained in good condition any bare spots revegetated as soon as possible.
- Vehicles should not be parked or driven on an Infiltration Basin and care should be taken to avoid excessive compaction by mowers.
- Inspect the basin after runoff events and make sure that runoff drains down within 72 hours.
- Mosquitoes should not be a problem if the water drains in 72 hours. Mosquitoes require a considerably long breeding period with relatively static water levels.
- Inspect for accumulation of sediment, damage to outlet control structures, erosion control measures, signs of water contamination/spills, and slope stability in the berms.
- Mow only as appropriate for vegetative cover species.
- Remove accumulated sediment from basin as required. Restore original cross section and infiltration rate. Properly dispose of sediment.

Extended Detention Basins (Regional Water Quality Basins)

Maintenance is necessary to ensure proper functionality of the extended detention basin (Regional Water Quality Basins) and should take place on a quarterly basis. A basin maintenance plan should be developed which includes the following measures:

- All basin structures expected to receive and/or trap debris and sediment should be inspected for clogging and excessive debris and sediment accumulation at least four times per year, as well as after every storm greater than 1 inch.
- Structures include basin bottoms, trash racks, outlets structures, riprap or gabion structures, and inlets.
- Sediment removal should be conducted when the basin is completely dry. Sediment should be disposed of properly and once sediment is removed, disturbed areas need to be immediately stabilized and revegetated.
- Mowing and/or trimming of vegetation should be performed as necessary to sustain the system, but all detritus should be removed from the basin.
- Vegetated areas should be inspected annually for erosion.

- Vegetated areas should be inspected annually for unwanted growth of exotic/invasive species.
- Vegetative cover should be maintained at a minimum of 95 percent. If vegetative cover has been reduced by 10%, vegetation should be reestablished.

Wet Ponds/Basins (Regional Water Quality Basins or Basin Retrofits)

The following represents the recommended maintenance for wet basins:

- During the first growing season or until established, vegetation should be inspected every 2 to 3 weeks.
- Wet Ponds/Basins should be inspected at least 4 times per year and after major storms (greater than 2 inches in 24 hours) or rapid ice breakup. Inspections should assess the vegetation, erosion, flow channelization, bank stability, inlet/outlet conditions, embankment, and sediment/debris accumulation.
- The pond drain should be inspected and tested 4 times per year. Problems should be corrected as soon as possible.
- Wet Pond and buffer vegetation may need support (watering, weeding, mulching, replanting, etc.) during the first 3 years. Undesirable species should be carefully removed and desirable replacements planted if necessary.
- Once established, properly designed, and installed Wet Ponds should require little maintenance.
- Vegetation should maintain at least an 85 percent cover of the emergent vegetation zone and buffer area.
- Annual harvesting of vegetation may increase the nutrient removal of Wet Ponds; if performed, it should generally be done in the summer so that there is adequate regrowth before winter. Care should be taken to minimize disturbance, especially of bottom sediments, during harvesting. The potential disturbance from harvesting may outweigh its benefits unless the WP receives a particularly high nutrient load or discharges to a nutrient sensitive waterbody.
- Sediment should be removed from the forebay before it occupies 50 percent of the forebay, typically every 5 to 10 years.

Stream Bank & Floodplain Restoration

The following represents the recommended maintenance for Stream Bank Repair & Floodplain Restoration Projects:

- For the first year, stream restoration areas are to be inspected after each significant rain event for the first two (2) years, and after the first two years, inspected quarterly.
- Planned vegetation meant to establish stability through root structure should be monitored and replaced if displaced, dead or dying.
- Accumulated debris from storms should be picked up and disposed of.
- Any areas exhibiting scour should be mended or repaired using PA DEP approved means. Hard armoring is not allowed.

- Plants established in any floodplain restoration activity should be replaced and reestablished if dislodged or dead.

Riparian Buffer Restoration

The following represents the recommended maintenance for Riparian Buffer Restoration activities:

- For years one through two:
 - Stream restoration areas are to be inspected after each significant rain event.
 - Invasive species are to be removed or treated on a quarterly basis.
 - Trees/shrubs are to be pruned, re-staked and re-tubed as needed.
 - Dislodged or dead trees/shrubs are to be replaced annually.
- For years three through five:
 - Stream restoration areas are to be inspected on a quarterly basis.
 - Invasive species are to be removed or treated on an annual basis.
 - Trees/shrubs are to be pruned, re-staked and re-tubed as needed.
 - Dislodged or dead trees/shrubs are to be replaced annually.

SECTION 9 | REFERENCES

US Environmental Protection Agency (USEPA). October 2003. *Nutrient and Siltation TMDL Development for Wissahickon Creek, Pennsylvania.*

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Chesapeake Bay Program. January 2015. *Recommendations of the Expert Panel to Define Removal Rates for New State Stormwater Performance Standards*

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<http://www.greenspacealliance.org/home/rgp.asp?modID=17>

APPENDIX

APPENDIX A
PROGRAM SUMMARY

ID	Era 3 Candidate Projects	Reduction (lbs/yr)	Cost (\$)	\$/lb	Municipality	Municipally- Owned	LF of Stream Restoration	BMP Area (sq ft)	Description
1	Worcester Basin Retrofit	50,000.00	\$88,000.00	1.76	WT	Yes	-	87,120	Minor excavation (forebay/wet pool), re-seeding
2	Cholet Farms Stream Restoration Project	64,975.00	\$148,030.00	2.28	ST	Yes	565	-	Re-establishment of softer streambank side-slopes, plantings
3	Towamencin Floodplain Restoration	131,975.00	\$185,212.50	2.28	TT	No	525	-	Re-establishment of softer streambank side-slopes, plantings, floodplain enhancements
4	Worcester Twp Stream Restoration Program Phase I	124,775.00	\$284,270.00	2.28	WT	Yes	1085	-	Re-establishment of softer streambank side-slopes, plantings
5	Nash Elementary Regional Water Quality Basin	95,400.00	\$277,860.00	2.91	TT	No	-	183,388	A New Regional Water Quality (Extended Detention Basin) Proposed to be on both School (Nash Elementary) and Township Property (Bustard Park)
6	Pennfield Middle School Regional Water Quality Basin	33,800.00	\$146,542.92	4.34	HT	No	-	106,390	New Regional WQ Basin (Dry Extended Detention Basin) is proposed to be on school property (Pennfield Middle School)
7	Lower Providence Property Basin Retrofit	18,800.00	\$88,000.00	4.68	LPT	Yes	-	61,161	Minor excavation (forebay/wet pool), re-seeding. Conversion to Wetlands/Wet Ponds
8	Worcester Township Riparian Buffer	16,400.00	\$88,080.30	5.37	WT	Yes	-	-	Re-establishment of riparian buffer
9	Eagleville Correctional Regional Water Quality Basin	32,600.00	\$280,189.80	8.59	LPT	No	-	184,925	Regional Water Quality Basin (Wetlands), Proposed to be on County land
10	Perkiomen Valley Airport Bioswales (Private)	14,400.00	\$158,031.81	10.97	ST	No	-	39,113	Bioswales to be placed on roads edge to catch runoff from landing strip
11	Worcester Twp Stream Restoration Program Phase II	283,475.00	\$645,830.00	2.28	WT	No	2465	-	Streambank Restoration using bio-technical stabilization techniques Approximately 1600 LF
12	Visitation Road Stream Restoration Project	23,000.00	\$52,440.00	2.28	LPT	Yes	200	-	Streambank Restoration using bio-technical stabilization techniques Approximately 200 LF
13	Shady Brook Run Stream Restoration Project	46,000.00	\$104,880.00	2.28	ST	Yes	400	-	Streambank Restoration using bio-technical stabilization techniques Approximately 400 LF

Construction Costs Total	\$2,547,367.33
Estimated 5-year O&M Total	\$642,809.62
Soft Costs: Survey, Design, Permitting, Administration (15%)	\$382,105.10
Contingency (10%)	\$254,736.73
Total Estimated Program Cost	\$3,827,018.78

Permit 1 Required Reduction (10%) (lbs/yr)	923,591.93
Total Sediment Reduction from Proposed Projects (lbs/yr)	935,600
Difference in Proposed vs Required Reduction	(12,008.07)

Township	# of Projects
Worcester	4
Towamencin	2
Skippack	3
Lower Providence	3
Hatfield	1
Total Projects	13

5,240

APPENDIX B
MAPSHED BASELINE MODEL

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
GWLF-E Average Loads by Source for Watershed 0							
Source	Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	5921	424345.76	71.70	1943.35	0.33	534.36	0.09
Cropland	2254	1829197.43	811.50	7866.53	3.49	1374.23	0.61
Forest	8323	66866.20	8.00	432.52	0.05	55.78	0.01
Wetland	264	1168.45	4.40	49.74	0.19	3.20	0.01
Disturbed	2281	114089.22	50.00	292.18	0.13	100.33	0.04
Turfgrass	299	10758.56	36.00	138.71	0.46	15.72	0.05
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	5	8686.21	1737.20	18.43	3.69	5.27	1.05
LD Mixed	57	947.99	16.60	21.58	0.38	2.31	0.04
MD Mixed	1604	111090.93	69.30	2352.93	1.47	267.35	0.17
HD Mixed	2884	199738.81	69.30	4230.91	1.47	480.76	0.17
LD Residential	2945	48611.93	16.50	1119.04	0.38	120.53	0.04
MD Residential	7463	516895.82	69.30	10948.91	1.47	1244.13	0.17
HD Residential	1357	93961.02	69.20	1990.38	1.47	226.17	0.17
Water	55.002488						
Farm Animals				0.0		0.0	
Tile Drainage		0.0		0.0		0.0	
Stream Bank		34733659.6		17365.8		5200.7	
Groundwater				112159.4		1570.7	
Point Sources				0.0		0.0	
Septic Systems				0.0		0.0	
Totals	35712	38160018		160930		11202	

Figure B-1: Skippack Creek Watershed Baseline Sediment Wasteload Total Before Improvements Watershed Total – All Regions

38,160,018 lbs Sediment Load

11,202 lbs Phosphorous Load

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
View loads for municipality:		Hatfield Twp (33120)					
Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	79	5664.30	71.70	26.10	0.33	7.10	0.09
Cropland	20	16230.00	811.50	69.80	3.49	12.20	0.61
Forest	7	56.00	8.00	0.40	0.05	0.10	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	27	1350.00	50.00	3.50	0.13	1.10	0.04
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	2	33.20	16.60	0.80	0.38	0.10	0.04
MD Mixed	5	346.50	69.30	7.40	1.47	0.90	0.17
HD Mixed	42	2910.60	69.30	61.70	1.47	7.10	0.17
LD Residential	32	528.00	16.50	12.20	0.38	1.30	0.04
MD Residential	114	7900.20	69.30	167.60	1.47	19.40	0.17
HD Residential	47	3252.40	69.20	69.10	1.47	8.00	0.17
Water	0						
						Source Weighting	
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		441715.05		220.8		66.1	0.016
Groundwater				1570.2		22.0	0.014
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	375	479986.3		2209.6		145.4	

