MS4 NPDES Permit
Pollution Reduction Plan (PRP)

FOR

Allen Township
4717 Indian Trail Road
Northampton, PA 18067

Prepared by
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Date: July 10, 2018

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List of Acronyms

BMP	Best Management Practices
CBW	Chesapeake Bay Watershed
CWA	Clean Water Act
DEP	Department of Environmental Protection
GIS	Geographic Information System
IDDE	Illicit Discharge Detection and Elimination
MCM	Minimum Control Measure
MS4	Municipal Separate Storm Sewer System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
PRP	Pollution Reduction Plan
SOP	Standard Operating Procedure
TMDL	Total Maximum Daily Load
UA	Urbanized Area

Common Terms related to Stormwater Management

(As defined by PA Code 25, Chapter 92a. and Chapter 96 *)

Best Management Practice (BMP) – schedules of activities, prohibitions of practices, maintenance procedures and other management practices to prevent or reduce pollutant loading to surface waters of the Commonwealth.

Buffer (Vegetated) – A permanent strip of dense perennial vegetation established parallel to the contours of and perpendicular to the dominant slope of the field for purposes that include slowing water runoff, enhancing water infiltration and minimizing risk of any potential pollutants from leaving the field and reaching surface waters.

Intermittent Stream – A body of water flowing in a channel or bed composed primarily of substrates associated with flowing water, which, during period of the year, is below the local water table and obtains its flow from both surface runoff and groundwater discharges.

Loading Capacity * - the greatest amount of loading that a surface water can receive without violating a water quality standard

MS4 – Municipal Separate Storm Sewer System – A separate storm sewer (including roads with drainage sytems, municipal streets, catch basins, curbs, gutters, ditches, manmade channels or storm drains) which is all of the following:

(i) Owned or operated by a State, City, town, Borough, County District association or other public body (created by or under State Law) having jurisdiction over disposal of sewage, industrial wastes, stormwater or other wastes, including special districts under state law such as a sewer district, flood control district or drainage district, or similar entity, or a designated and approved management agency under section 208 of the Federal Act (33 U.S.C.A. 1288) that discharges surface waters of this Commonwealth.

(ii) Designed or used for collecting or conveying stormwater

(iii) Not a combined sewer

(iv) Not part of a POTW (Publicly Owned Treatment Works)

Perennial Stream – A body of water flowing in a channel or bed composed primarily of substrates associated with flowing waters and capable, in the absence of pollution or other manmade stream disturbances, of supporting benthic macroinvertebrate community which is composed of two or more recognizable taxonomic groups of organisms which are large enough to be seen by the unaided eye and can be retained by a United States Standard No. 30 sieve and live at least part of their life cycles within or upon available substrates in a body of water or water transport system.

Separate Storm Sewer – A conveyance or system of conveyances including pipes, conduits, ditches and channels, primarily used for collecting and conveying storwmater runoff.

Storm Sewershed – The land area which drains to the municipal separate storm sewer system from within the jurisdiction of the MS4 permittee.

Stormwater – runoff from precipitation, snow melt runoff and surface runoff and drainage.

Surface Waters – Perennial and intermittent streams, rivers, lakes, reservoirs, ponds, wetlands, springs, natural seeps and estuaries, excluding water at facilities approved for wastewater treatment such as wastewater treatment impoundments, cooling water ponds and constructed wetlands used as part of a wastewater treatment process.

Purpose

The submission of this Pollution Reduction Plan (PRP) is in accordance with the requirements as defined in the *Individual Permit PAI-13 Authorization to Discharge Under the National Pollutant Discharge Elimination System (NPDES).* This individual permit, issued by the PA Department of Environmental Protection (DEP), grants municipalities the authority to discharge its stormwater into Waters of the Commonwealth under a *Stormwater Discharges from Small Municipal Storm Sewer Systems (MS4)* permit.

Allen Township covers four (4) watersheds: Catasauqua Creek, Dry Run, Hokendauqua Creek and the Lehigh River. DEP has listed each of these waterways as being impaired due to sediment, and the Lehigh River and Hokendauqua Creek with additional impairments such as suspended solids, and organic enrichment (See Appendix A). In accordance with Allen Township's MS4 permit, this PRP has been developed to address water quality initiatives within these drainage areas of impaired streams.

This Pollution Reduction Plan (PRP) may be evaluated by Allen Township at any time for its effectiveness in reducing pollutant loads from its stormwater discharges. If Allen Township believes the PRP should be revised or best management practices (BMP) updated, the Township shall work with the Northeast Regional Office of DEP for review and approval of any revisions and/or updates.

Pollution Prevention

By developing guidelines to help Allen Township manage its stormwater objectives, the 'front end' planning and design process becomes an important tool to assist in the thoughtful prevention of additional pollutants discharging into the Township's impaired waters. Controls and management solutions shall be reviewed to limit cases of removing pollutants from one location and medium, only to transfer them and their possible liabilities to another location. A proactive approach to addressing water quality and pollution concerns at the beginning of a project can decrease the cost, risks and environmental concerns that come from having to manage a problem after its already been created.

Implementation of Allen Township's PRP shall be a multimedia approach, in that program requirements shall integrate educational materials, opportunities for the public to participate, operation and maintenance measures, and training events, whenever possible.

POLLUTION REDUCTION PLAN ELEMENTS

A. PUBLIC PARTICIPATION

Public participation is an essential part of the PRP because it enhances buy-in from landowners that may have an impact on pollutant discharges, it uncovers missing elements or errors in the calculations, and builds cooperative partnerships among the municipality and other local entities.

On April 10th, 2018 Allen Township scheduled an MS4 presentation by the Engineer's office to provide an overview on the MS4 NPDES permit, upcoming changes to the permit, sediment reductions and a discussion on the MS4 waiver process and guidelines.