Figure B-2: GWLF-E output for planning area of Hatfield Township

479,986.30 lbs of Sediment Load

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
View loads for municipality:		Lower Providence Twp (45080)					
Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	121	8675.70	71.70	39.90	0.33	10.90	0.09
Cropland	25	20287.50	811.50	87.30	3.49	15.30	0.61
Forest	180	1440.00	8.00	9.00	0.05	1.80	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	40	2000.00	50.00	5.20	0.13	1.60	0.04
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	89	6167.70	69.30	130.80	1.47	15.10	0.17
HD Mixed	35	2425.50	69.30	51.50	1.47	6.00	0.17
LD Residential	5	82.50	16.50	1.90	0.38	0.20	0.04
MD Residential	588	40748.40	69.30	864.40	1.47	100.00	0.17
HD Residential	52	3598.40	69.20	76.40	1.47	8.80	0.17
Water	0						
				Source Weighting			
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		1328646.51		664.3		198.9	0.048
Groundwater				4149.9		58.1	0.037
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	1135	1414072.2		6080.6		416.7	

Figure B-3: GWLF-E output for planning area of Lower Providence Township

1,414,072.20 lbs of Sediment Load

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
View loads for municipality:		Skippack Twp (71016)					
Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	193	13838.10	71.70	63.70	0.33	17.40	0.09
Cropland	111	90076.50	811.50	387.40	3.49	67.70	0.61
Forest	161	1288.00	8.00	8.10	0.05	1.60	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	104	5200.00	50.00	13.50	0.13	4.20	0.04
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	7	116.20	16.60	2.70	0.38	0.30	0.04
MD Mixed	64	4435.20	69.30	94.10	1.47	10.90	0.17
HD Mixed	62	4296.60	69.30	91.10	1.47	10.50	0.17
LD Residential	356	5874.00	16.50	135.30	0.38	14.20	0.04
MD Residential	158	10949.40	69.30	232.30	1.47	26.90	0.17
HD Residential	227	15708.40	69.20	333.70	1.47	38.60	0.17
Water	0						
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		1508967.43		754.4		225.9	0.048
Groundwater				5383.7		75.4	0.048
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	1443	1660749.8		7500.0		493.6	

Figure B-4: GWLF-E output for planning area of Skippack Township

1,660,749.80 lbs of Sediment Load

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
View loads for municipality:		Towamencin Twp (77152)					
Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	284	20362.80	71.70	93.70	0.33	25.60	0.09
Cropland	32	25968.00	811.50	111.70	3.49	19.50	0.61
Forest	282	2256.00	8.00	14.10	0.05	2.80	0.01
Wetland	5	22.00	4.40	1.00	0.19	0.10	0.01
Disturbed	153	7650.00	50.00	19.90	0.13	6.10	0.04
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	128	8870.40	69.30	188.20	1.47	21.80	0.17
HD Mixed	143	9909.90	69.30	210.20	1.47	24.30	0.17
LD Residential	175	2887.50	16.50	66.50	0.38	7.00	0.04
MD Residential	1569	108731.70	69.30	2306.40	1.47	266.70	0.17
HD Residential	72	4982.40	69.20	105.80	1.47	12.20	0.17
Water	0						
							Source Weighting
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		3382442.20		1691.1		506.5	0.124
Groundwater				10991.6		153.9	0.098
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	2843	3574082.9		15800.2		1046.5	

Figure B-5: GWLF-E output for planning area of Towamencin Township

3,574,082.90 lbs of Sediment Load

Watershed Totals		Municipality Loads		Regulated Loads		Unregulated Loads	
View loads for municipality:		Worcester Twp (86496)					
Source	Source Area (ac)	Sediment		Nitrogen		Phosphorus	
		Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)	Total Load (lb)	Loading Rate (lb/ac)
Hay/Pasture	403	28895.10	71.70	133.00	0.33	36.30	0.09
Cropland	106	86019.00	811.50	369.90	3.49	64.70	0.61
Forest	331	2648.00	8.00	16.60	0.05	3.30	0.01
Wetland	0	0.00	0.00	0.00	0.00	0.00	0.00
Disturbed	111	5550.00	50.00	14.40	0.13	4.40	0.04
Turfgrass	0	0.00	0.00	0.00	0.00	0.00	0.00
Open Land	0	0.00	0.00	0.00	0.00	0.00	0.00
Bare Rock	0	0.00	0.00	0.00	0.00	0.00	0.00
Sandy Areas	0	0.00	0.00	0.00	0.00	0.00	0.00
Unpaved Roads	0	0.00	0.00	0.00	0.00	0.00	0.00
LD Mixed	0	0.00	0.00	0.00	0.00	0.00	0.00
MD Mixed	17	1178.10	69.30	25.00	1.47	2.90	0.17
HD Mixed	77	5336.10	69.30	113.20	1.47	13.10	0.17
LD Residential	477	7870.50	16.50	181.30	0.38	19.10	0.04
MD Residential	544	37699.20	69.30	799.70	1.47	92.50	0.17
HD Residential	27	1868.40	69.20	39.70	1.47	4.60	0.17
Water	0						
						Source Weighting	
Farm Animals				0.0		0.0	0.000
Tile Drainage		0.00		0.0		0.0	0.000
Stream Bank		1929963.66		964.9		289.0	0.051
Groundwater				7514.7		105.2	0.067
Point Sources				0.0		0.0	0.000
Septic Systems				0.0		0.0	0.000
Totals	2093	2107028.1		10172.4		635.1	

Figure B-6: GWLF-E output for planning area of Worcester Township

2,107,028.10 lbs of Sediment Load

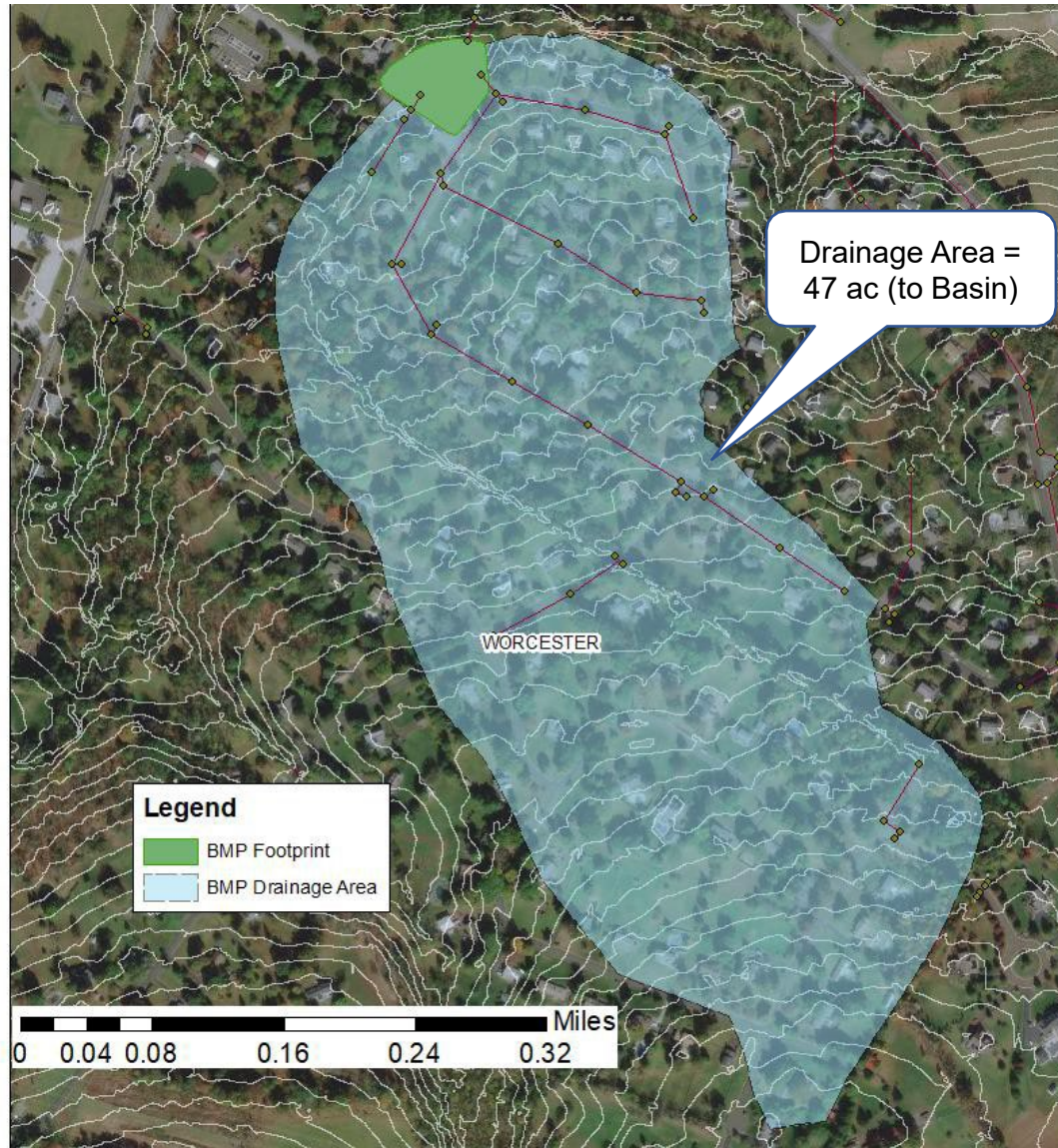
Table B-1: GWLF-E output for total regulated area of permit (Short-Term)

Component/Source	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	479,986	10%	47,999
Lower Providence	1,414,072	10%	141,407
Skippack	1,660,750	10%	166,075
Towamencin	3,574,083	10%	357,408
Worcester	2,107,028	10%	210,703
Total	9,235,919	10%	923,592

Table B-2: GWLF-E output for total regulated area of permit (Long-Term)

Component/Source	Current Sediment Load (lbs/yr)	Required % of Reduction	Required Reduction (lbs/yr)
Hatfield	479,986	18%	86,398
Lower Providence	1,414,072	18%	254,533
Skippack	1,660,750	18%	298,935
Towamencin	3,574,083	18%	643,335
Worcester	2,107,028	18%	379,265
Total	9,235,919	18%	1,662,465

APPENDIX C
PROPOSED PROJECTS
(SHORT-TERM & ALTERNATES)



DRAINAGE AREA MAP

ESTIMATED COST: \$88,000

CONTROL MEASURE TYPE: BASIN RETROFIT

ESTIMATED ANNUAL SEDIMENT REDUCTION: 50,000 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Grading and expansion of existing dry detention basin and incorporation of forebay and wet pool area along with naturalization with native plantings and seeding.