On July 10th, 2018 Allen Township scheduled a second public meeting and MS4 presentation at Allen Township Volunteer Fire Company. The second presentation was the public meeting to review the Pollution Reduction Plan (PRP), specifically the proposed BMPs anticipated to address the sediment reductions. The meeting was publicly advertised in the Express Times on DATE, and notifications posted to the Township's webpage. A copy of the public notice is included in Appendix B.

An electronic copy of the PRP report and presentation were uploaded to the Township's website for public download and review. The public was given 30 days to provide commentary on the report's contents. The public were able to submit comments directly to the Township Building in writing, or by email to the Township office.

B. MAPPING

In order to determine how much existing sediment was being contributed by the municipality to its receiving streams, the Township needed to first examine how stormwater runoff was entering its boundaries, how the stormwater runoff was being impacted once inside its boundaries, and how the stormwater was then collected and discharged from the municipality. The Township had an existing storm sewer map for its MS4 permit, showing the locations of storm outfalls, inlets, manholes, pipes, swales and pipe discharge locations. This map was used as a base to identify land uses and the impervious/pervious surfaces and the storm sewershed boundary associated with each MS4 outfall.

Use of this base map was permitted as described in the NPDES PRP Instructions: *'The map may be the same as that used to satisfy MCM #3 of the PAI-13 Individual Permit, with the addition of land use and/or impervious/pervious surfaces, the storm sewershed boundary, and locations of proposed BMPs, or may be a different map'.* The map needed to be sufficiently detailed to identify the "planning area" relevant to satisfying the requirements of Appendix D and/or Appendix E in the *Municipal Requirements MS4 Table* published by PA DEP and last updated on March 5, 2018 (See Table 2). The map also needed to be able to demonstrate that the proposed BMPs were located in appropriate storm sewersheds to meet the requirements.

The following GIS platform maps were used for analysis and development of the Township's PRP.

1. Storm Sewer & Street Map – existing basemap showing the municipal storm sewer system with outfall locations, streams and drainage channels.

2. Topo & Impaired Stream Map – contour information was provided by LIDAR shapefile information downloaded from Pennsylvania Spatial Data Access (PASDA) website. The contours provide information on the general grading and how stormwater is directed through the Township. The impaired stream information was provided by PA DEP online GIS mapping service eMAP. The DEP site provides information on the reach extent, and location of impaired streams.

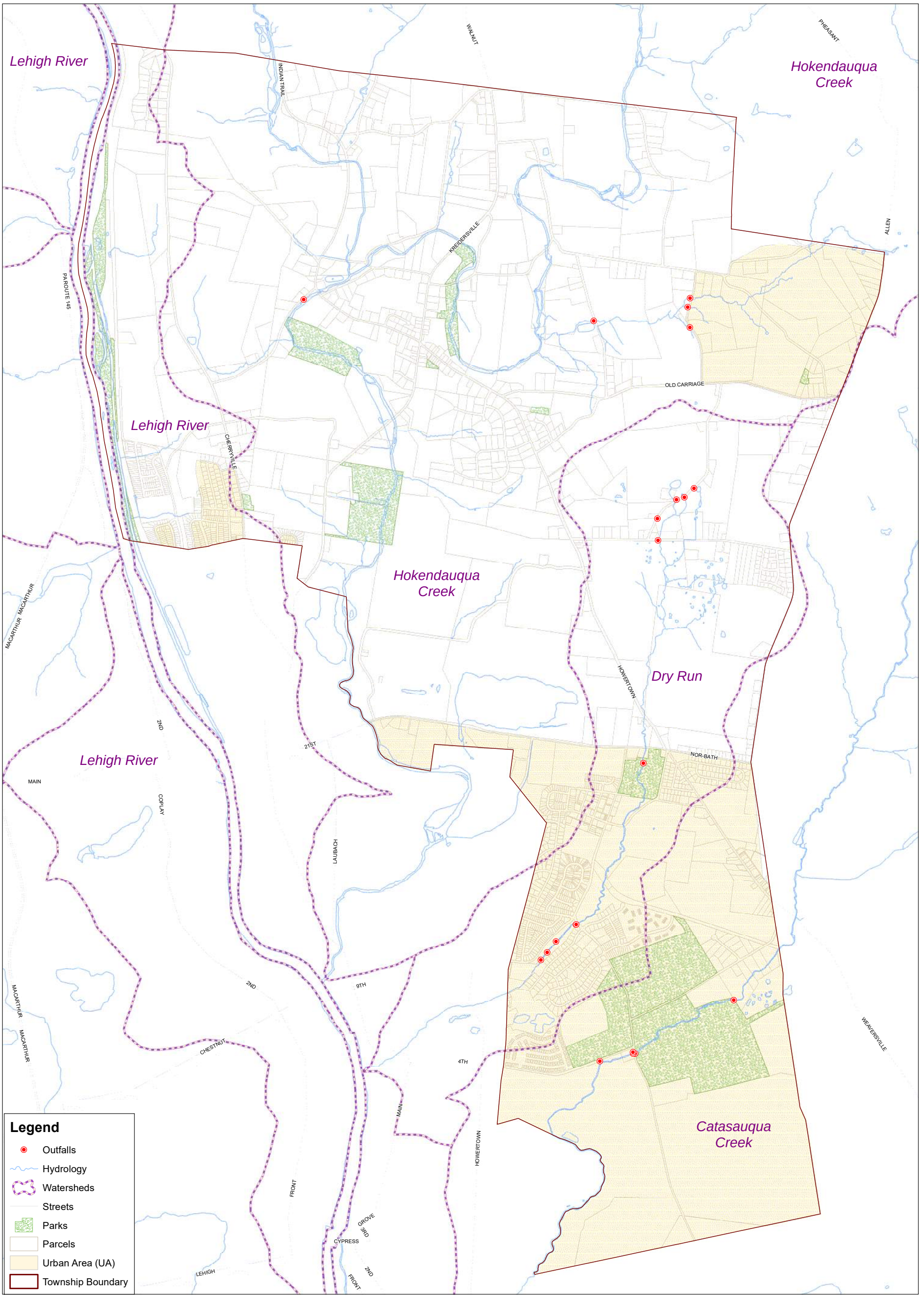
3. Storm Drainage Areas Map – drainage areas to each MS4 outfall were evaluated by the Engineer's office assessing how the stormwater runoff entered and traveled through the storm sewer system by street inlets and pipes. The drainage areas also include 'dispersed discharges' where runoff is not piped, but allowed to flow across the surface into a receiving body of water, such as quarry pits, ponds or tributary stream.