WORCESTER BASIN RETROFIT PROJECT

ADDRESS: 2941 CLYSTON ROAD, WORCESTER, PA 19403 **LATITUDE, LONGITUDE:** 40.197556, -75.345187

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Riparian Buffer Restoration

Area Treated (ha)		Existing Area (ha)	
LD Residential	0.4474	LD Residential	1192
MD Residential	0	MD Residential	3020
HD Residential	0	HD Residential	549
LD Mixed	0	LD Mixed	23
MD Mixed	1.0547	MD Mixed	649
HD Mixed	0.2107	HD Mixed	1167
Total	2	Total	6600

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 5.08

Volume (m3) 406

Run

Calculated Reduction Efficiency

TN 0.67 TP 0.78 TSS 0.84

New Development

BMP Type

Select BMP Type

Area Developed (ha)		Area Replaced (ha)		Existing Area (ha)	
LD Residential	0	Hay/Pasture	0	Hay/Pasture	2396
MD Residential	0	Cropland	0	Cropland	912
HD Residential	0	Forest	0	Forest	3368
LD Mixed	0	Disturbed	0	Disturbed	923
MD Mixed	0	Turfgrass	0	Turfgrass	121
HD Mixed	0	Open Land	0	Open Land	0
Total	0	Total	0	Total	7720

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 7.10

Volume (m3) 0

Run

Calculated Reduction Efficiency

TN 0.00 TP 0.00 TSS 0.00

Stream Protection

Vegetative buffer strip width (m)	0
Fraction of streams treated (0-1)	0.000
Total streams in non-ag areas (km)	149.2
Streams w/bank stabilization (km)	0.0

Street Sweeping

Fraction of area treated (0-1)	1.000						
Sweep Type	<input checked="" type="radio"/> Mechanical <input type="radio"/> Vacuum						
Times/month							
Jan	0	Apr	0	Jul	0	Oct	0
Feb	0	May	0	Aug	0	Nov	0
Mar	0	Jun	0	Sep	0	Dec	0

Rural BMP Editor

BMP Efficiency Editor

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Figure 1: Worcester Basin Retrofit GWLF-E Urban Area Inputs

GWLF Total Loads for file: [Worcester_BasinRetrofit2-0](#) Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.2	1094.7	1943.4	280.2	534.4
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.4	714.2	2350.7	102.3	267.0
HD Mixed	2884	14.6	0.0	99.7	1284.2	4226.9	183.9	480.1
LD Residential	2945	3.5	0.0	24.3	314.1	1118.0	44.6	120.4
MD Residential	7463	6.0	0.0	258.0	3323.2	10938.6	475.9	1242.3
HD Residential	1357	8.4	0.0	46.9	604.1	1988.5	86.5	225.8
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17342.7		17343.7		5194.1
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19055.0	124236.3	160888.7	3083.0	11191.5

25.0 Tons
(50,000 lbs)

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Figure 2: Sediment Wasteload Total with Worcester Basin Retrofit



DRAINAGE AREA MAP

ESTIMATED COST: \$148,030

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 64,975 lbs/yr

PROJECT STATUS: FUTURE

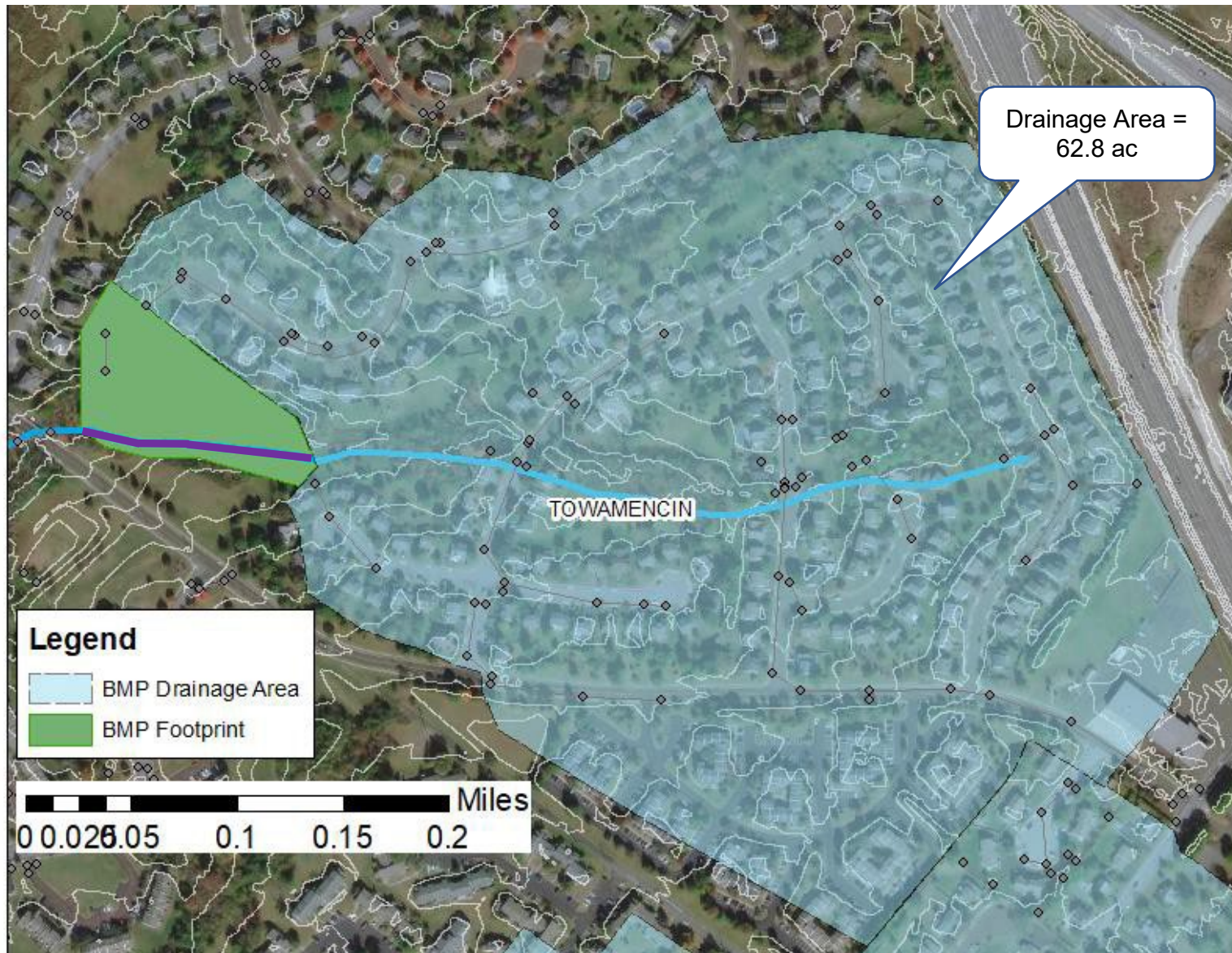
DESCRIPTION: The streambank along Cholet Farms will be restored and a riparian buffer will be planted along the 565 linear feet of stream. The approximate reduction in sediment for this project is 64,975 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

CHOLET FARMS STREAM RESTORATION

ADDRESS: SKIPPACK VILLAGE TRAIL, SCHWENKSVILLE, PA 19473 **LATITUDE, LONGITUDE:** 40.218923, -75.409644

Planned by:
AEGIS





DRAINAGE AREA MAP

ESTIMATED COST: \$185,213

CONTROL MEASURE TYPE: FLOODPLAIN RESTORATION & STREAM BANK REPAIR

ESTIMATED ANNUAL SEDIMENT REDUCTION: 131,975 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Biotechnical stabilization of scoured stream banks and large-scale floodplain enhancements.

TOWAMENCIN FLOODPLAIN RESTORATION PROGRAM

ADDRESS: DORCESTER WAY, HARLEYSVILLE, PA 19438 **LATITUDE, LONGITUDE:** 40.244463, -75.351920

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Floodplain Restoration

Area Treated (ha)

LD Residential	0
MD Residential	22.677
HD Residential	0
LD Mixed	0
MD Mixed	1.1639
HD Mixed	0
Total	24

Existing Area (ha)

LD Residential	1192
MD Residential	3020
HD Residential	549
LD Mixed	23
MD Mixed	649
HD Mixed	1167
Total	6600

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 5.08

Volume (m3) 6295

Run

Calculated Reduction Efficiency

TN 0.67 TP 0.78 TSS 0.84

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential	0
MD Residential	0
HD Residential	0
LD Mixed	0
MD Mixed	0
HD Mixed	0
Total	0

Area Replaced (ha)

Hay/Pasture	0
Cropland	0
Forest	0
Disturbed	0
Turfgrass	0
Open Land	0
Total	0

Existing Area (ha)

Hay/Pasture	2396
Cropland	912
Forest	3368
Disturbed	923
Turfgrass	121
Open Land	0
Total	7720

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 7.10

Volume (m3) 0

Run

Calculated Reduction Efficiency

TN 0.00 TP 0.00 TSS 0.00

Stream Protection

Vegetative buffer strip width (m) 0

Fraction of streams treated (0-1) 0.000

Total streams in non-ag areas (km) 149.2

Streams w/bank stabilization (km) 0.0

Street Sweeping

Fraction of area treated (0-1) 1.000

Sweep Type Mechanical Vacuum

Times/month

Jan	0	Apr	0	Jul	0	Oct	0
Feb	0	May	0	Aug	0	Nov	0
Mar	0	Jun	0	Sep	0	Dec	0

Rural BMP Editor

BMP Efficiency Editor

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Figure 3: Worcester Basin Retrofit GWLF-E Urban Area Inputs

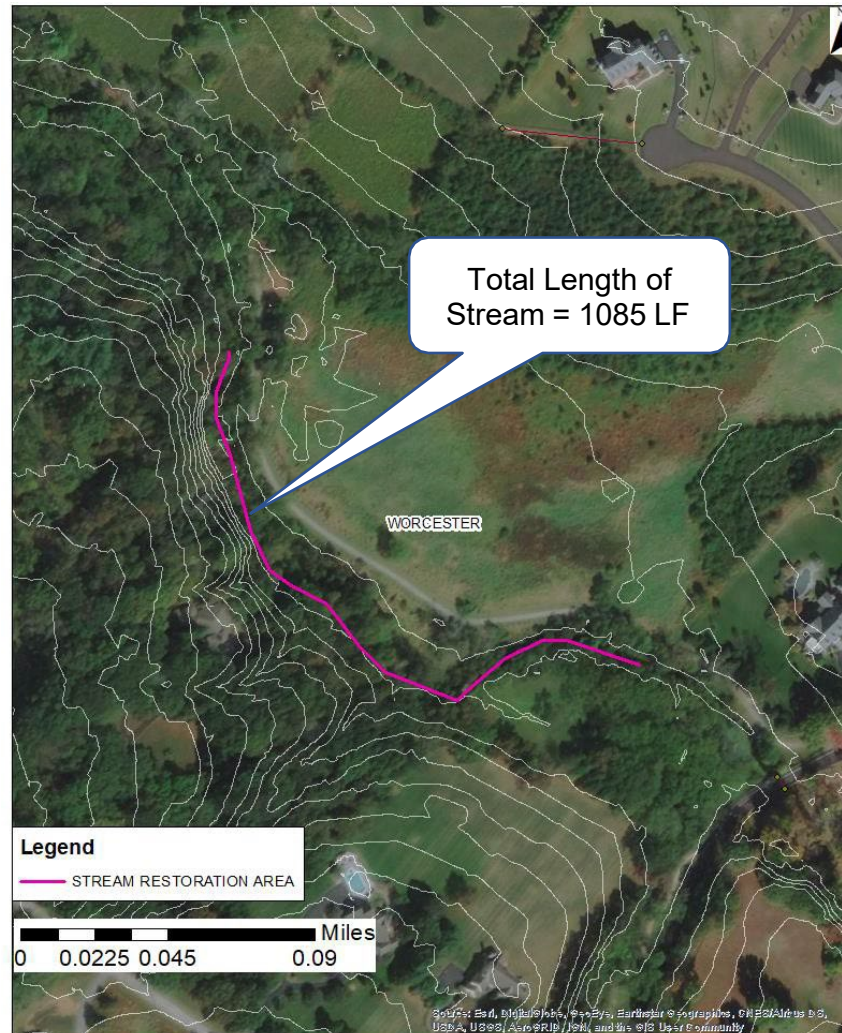
GWLF Total Loads for file: [TowamencinFloodplainRes](#) Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.2	1094.7	1943.4	280.2	534.4
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.4	713.9	2349.8	102.2	266.8
HD Mixed	2884	14.6	0.0	99.6	1283.7	4225.2	183.8	479.7
LD Residential	2945	3.5	0.0	24.2	314.0	1117.5	44.6	120.3
MD Residential	7463	6.0	0.0	257.8	3321.9	10934.1	475.6	1241.5
HD Residential	1357	8.4	0.0	46.9	603.9	1987.7	86.5	225.7
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17332.3		17332.7		5191.9
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19044.2	124233.8	160869.3	3082.5	11187.8

35.8 Tons
(71,600 lbs)

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Figure 4: Sediment Wasteload Total with Worcester Basin Retrofit
 $[71,600 \text{ lbs/yr [Floodplain Enhancement} + 60,375 [525 \text{ LF} \times 115 \text{ lbs/yr/LF}] = 131,975 \text{ lbs/yr}]$



DRAINAGE AREA MAP

ESTIMATED COST: \$284,270

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 124,775 lbs/yr

PROJECT STATUS: FUTURE

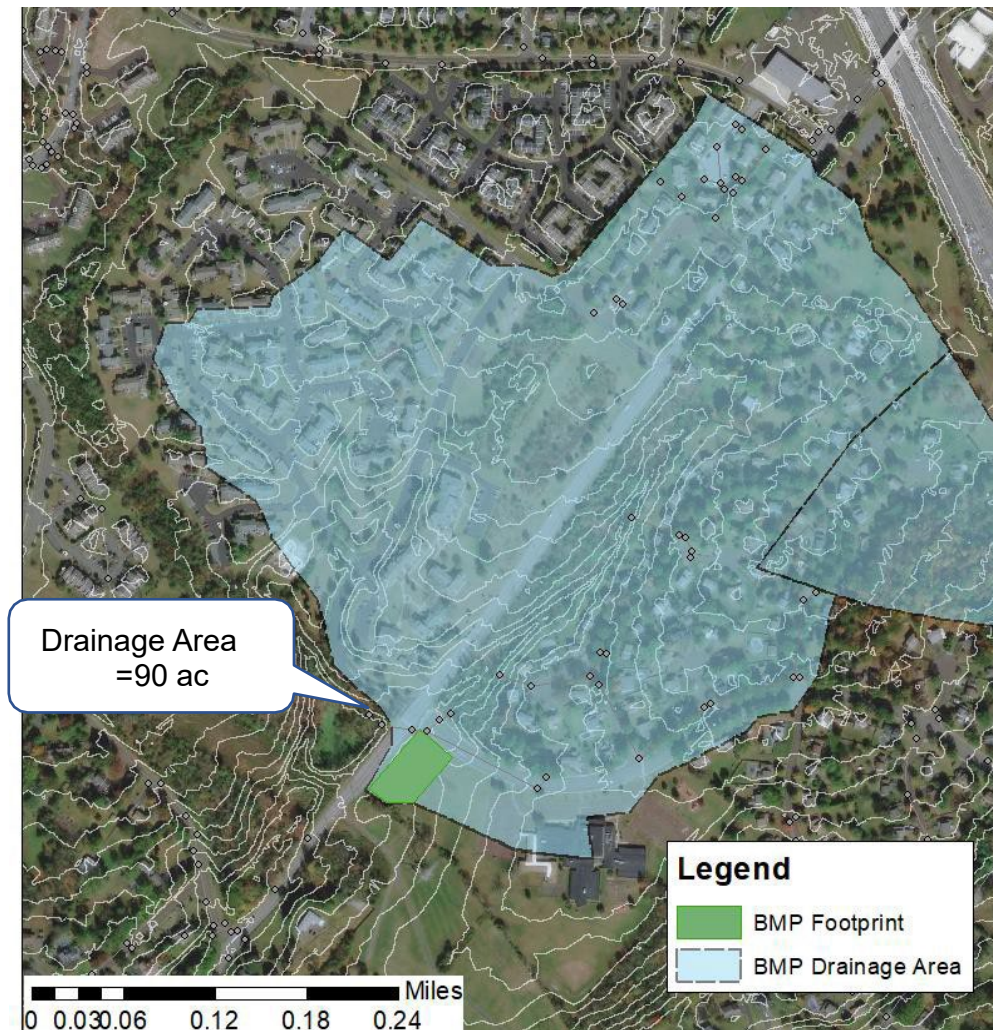
DESCRIPTION: Approximately 1,085 linear feet of streambank located on property owned by Worcester Township will be restored. The estimated reduction in sediment from this project is 124,775 pounds.

WORCESTER TOWNSHIP STREAM RESTORATION PROGRAM (PHASE 1)

ADDRESS: 3239 FAWN ROAD, COLLEGEVILLE, PA 19426 **LATITUDE, LONGITUDE:** 40.204289, -75.361674

Planned by:
AEGIS





DRAINAGE AREA MAP

ESTIMATED COST: \$277,865

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 95,400 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: This basin will be located on properties owned by North Penn SD and Towamencin Twp. A new regional WQ basin (Dry Extended Detention) will be constructed to promote infiltration. This basin will receive runoff from areas from the school property as well as runoff from several subdivisions and associated transportation infrastructure, with a drainage area of approximately 90 acres. It is planned as an infiltration basin, baseflow replication or extended detention features may also be used depending on suitability of area for infiltration.

TOWAMENCIN (BUSTARD PARK & NASH ELEMENTRY SCHOOL) REGIONAL WATER QUALITY BASIN

ADDRESS: 1560 LIBERTY BELL DR, TOWAMENCIN, PA 19438 **LATITUDE, LONGITUDE:** 40.234523°, -75.349130°



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Infiltration Basin

Area Treated (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Existing Area (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Area Replaced (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Existing Area (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

Stream Protection

Vegetative buffer strip width (m)
 Fraction of streams treated (0-1)
 Total streams in non-ag areas (km)
 Streams w/bank stabilization (km)

Street Sweeping

Fraction of area treated (0-1)
 Sweep Type Mechanical Vacuum
 Times/month
 Jan Apr Jul Oct
 Feb May Aug Nov
 Mar Jun Sep Dec

Figure 5: Towamencin & North Penn Property Regional WQ Basin GWLF-E Inputs

Rural Land BMP Scenario Editor

	Hectares		BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8
Row Crops	<input type="text" value="912"/>	% Existing	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.1"/>
Hay/Pasture	<input type="text" value="2,397"/>	% Existing				<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.1"/>
Streams in Agricultural Areas	<input type="text" value="23.5"/>	Km								<input type="text" value="0"/>
Total Stream Length	<input type="text" value="172.6"/>	Km								<input type="text" value="0"/>
Unpaved Road Length	<input type="text" value="3.2"/>	Km								<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>

Existing Km

Figure 6: Farmland Contribution to Regional WQ Basin

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.0	1093.6	1941.5	279.9	533.8
Cropland	2254	2.8	8879.6	913.7	4204.1	7859.1	278.3	1372.9
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.0	21.5	0.9	2.3
MD Mixed	1604	10.2	0.0	55.3	712.7	2345.7	102.1	266.4
HD Mixed	2884	14.6	0.0	99.5	1281.5	4218.0	183.5	479.1
LD Residential	2945	3.5	0.0	24.2	313.4	1115.6	44.5	120.1
MD Residential	7463	6.0	0.0	257.5	3316.2	10915.5	475.0	1239.8
HD Residential	1357	8.4	0.0	46.8	602.9	1984.3	86.3	225.4
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17322.0		17321.7		5187.5
Groundwater					112134.8	112134.8	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19032.3	124193.7	160789.3	3080.7	11178.3

47.7 Tons
(95,400 lbs)

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Figure 7: Sediment Wasteload Total with Hatfield (and SD) Property Regional WQ Basin



DRAINAGE AREA MAP

ESTIMATED COST: \$146,543

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 33,800 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: This new dry extended detention basin will be located on property owned by North Penn SD (in Hatfield Twp). A regional WQ basin will be constructed to promote infiltration along with stormwater detention. This basin will receive runoff from areas from the school property as well as runoff from three subdivisions and associated transportation infrastructure, with a drainage area of approximately 45 acres.

PENNFIELD MIDDLE SCHOOL (HATFIELD) REGIONAL WATER QUALITY BASINS

ADDRESS: 726 FORTY FOOT RD, HATFIELD, PA 19440 **LATITUDE, LONGITUDE:** 40.269959°, -75.314396°

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Infiltration Basin

Area Treated (ha)

LD Residential

0

MD Residential

6.035

HD Residential

0

LD Mixed

0

MD Mixed

1.237

HD Mixed

2.072

Total

9

Existing Area (ha)

LD Residential

1192

MD Residential

3020

HD Residential

549

LD Mixed

23

MD Mixed

649

HD Mixed

1167

Total

6600

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)

6.35

Volume (m3)

3544

Run

Calculated Reduction Efficiency

TN

0.68

TP

0.78

TSS

0.85

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential

0

MD Residential

0

HD Residential

0

LD Mixed

0

MD Mixed

0

HD Mixed

0

Total

0

Area Replaced (ha)

Hay/Pasture

0

Cropland

0

Forest

0

Disturbed

0

Turfgrass

0

Open Land

0

Total

0

Existing Area (ha)

Hay/Pasture

2396

Cropland

912

Forest

3368

Disturbed

923

Turfgrass

121

Open Land

0

Total

7720

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)

7.10

Volume (m3)

0

Run

Calculated Reduction Efficiency

TN

0.00

TP

0.00

TSS

0.00

Stream Protection

Vegetative buffer strip width (m)

0

Fraction of streams treated (0-1)

0.000

Total streams in non-ag areas (km)

149.2

Streams w/bank stabilization (km)

0.0

Street Sweeping

Fraction of area treated (0-1)

1.000

Sweep Type

Mechanical

Vacuum

Times/month

Jan

0

Apr

0

Jul

0

Oct

0

Feb

0

May

0

Aug

0

Nov

0

Mar

0

Jun

0

Sep

0

Dec

0

Rural BMP Editor

BMP Efficiency Editor

Export to JPEG

Save File

Close



Figure 8: Pennfield Middle School (Hatfield) Property Basin Retrofit GWLF-E Inputs

Rural Land BMP Scenario Editor

	Hectares		BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8
Row Crops	<input type="text" value="912"/>	% Existing	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>
Hay/Pasture	<input type="text" value="2,397"/>	% Existing				<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.3"/>
Streams in Agricultural Areas	<input type="text" value="23.5"/>	Km								<input type="text" value="0"/>
Total Stream Length	<input type="text" value="172.6"/>	Km								<input type="text" value="0"/>
Unpaved Road Length	<input type="text" value="3.2"/>	Km								<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>