4. Impairment Area Map – after the drainage areas were outlined, a storm sewershed boundary was delineated. This boundary shows which areas of the Township drain and have impact on the impaired stream, specifically the four impaired streams listed by DEP. Any areas draining to non-impaired streams are not included in the PRP calculations.

5. Land Use Map – land uses were evaluated within each of the watersheds. Determining land use for a property is a primary objective for calculating the pervious and impervious areas within each sewershed. Different types of land uses will have different levels of impervious coverage.

6. Parsing – the map may show areas that are to be "parsed" from the planning area. At the MS4's discretion, certain areas may be shown on the map that are within the storm sewershed but are not included in the calculation of land area or the existing pollution loading. These areas are already covered by an NPDES permit for the control of stormwater. If the land is removed from the planning area, BMPs implemented on that land may not be used as credit toward meeting the Township's pollutant loading reduction requirements.

   Allen Township chose to parse out three properties in the Catasauqua Creek drainage area: The Fed Ex property on Willowbrook Road, Lot 4 on Willowbrook Road, and Lot 5 on Willowbrook Road. Each of these warehouse facilities required their own NPDES permits with DEP for on-site treatment of stormwater, and required an Operation & Maintenance (O&M) Agreement by the property owner to maintain their best management practices (BMPs) on the property.



OVERALL MS4 BOUNDARY & WATERSHED MAP
ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

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BARRY ISETT & associates INC
MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

0 1,500 3,000 6,000 Feet

LEHIGH TOWNSHIP

MOORE TOWNSHIP

EAST ALLEN TOWNSHIP

NORTHAMPTON BOROUGH

NORTH CATASAUQUA BOROUGH

Lehigh RIver

Hokendauqua Creek

Dry Run

Catasauqua Creek

Legend

- Impaired Streams
- Hydrology
- Contours
- Township Boundary

TOPO & IMPAIRED STREAMS MAP

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

BARRY ISETT & associates INC
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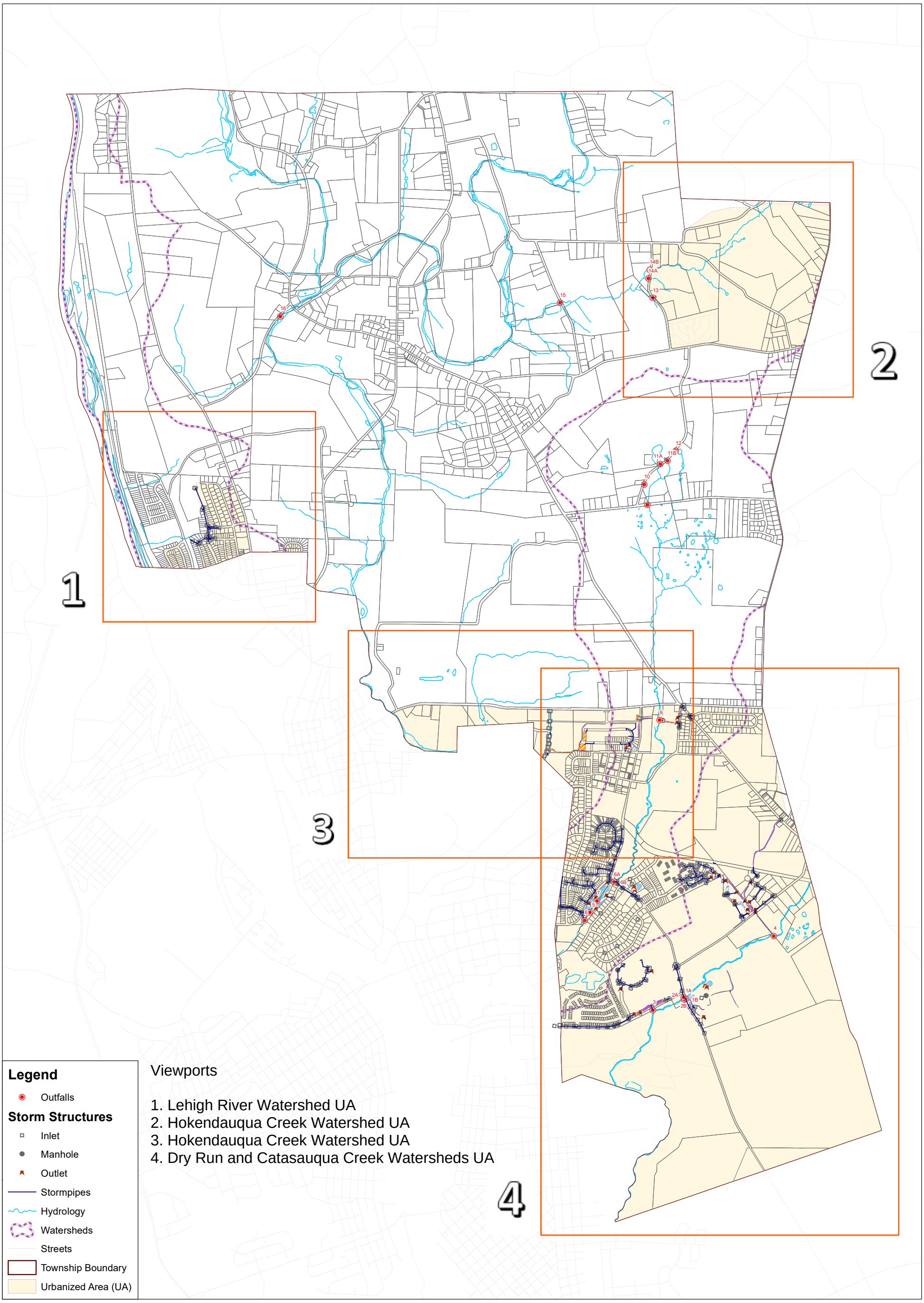

Legend

- Outfalls

Storm Structures

- Inlet
- Manhole
- Outlet
- Stormpipes
- Hydrology
- Watersheds
- Streets
- Township Boundary
- Urbanized Area (UA)

Viewports

1. Lehigh River Watershed UA
2. Hokendauqua Creek Watershed UA
3. Hokendauqua Creek Watershed UA
4. Dry Run and Catasauqua Creek Watersheds UA

MS4 LOCATION MAP
LEHIGH RIVER AND HOKENDAUQUA CREEK WATERSHED AREAS

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

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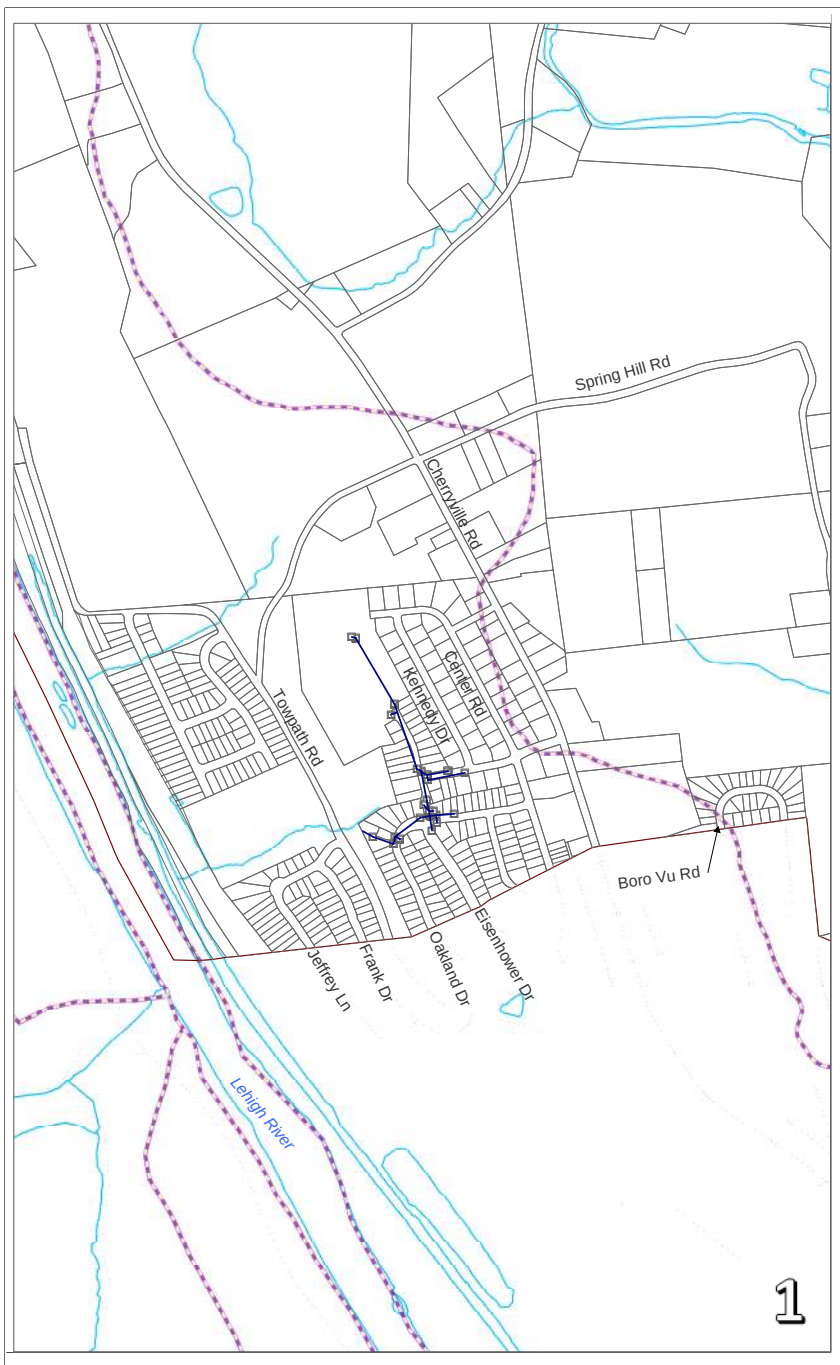