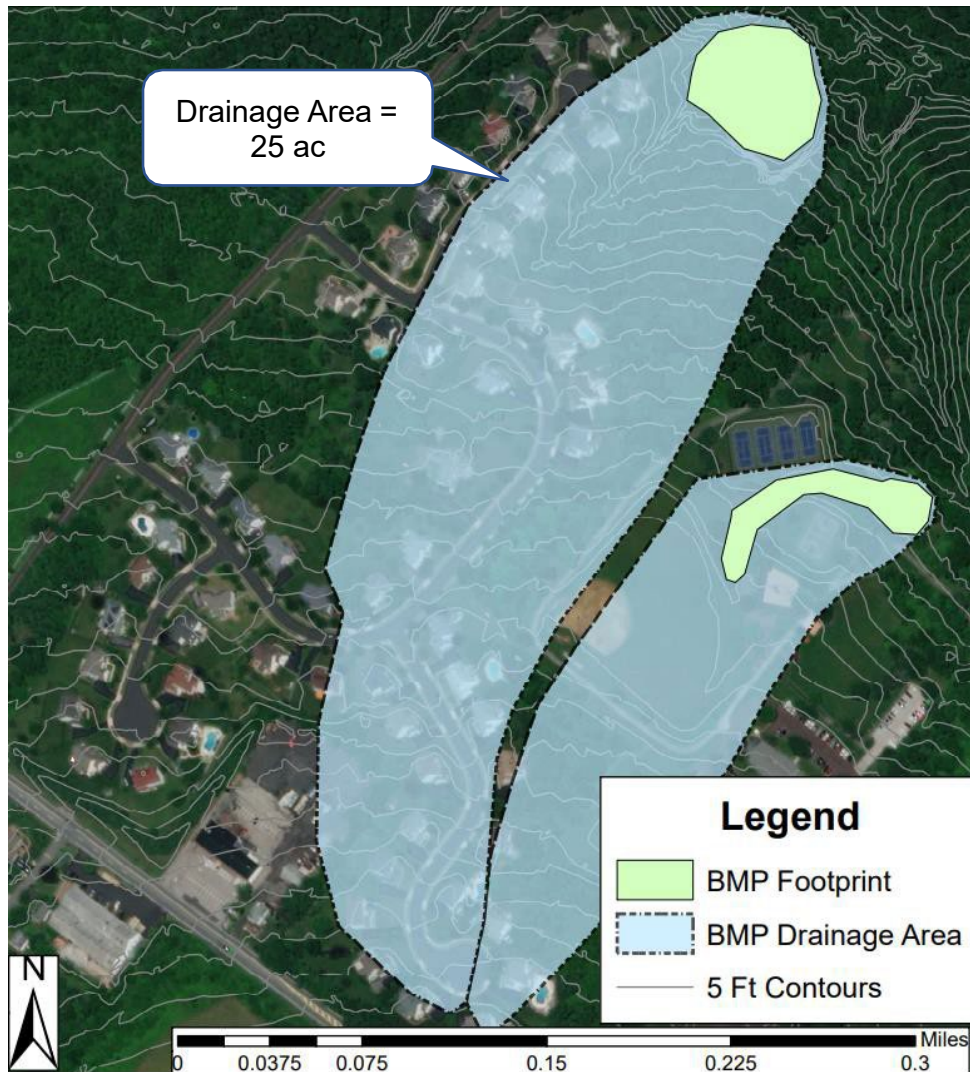
Existing Km

Figure 9: Farmland Contribution to Regional WQ Basin

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	211.6	1091.6	1937.8	279.4	532.8
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.1	2350.4	102.3	267.0
HD Mixed	2884	14.6	0.0	99.7	1284.0	4226.4	184.0	480.2
LD Residential	2945	3.5	0.0	24.3	314.0	1117.9	44.6	120.4
MD Residential	7463	6.0	0.0	258.1	3322.9	10937.3	476.0	1242.6
HD Residential	1357	8.4	0.0	46.9	604.1	1988.3	86.5	225.9
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17351.2		17350.4		5196.3
Groundwater					112106.1	112106.1	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19063.1	124179.4	160834.2	3082.4	11192.8

16.9 Tons
(33,800 lbs)

Figure 10: Sediment Wasteload Total with Hatfield (and SD) Property Contribution to Regional WQ Basin



DRAINAGE AREA MAP

ESTIMATED COST: \$88,000

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 18,800 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: This basin is located on property owned by Lower Providence Township. The detention basins will be retrofitted to expand the footprint of the BMP and to function as wetlands/wet ponds. This basin primarily services a housing development adjacent to the BMP, with a drainage area of approximately 25 acres.

LOWER PROVIDENCE PROPERTY BASIN RETROFITS

ADDRESS: HONEYLOCUST CIRCLE, EAGLEVILLE, PA 19403 **LATITUDE, LONGITUDE:** 40.166839, -75.408022

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Constructed Wetland

Area Treated (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Existing Area (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Area Replaced (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Existing Area (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

Stream Protection

Vegetative buffer strip width (m)
 Fraction of streams treated (0-1)
 Total streams in non-ag areas (km)
 Streams w/bank stabilization (km)

Street Sweeping

Fraction of area treated (0-1)
 Sweep Type Mechanical Vacuum
 Times/month
 Jan Apr Jul Oct
 Feb May Aug Nov
 Mar Jun Sep Dec



Figure 11: Lower Providence Property Basin Retrofit GWLF-E Inputs

GWLF Total Loads for file: April26_LowerProvPropBasi Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.0	1094.2	1942.6	280.0	534.0
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.6	2352.1	102.4	267.2
HD Mixed	2884	14.6	0.0	99.8	1284.9	4229.5	184.1	480.5
LD Residential	2945	3.5	0.0	24.3	314.3	1118.6	44.6	120.5
MD Residential	7463	6.0	0.0	258.3	3325.2	10945.1	476.4	1243.4
HD Residential	1357	8.4	0.0	46.9	604.5	1989.7	86.6	226.0
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17357.9		17357.0		5198.5
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19070.6	124239.6	160913.5	3083.7	11197.7

9.4 Tons (18,800 lbs)
Sediment Reduced

Figure 12: Sediment Wasteload Total with Lower Providence Property Basin Retrofit



DRAINAGE AREA MAP

ESTIMATED COST: \$88,080

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 16,400 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: A field used for agriculture will be retired and reestablished as a riparian buffer with retentive grading.

WORCESTER TOWNSHIP RIPARIAN BUFFER PROJECT

ADDRESS: 3239 FAWN ROAD, COLLEGEVILLE, PA 19426

LATITUDE, LONGITUDE: 40.203541, -75.357480

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Riparian Buffer Restoration

Area Treated (ha)

LD Residential 0.4474

MD Residential 0

HD Residential 0

LD Mixed 0

MD Mixed 1.0547

HD Mixed 0.2107

Total 2

Existing Area (ha)

LD Residential 1192

MD Residential 3020

HD Residential 549

LD Mixed 23

MD Mixed 649

HD Mixed 1167

Total 6600

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 5.08

Volume (m3) 406

Run

Calculated Reduction Efficiency

TN 0.67

TP 0.78

TSS 0.84

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential 0

MD Residential 0

HD Residential 0

LD Mixed 0

MD Mixed 0

HD Mixed 0

Total 0

Area Replaced (ha)

Hay/Pasture 0

Cropland 0

Forest 0

Disturbed 0

Turfgrass 0

Open Land 0

Total 0

Existing Area (ha)

Hay/Pasture 2396

Cropland 912

Forest 3368

Disturbed 923

Turfgrass 121

Open Land 0

Total 7720

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 7.10

Volume (m3) 0

Run

Calculated Reduction Efficiency

TN 0.00

TP 0.00

TSS 0.00

Stream Protection

Vegetative buffer strip width (m) 0

Fraction of streams treated (0-1) 0.000

Total streams in non-ag areas (km) 149.2

Streams w/bank stabilization (km) 0.0

Street Sweeping

Fraction of area treated (0-1) 1.000

Sweep Type Mechanical Vacuum

Times/month

Jan 0 Apr 0 Jul 0 Oct 0

Feb 0 May 0 Aug 0 Nov 0

Mar 0 Jun 0 Sep 0 Dec 0

Rural BMP Editor

BMP Efficiency Editor

Export to JPEG

Save File

Close



Figure 13: Urban Lands Treated by Worcester Township Riparian Buffer Project

Basin GWLF-E Inputs

Rural Land BMP Scenario Editor

	Hectares		BMP1	BMP2	BMP3	BMP4	BMP5	BMP6	BMP7	BMP8
Row Crops	<input type="text" value="912"/>	% Existing	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.1"/>	<input type="text" value="0.0"/>		<input type="text" value="0.0"/>
Hay/Pasture	<input type="text" value="2,397"/>	% Existing				<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>	<input type="text" value="0.0"/>
Streams in Agricultural Areas	<input type="text" value="23.5"/>	Km								<input type="text" value="0"/>
Total Stream Length	<input type="text" value="172.6"/>	Km								<input type="text" value="0"/>
Unpaved Road Length	<input type="text" value="3.2"/>	Km								<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>
										<input type="text" value="0"/>

Existing Km

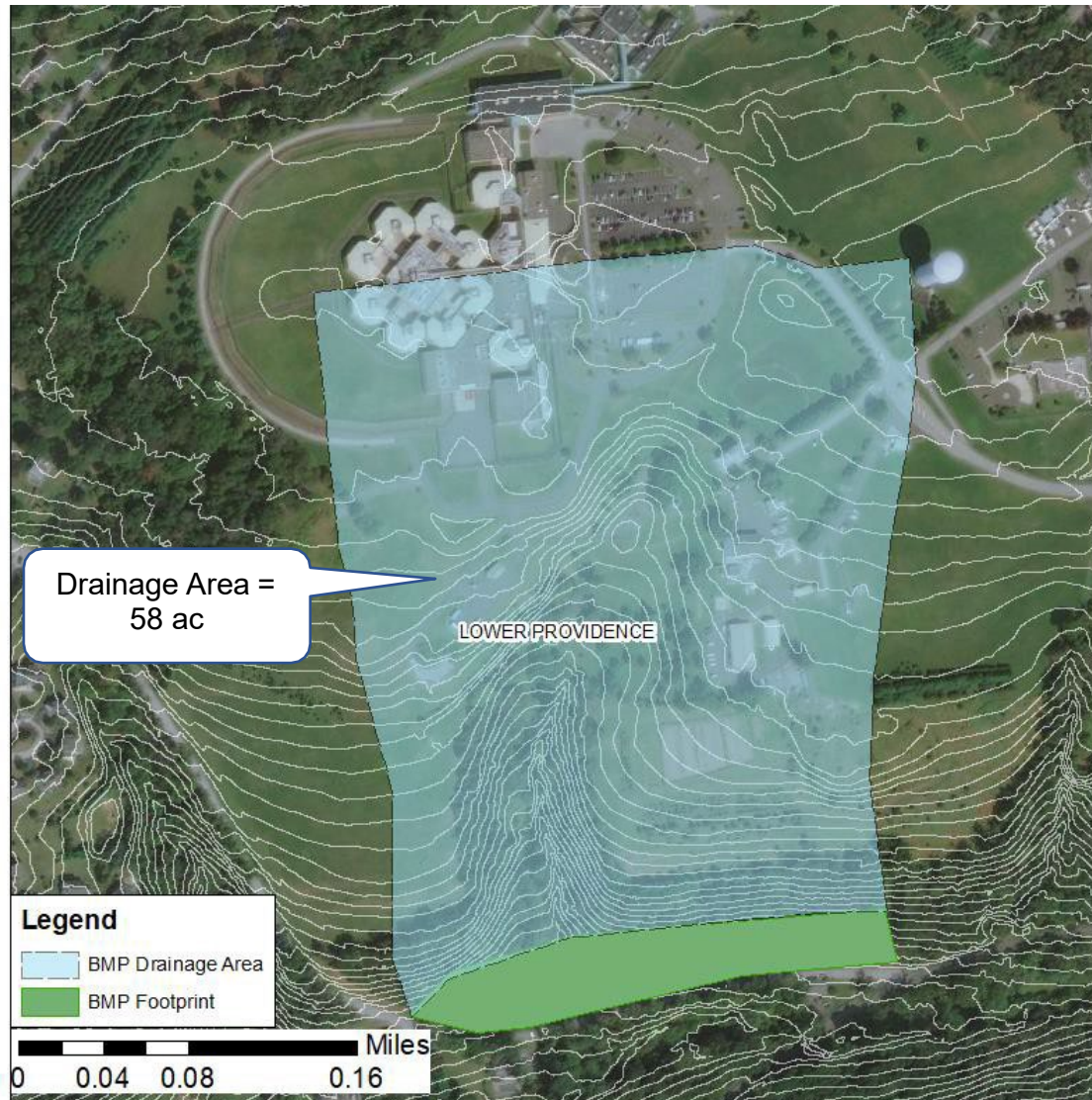
Figure 14: Agricultural Retirement to Worcester Township Riparian Buffer