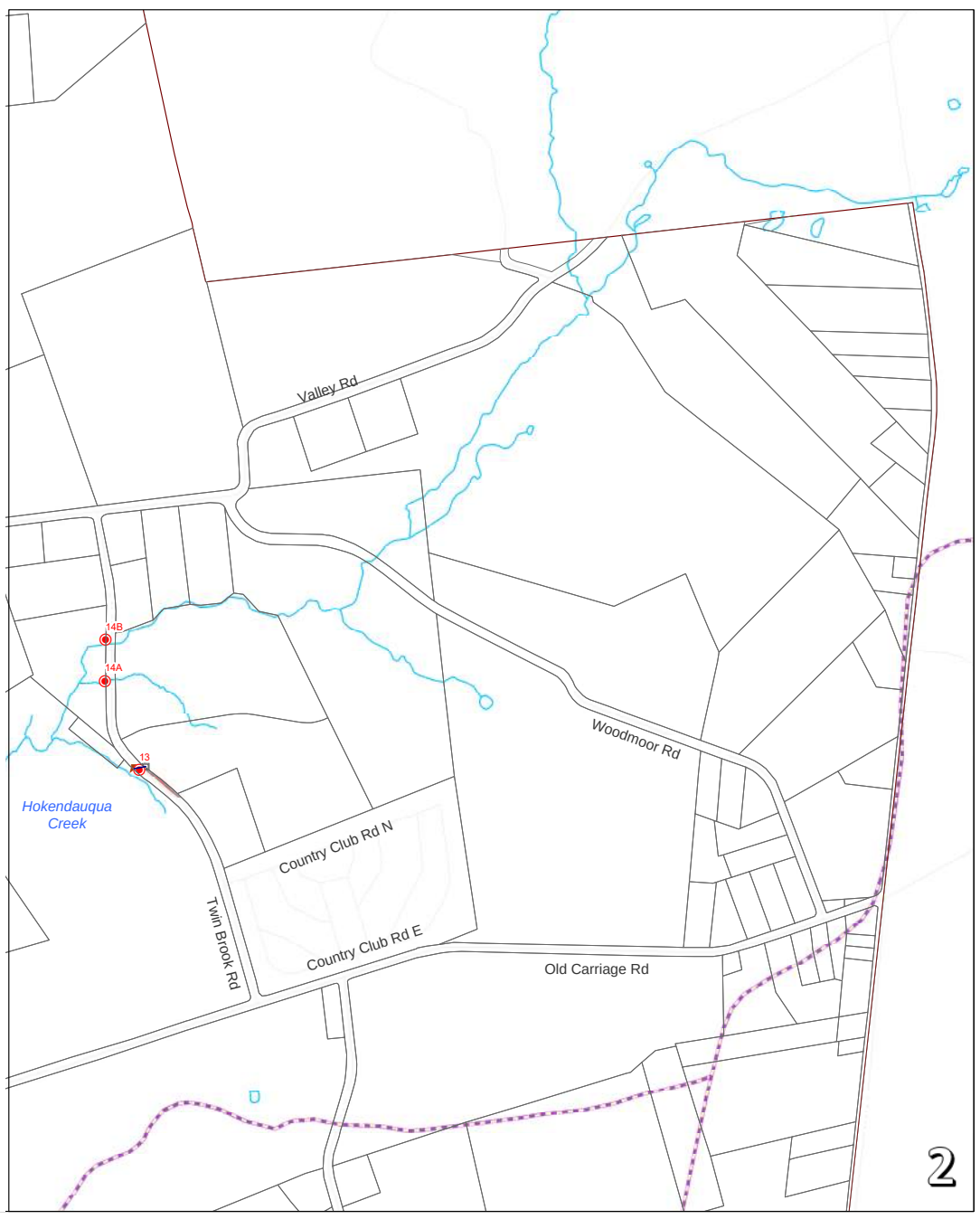

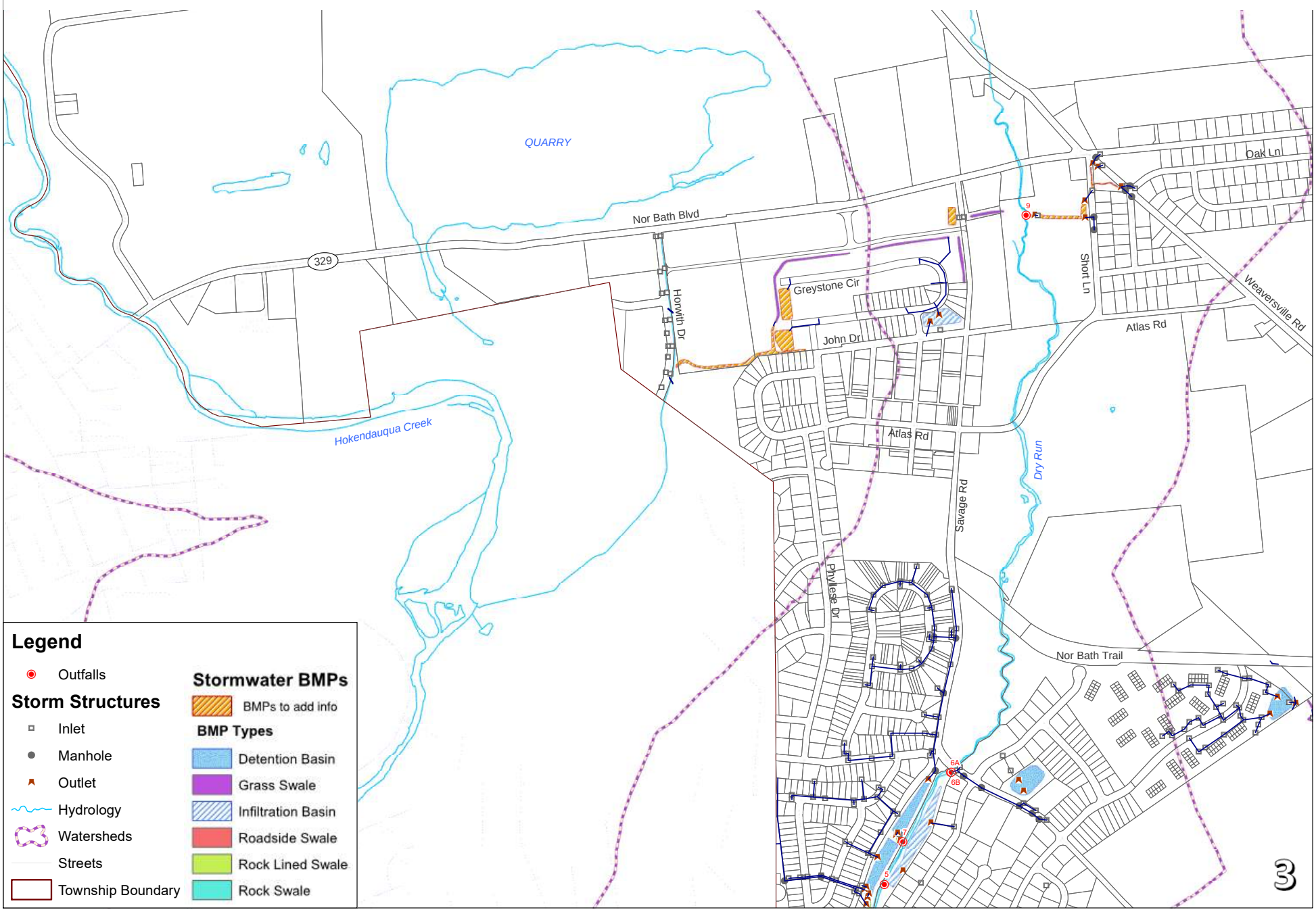

STORM DRAINAGE MAP
LEHIGH RIVER AND HOKENDAUQUA CREEK WATERSHED AREAS

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