GWLF Total Loads for file: WorcesterRiparianBuffer229 **Period of analysis:** 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	211.6	1092.5	1939.4	279.5	533.1
Cropland	2254	2.8	8879.6	909.2	4188.4	7829.6	277.0	1366.7
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.8	2352.7	102.4	267.3
HD Mixed	2884	14.6	0.0	99.9	1285.3	4230.5	184.2	480.7
LD Residential	2945	3.5	0.0	24.3	314.4	1119.0	44.7	120.5
MD Residential	7463	6.0	0.0	258.4	3326.1	10947.9	476.6	1244.0
HD Residential	1357	8.4	0.0	47.0	604.6	1990.2	86.6	226.1
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17364.6		17363.6		5200.7
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19071.8	124219.7	160885.4	3082.0	11192.5

8.2 Tons (16,400 lbs)
Sediment Reduced

Figure 15: Sediment Wasteload Total with Worcester Township Riparian Buffer



DRAINAGE AREA MAP

ESTIMATED COST: \$280,190

CONTROL MEASURE TYPE: DETENTION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 32,600 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: This project is proposing the installation of wetlands south of the Montgomery County Correctional Facility in Eagleville. The planned basin will capture an estimated 58 acres of runoff from the Correctional Facility.

MONTGOMERY COUNTY (EAGLEVILLE) CORRECTIONAL FACILITY BASIN

ADDRESS: 60 EAGLEVILLE ROAD, EAGLEVILLE, PA 19403 **LATITUDE, LONGITUDE:** 40.154046, -75.422613

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Constructed Wetland

Area Treated (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Existing Area (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Area Replaced (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Existing Area (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

Stream Protection

Vegetative buffer strip width (m)
 Fraction of streams treated (0-1)
 Total streams in non-ag areas (km)
 Streams w/bank stabilization (km)

Street Sweeping

Fraction of area treated (0-1)
 Sweep Type Mechanical Vacuum
 Times/month
 Jan Apr Jul Oct
 Feb May Aug Nov
 Mar Jun Sep Dec

Figure 16: MONTGOMERY COUNTY (EAGLEVILLE) CORRECTIONAL FACILITY BASIN Retrofit GWLF-E Inputs

GWLF Total Loads for file: MontCoPrisonBasin_Rural_I Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	211.5	1091.7	1938.1	279.3	532.7
Cropland	2254	2.8	8879.6	913.1	4202.5	7856.0	278.1	1372.1
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.5	2351.7	102.3	267.1
HD Mixed	2884	14.6	0.0	99.8	1284.7	4228.7	184.0	480.4
LD Residential	2945	3.5	0.0	24.3	314.2	1118.4	44.6	120.4
MD Residential	7463	6.0	0.0	258.2	3324.6	10943.1	476.2	1243.1
HD Residential	1357	8.4	0.0	46.9	604.4	1989.3	86.6	226.0
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17353.3		17352.6		5196.3
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19063.7	1124230.3	160890.3	3082.3	11191.4

16.3 Tons (32,600 lbs)

Figure 17: Sediment Wasteload Total with Eagleville Correctional Regional Water Quality Basin



DRAINAGE AREA MAP

ESTIMATED COST: \$158,032

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 14,400 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: A bioswale is planned along Collegeville Road on Perkiomen Valley Airport property. This bioswale will collect stormwater from the contributing land from the airport, which equalates to a drainage area of approximately 12 acres.

PERKIOMEN VALLEY AIRPORT BIOSWALE

ADDRESS: 767 COLLEGEVILLE RD, COLLEGEVILLE, PA 19426 **LATITUDE, LONGITUDE:** 40.204307, -75.425462

Planned by:
AEGIS



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Vegetated Swale / Bioswale

Area Treated (ha)

LD Residential 0.268

MD Residential 0.0881

HD Residential 0

LD Mixed 0

MD Mixed 4.6357

HD Mixed 0

Total 5

Existing Area (ha)

LD Residential 1192

MD Residential 3020

HD Residential 549

LD Mixed 23

MD Mixed 649

HD Mixed 1167

Total 6600

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 5.08

Volume (m3) 1268

Run

Calculated Reduction Efficiency

TN 0.67

TP 0.78

TSS 0.84

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential 0

MD Residential 0

HD Residential 0

LD Mixed 0

MD Mixed 0

HD Mixed 0

Total 0

Area Replaced (ha)

Hay/Pasture 0

Cropland 0

Forest 0

Disturbed 0

Turfgrass 0

Open Land 0

Total 0

Existing Area (ha)

Hay/Pasture 2396

Cropland 912

Forest 3368

Disturbed 923

Turfgrass 121

Open Land 0

Total 7720

Rainfall Captured (2.54 cm = 1 in)

Depth (cm) 7.10

Volume (m3) 0

Run

Calculated Reduction Efficiency

TN 0.00

TP 0.00

TSS 0.00

Stream Protection

Vegetative buffer strip width (m) 0

Fraction of streams treated (0-1) 0.000

Total streams in non-ag areas (km) 149.2

Streams w/bank stabilization (km) 0.0

Street Sweeping

Fraction of area treated (0-1) 1.000

Sweep Type Mechanical Vacuum

Times/month

Jan 0 Apr 0 Jul 0 Oct 0

Feb 0 May 0 Aug 0 Nov 0

Mar 0 Jun 0 Sep 0 Dec 0

Rural BMP Editor

BMP Efficiency Editor

Export to JPEG

Save File

Close

Figure 18: Perkiomen Valley Airport Bioswale GWLF-E Inputs

GWLF Total Loads for file: Palmer_Airport-0

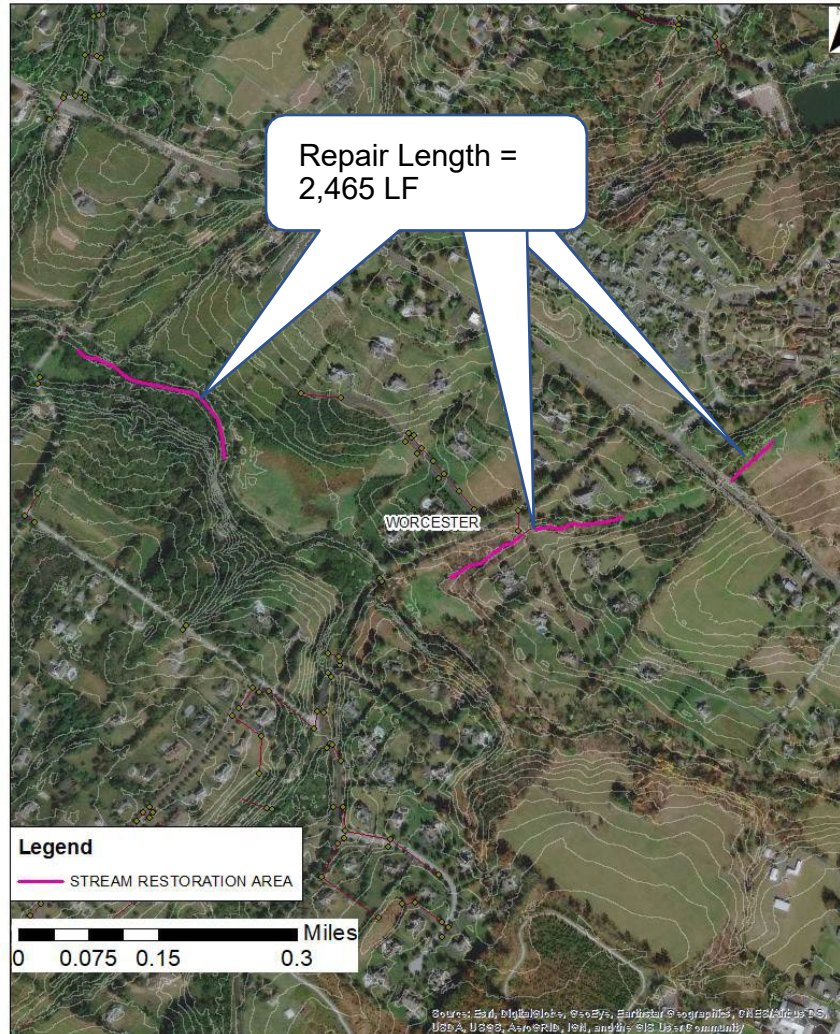
Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.2	1094.7	1943.4	280.2	534.4
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.5	2351.8	102.4	267.2
HD Mixed	2884	14.6	0.0	99.8	1284.8	4228.9	184.1	480.5
LD Residential	2945	3.5	0.0	24.3	314.2	1118.5	44.6	120.5
MD Residential	7463	6.0	0.0	258.3	3324.8	10943.8	476.4	1243.4
HD Residential	1357	8.4	0.0	47.0	604.4	1989.4	86.6	226.0
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17359.9		17359.2		5198.5
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19072.8	124239.3	160914.0	3083.8	11198.1

7.2 Tons (14,400 lbs)
Sediment Reduced

Go Back Pathogen Loads Export to JPEG Print Close

Figure 19: Sediment Wasteload Total with Perkiomen Valley Airport Bioswale



DRAINAGE AREA MAP

ESTIMATED COST: \$645,830

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 283,475 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Approximately 2,465 linear feet of streambank located on property owned by Worchester Township will be restored. The estimated reduction in sediment from this project is 283,475 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