BARRY ISETT & associates INC
MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

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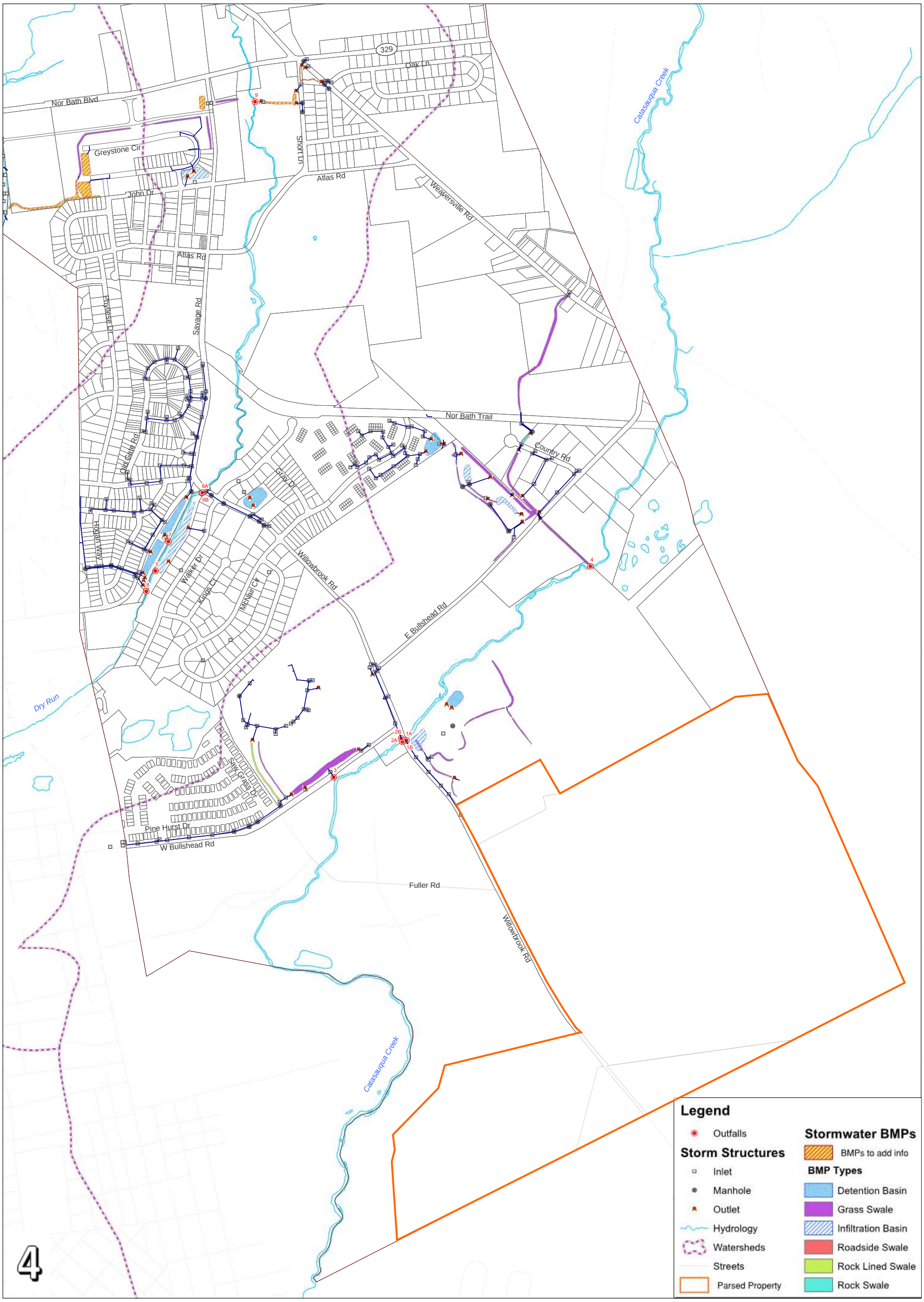

STORM DRAINAGE MAP
DRY RUN & CATASAUQUA CREEK WATERSHED AREAS

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

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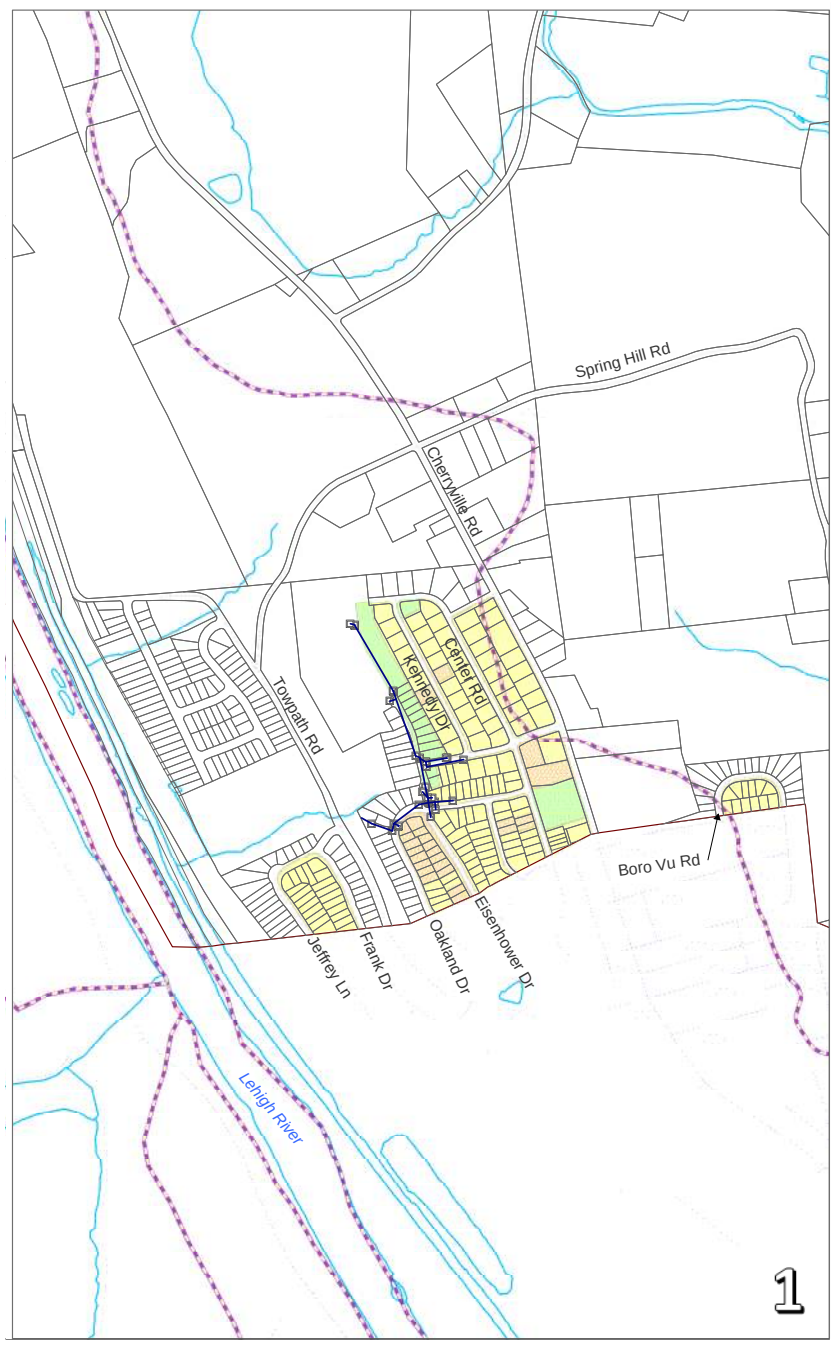