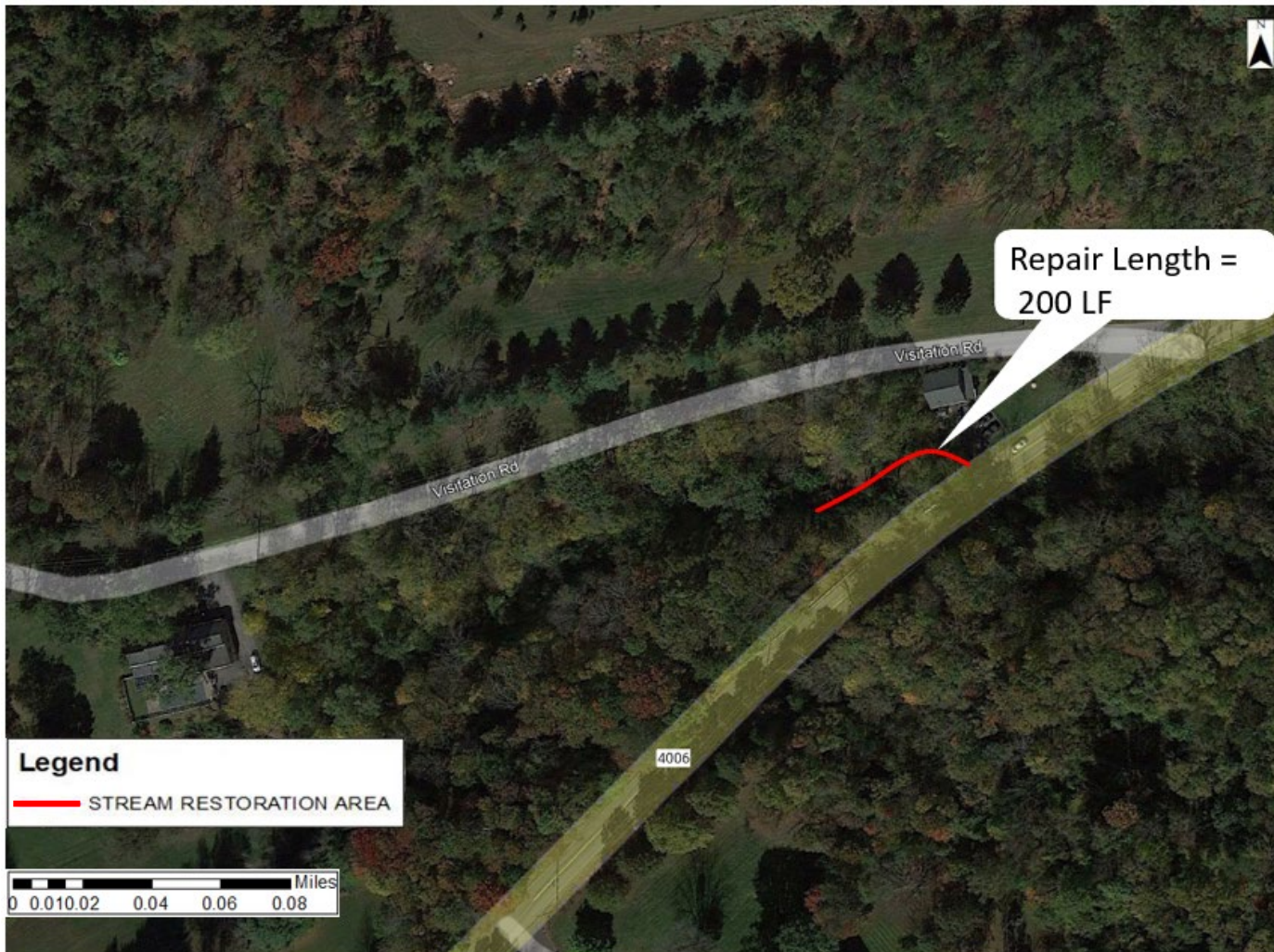
WORCESTER TOWNSHIP STREAM RESTORATION PROGRAM (PHASE 2)

ADDRESS: 3239 FAWN ROAD & HOLLOW ROAD, COLLEGEVILLE, PA 19426

LATITUDE, LONGITUDE: 40.203541, -75.357480

Planned by:
AEGIS





DRAINAGE AREA MAP

ESTIMATED COST: \$52,440

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 23,000 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Approximately 200 linear feet of streambank located on property owned by Lower Providence Township will be restored. The estimated reduction in sediment from this project is 23,000 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

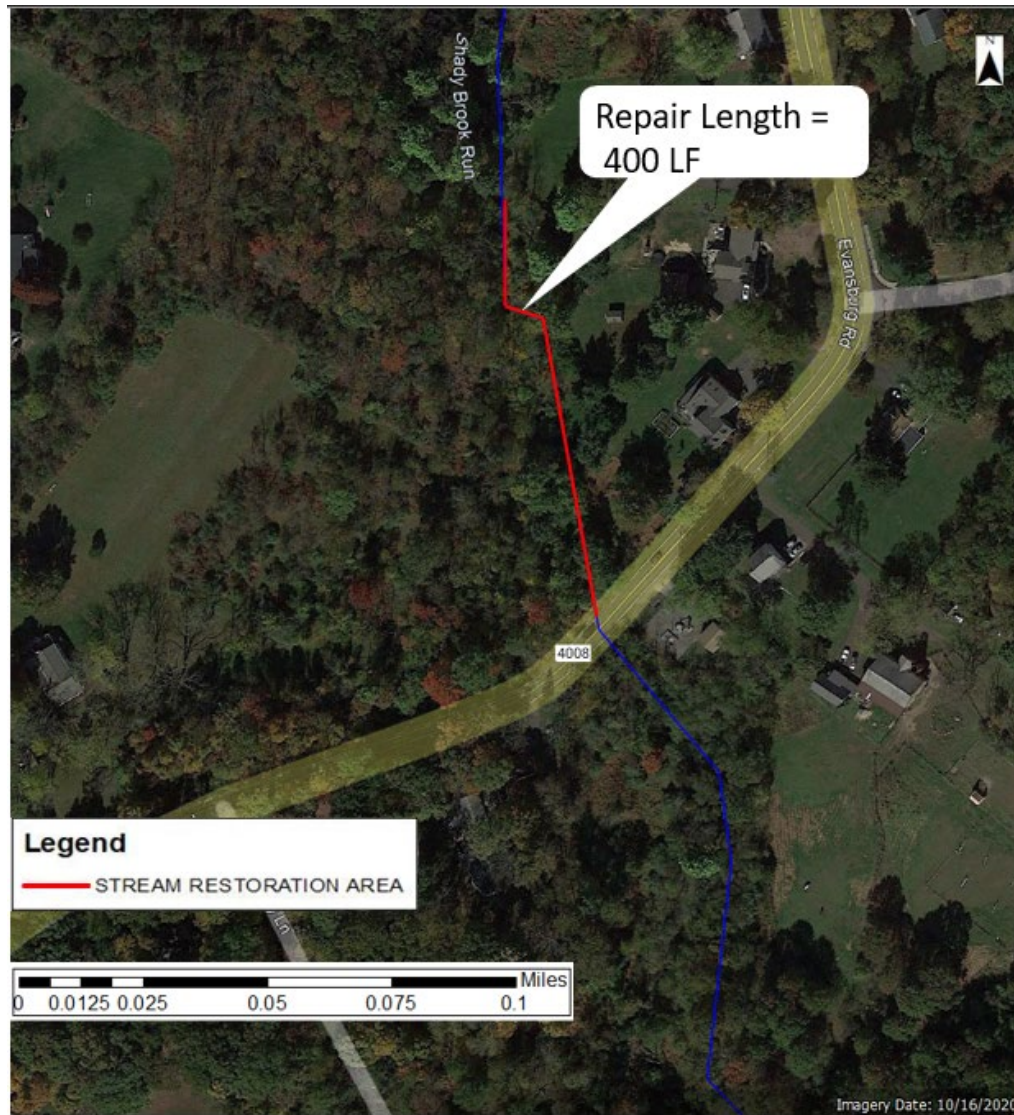
VISITATION ROAD STREAM RESTORATION PROJECT

ADDRESS: VISITATION & EAGLEVILLE ROAD, COLLEGEVILLE, PA 19426

LATITUDE, LONGITUDE: 40.153972, -75.419545

Planned by:
AEGIS





DRAINAGE AREA MAP

ESTIMATED COST: \$104,880

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 46,000 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Approximately 400 linear feet of streambank located on property owned by Skippack Township will be restored. The estimated reduction in sediment from this project is 46,000 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

SHADY BROOK RUN STREAM RESTORATION PROJECT

ADDRESS: 3239 FAWN ROAD & HOLLOW ROAD, COLLEGEVILLE, PA 19426

LATITUDE, LONGITUDE: 40.199824, -75.413695

Planned by:
AEGIS



PROJECT ALTERNATES



DRAINAGE AREA MAP

ESTIMATED COST: \$754,350

CONTROL MEASURE TYPE: RESTORATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 330,855 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Approximately 2,877 linear feet of streambank located on property owned by Towamencin Township will be restored. The estimated reduction in sediment from this project is 330,855 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

KRIEBEL ROAD STREAM RESTORATION PROJECT

ADDRESS: BETWEEN BUSTARD RD & TRUMBAUER RD, TOWAMENCIN, PA 19446

LATITUDE, LONGITUDE: 40.2272107, -75.346990





DRAINAGE AREA MAP

ESTIMATED COST: \$482,448

ESTIMATED ANNUAL SEDIMENT REDUCTION: 330,855 lbs/yr

CONTROL MEASURE TYPE: RESTORATION

PROJECT STATUS: FUTURE

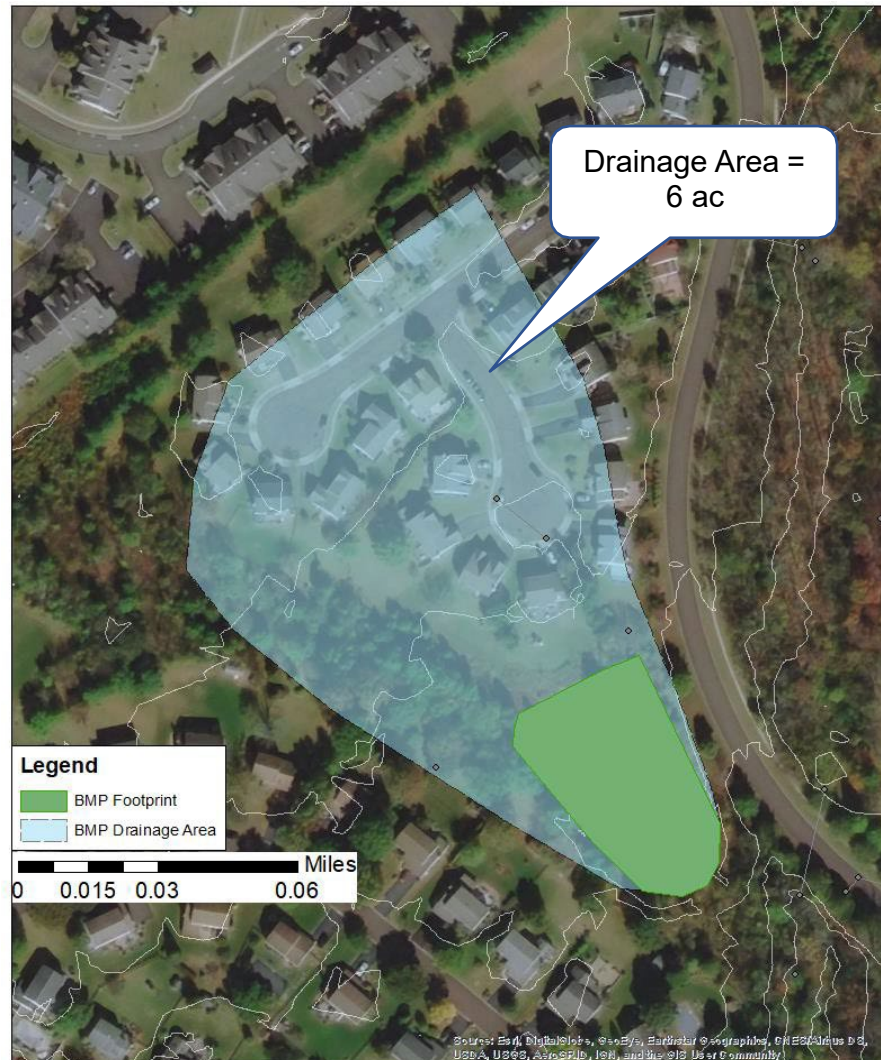
DESCRIPTION: Approximately 1,840 linear feet of streambank located on property owned by Towamencin Township will be restored. The estimated reduction in sediment from this project is 211,600 pounds. Estimated length of repair is approximate and might be expanded based on availability of funding. Estimated sediment reduction was calculated based on a reduction figure provided by PADEP for MapShed derived wasteload reduction targets of 115 lbs/lf/yr.

ANDERS ROAD STREAM RESTORATION PROJECT

ADDRESS: BETWEEN ANDERS RD & PENNSYLVANIA TURNPIKE, TOWAMENCIN, PA 19446

LATITUDE, LONGITUDE: 40.225233, -75.329518





DRAINAGE AREA MAP

ESTIMATED COST: \$88,000

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 8,400 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: This project entails retrofitting an existing basin into a wetland. This site is located along Grist Mill Drive in Grist Mill Park located in Towamencin Township. The park property is expansive and leaves room to increase the size of the basin and potentially capture stormwater from the adjacent recreational fields and homes.

GRIST MILL PARK BASIN RETROFIT

ADDRESS: GRIST MILL DRIVE, LANSDALE, PA 19446 **LATITUDE, LONGITUDE:** 40.258101, -75.317307



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Constructed Wetland

Area Treated (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Existing Area (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Area Replaced (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Existing Area (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

Stream Protection

Vegetative buffer strip width (m)
 Fraction of streams treated (0-1)
 Total streams in non-ag areas (km)
 Streams w/bank stabilization (km)

Street Sweeping

Fraction of area treated (0-1)
 Sweep Type Mechanical Vacuum
 Times/month
 Jan Apr Jul Oct
 Feb May Aug Nov
 Mar Jun Sep Dec



Figure 20: Grist Mill Park Basin Retrofits GWLF-E Inputs

GWLF Total Loads for file: GristMillParkBasins-0

Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.2	1094.7	1943.4	280.2	534.4
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.7	2352.6	102.4	267.3
HD Mixed	2884	14.6	0.0	99.8	1285.2	4230.2	184.1	480.7
LD Residential	2945	3.5	0.0	24.3	314.3	1118.9	44.6	120.5
MD Residential	7463	6.0	0.0	258.4	3325.9	10947.2	476.5	1243.8
HD Residential	1357	8.4	0.0	47.0	604.6	1990.1	86.6	226.1
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17362.8		17363.6		5200.7
Groundwater					112159.2	112159.2	1570.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19075.8	1124241.2	160924.8	3084.1	11201.0

4.2 Tons (8,400 lbs)
Sediment Reduced

Go Back Pathogen Loads Export to JPEG Print Close

Figure 21: Sediment Wasteload Total with Grist Mill Park Basin Retrofits



DRAINAGE AREA MAP

ESTIMATED COST: \$379,906

CONTROL MEASURE TYPE: DETENTION & INFILTRATION

ESTIMATED ANNUAL SEDIMENT REDUCTION: 38,200 lbs/yr

PROJECT STATUS: FUTURE

DESCRIPTION: Retrofit the two basins that are owned by Skippack Township along Church Road and Clonmel Road into constructed wetlands. These basins have the potential to be expanded due to the availability of space surrounding the basins.

SKIPPACK TOWNSHIP BASIN RETROFITS

ADDRESS: CLONMEL ROAD, COLLEGEVILLE, PA 19426 **LATITUDE, LONGITUDE:** 40.226842, -75.398869 & 40.227819, -75.400187



Urban Scenario BMP Editor

Performance Standard Calculations

Retrofits

BMP Type

Constructed Wetland

Area Treated (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Existing Area (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

New Development

BMP Type

Select BMP Type

Area Developed (ha)

LD Residential
 MD Residential
 HD Residential
 LD Mixed
 MD Mixed
 HD Mixed
Total

Area Replaced (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Existing Area (ha)

Hay/Pasture
 Cropland
 Forest
 Disturbed
 Turfgrass
 Open Land
Total

Rainfall Captured (2.54 cm = 1 in)

Depth (cm)
 Volume (m3)

Calculated Reduction Efficiency

TN TP TSS

Stream Protection

Vegetative buffer strip width (m)
 Fraction of streams treated (0-1)
 Total streams in non-ag areas (km)
 Streams w/bank stabilization (km)

Street Sweeping

Fraction of area treated (0-1)
 Sweep Type Mechanical Vacuum
 Times/month
 Jan Apr Jul Oct
 Feb May Aug Nov
 Mar Jun Sep Dec



Figure 22: Skippack Township Basin Retrofits GWLF-E Inputs

GWLF Total Loads for file: April26_SkipRecAreaBasins Period of analysis: 23 years from 1975 to 1997

Source	Area (Acres)	Runoff (in)	Tons		Total Loads (Pounds)			
			Erosion	Sediment	Dissolved N	Total N	Dissolved P	Total P
Hay/Pasture	5921	1.1	2059.9	212.2	1094.7	1943.4	280.2	534.4
Cropland	2254	2.8	8879.6	914.6	4208.1	7866.5	278.5	1374.2
Forest	8322	0.8	324.6	33.4	298.8	432.5	15.7	55.8
Wetland	264	4.2	5.7	0.6	47.4	49.7	2.5	3.2
Disturbed	2281	6.2	553.9	57.0	64.0	292.2	32.0	100.3
Turfgrass	299	0.7	52.2	5.4	117.2	138.7	9.3	15.7
Open Land	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Bare Rock	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sandy Areas	0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unpaved Roads	5	4.9	42.2	4.3	1.0	18.4	0.0	5.3
LD Mixed	57	3.5	0.0	0.5	6.1	21.6	0.9	2.3
MD Mixed	1604	10.2	0.0	55.5	714.3	2351.2	102.3	267.1
HD Mixed	2884	14.6	0.0	99.7	1284.5	4227.9	184.0	480.2
LD Residential	2945	3.5	0.0	24.3	314.2	1118.2	44.6	120.4
MD Residential	7463	6.0	0.0	258.1	3324.0	10941.0	476.1	1242.7
HD Residential	1357	8.4	0.0	46.9	604.3	1988.9	86.6	225.9
Farm Animals						0.0		0.0
Tile Drainage				0.0		0.0		0.0
Stream Bank				17348.4		17348.2		5196.3
Groundwater					112159.2	112159.2	1578.7	1570.7
Point Sources					0.0	0.0	0.0	0.0
Septic Systems					0.0	0.0	0.0	0.0
Totals	35654.8	4.50	11918.2	19060.9	124237.7	160897.7	3083.4	11194.5

19.1 Tons (38,200 lbs)
Sediment Reduced

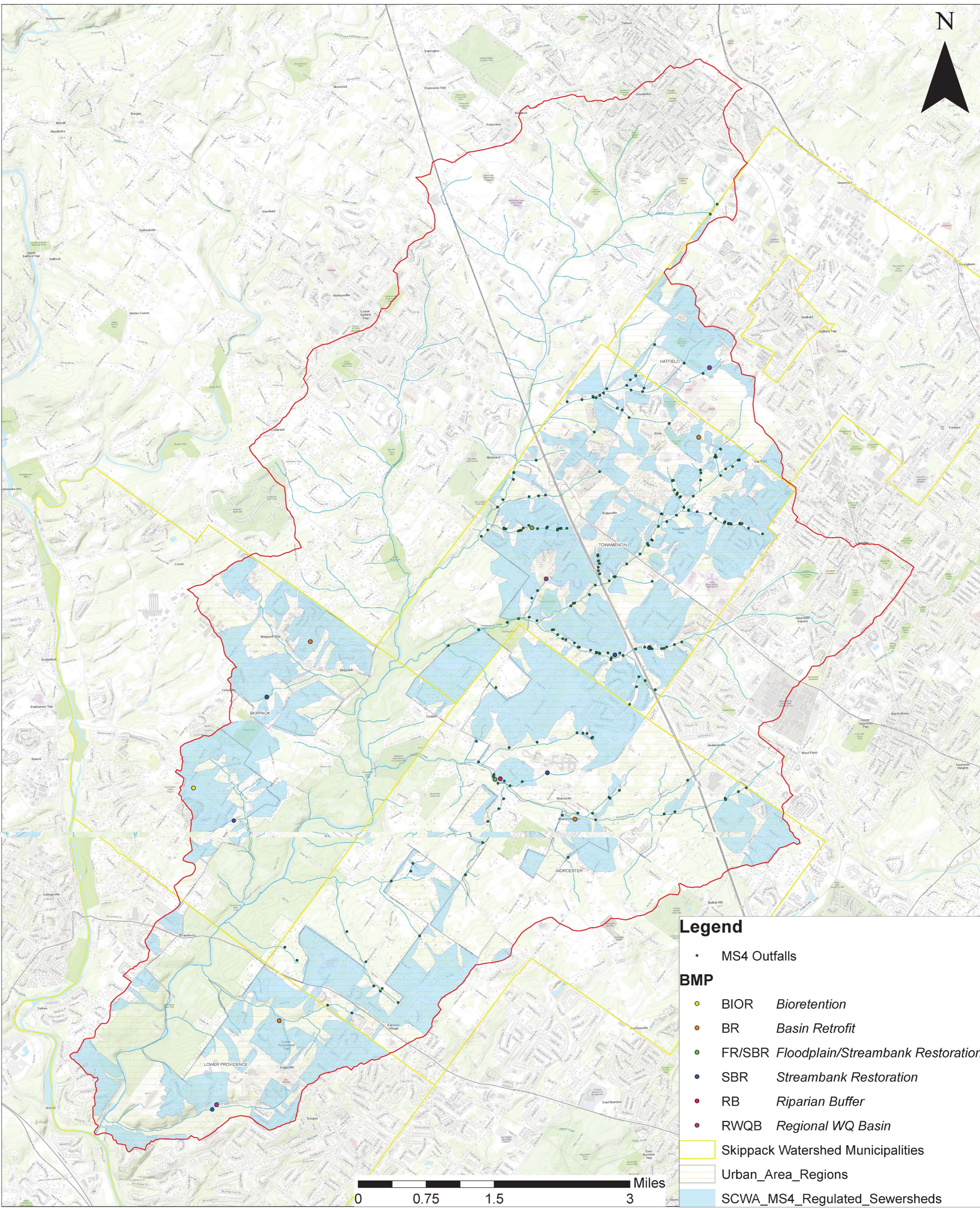
Go Back Pathogen Loads Export to JPEG Print Close

Figure 23: Sediment Wasteload Total with Skippack Township Basin Retrofits

APPENDIX D
DRAFT INTERGOVERNMENTAL AGREEMENT

APPENDIX E
PRIMARY MAPPING

N



Legend

• MS4 Outfalls

BMP

● BIOR *Bioretention*

● BR *Basin Retrofit*

● FR/SBR *Floodplain/Streambank Restoration*

● SBR *Streambank Restoration*

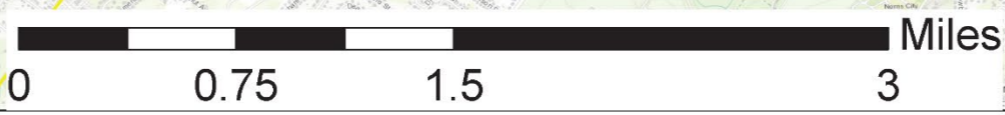
● RB *Riparian Buffer*

● RWQB *Regional WQ Basin*

▭ Skippack Watershed Municipalities

▭ Urban_Area_Regions

▭ SCWA_MS4_Regulated_Sewersheds



APPENDIX F
PUBLIC COMMENTS & RESPONSE