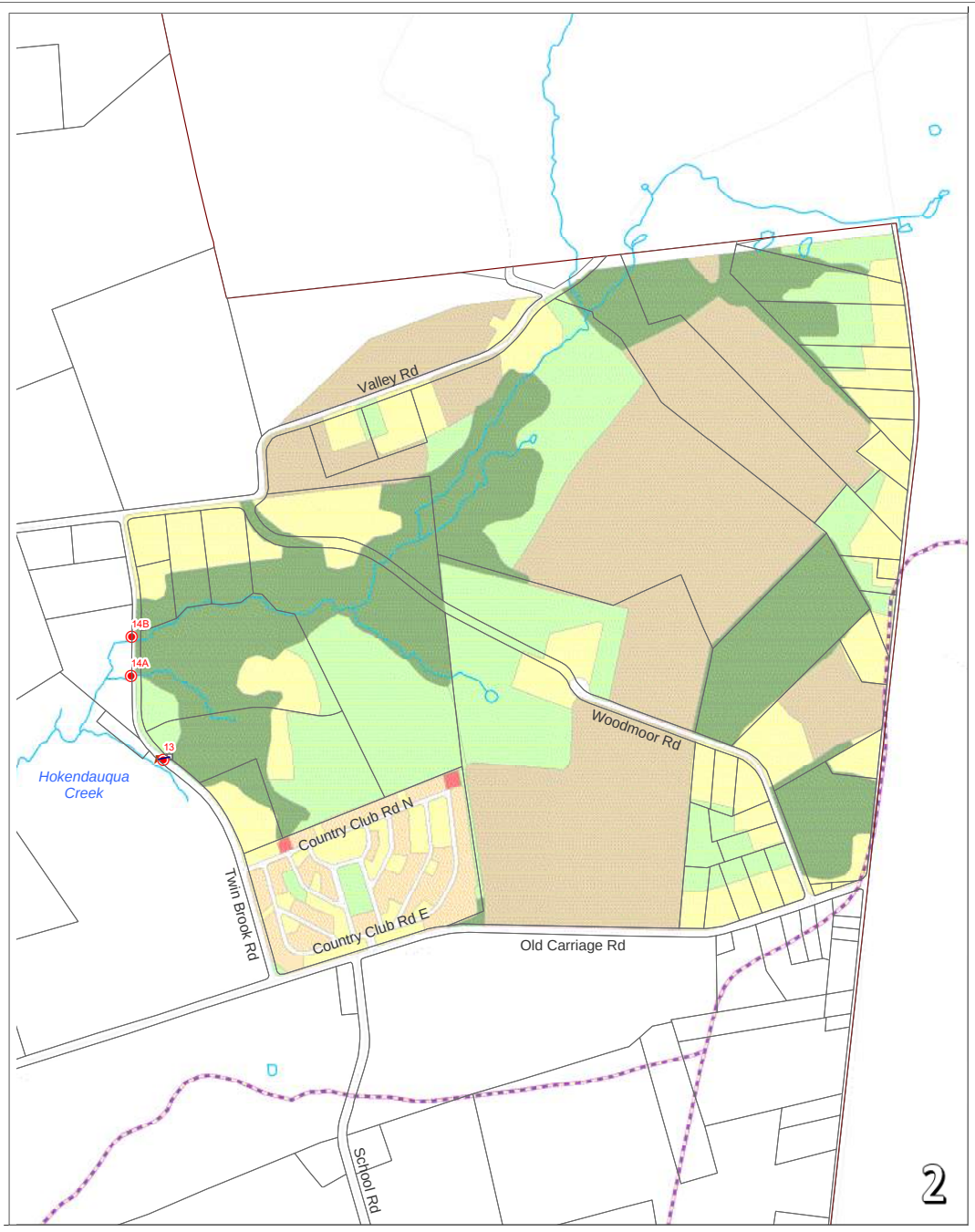

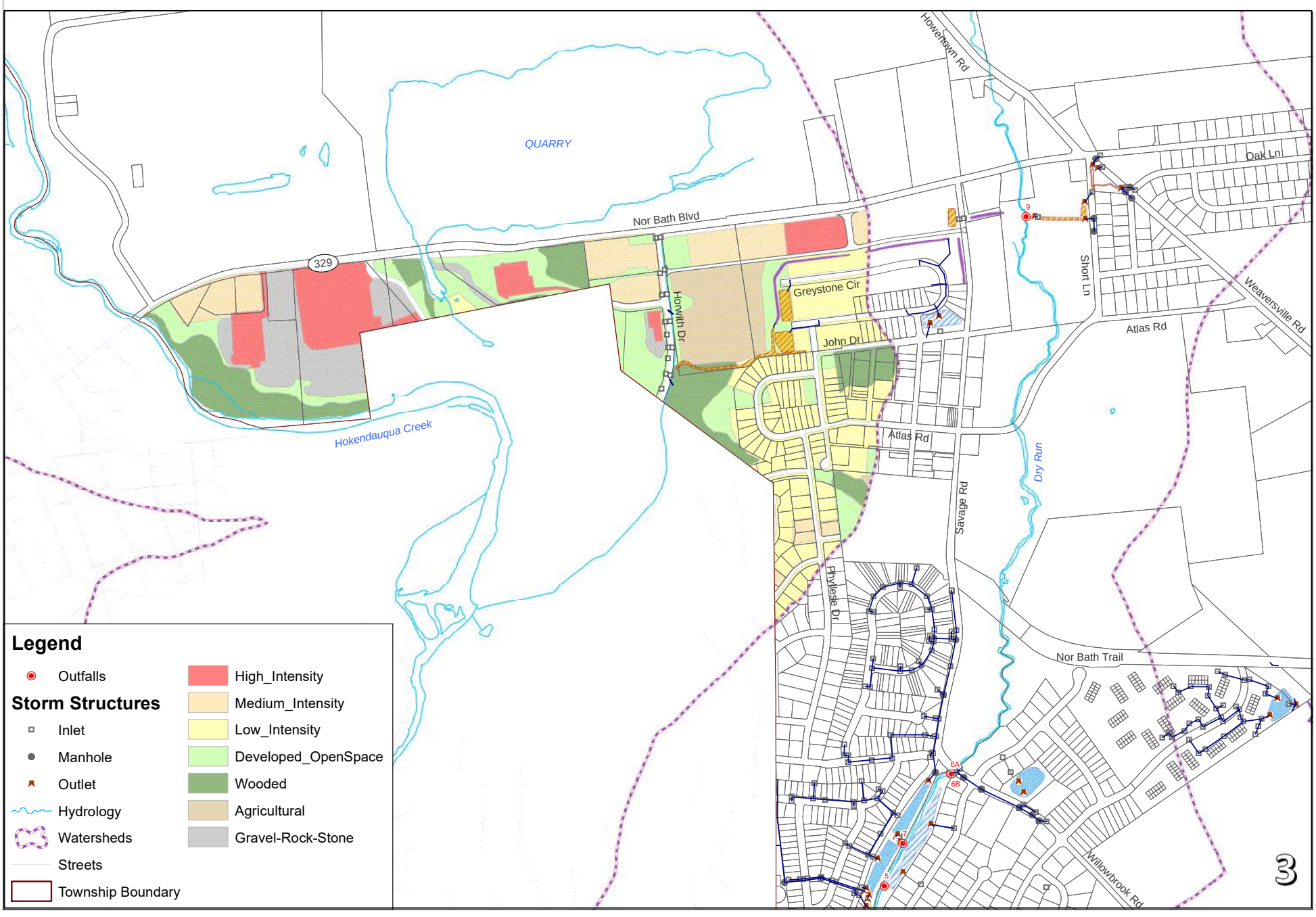

LAND USE MAP
LEHIGH RIVER AND HOKENDAUQUA CREEK WATERSHED AREAS

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

BARRY ISETT & associates INC
MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

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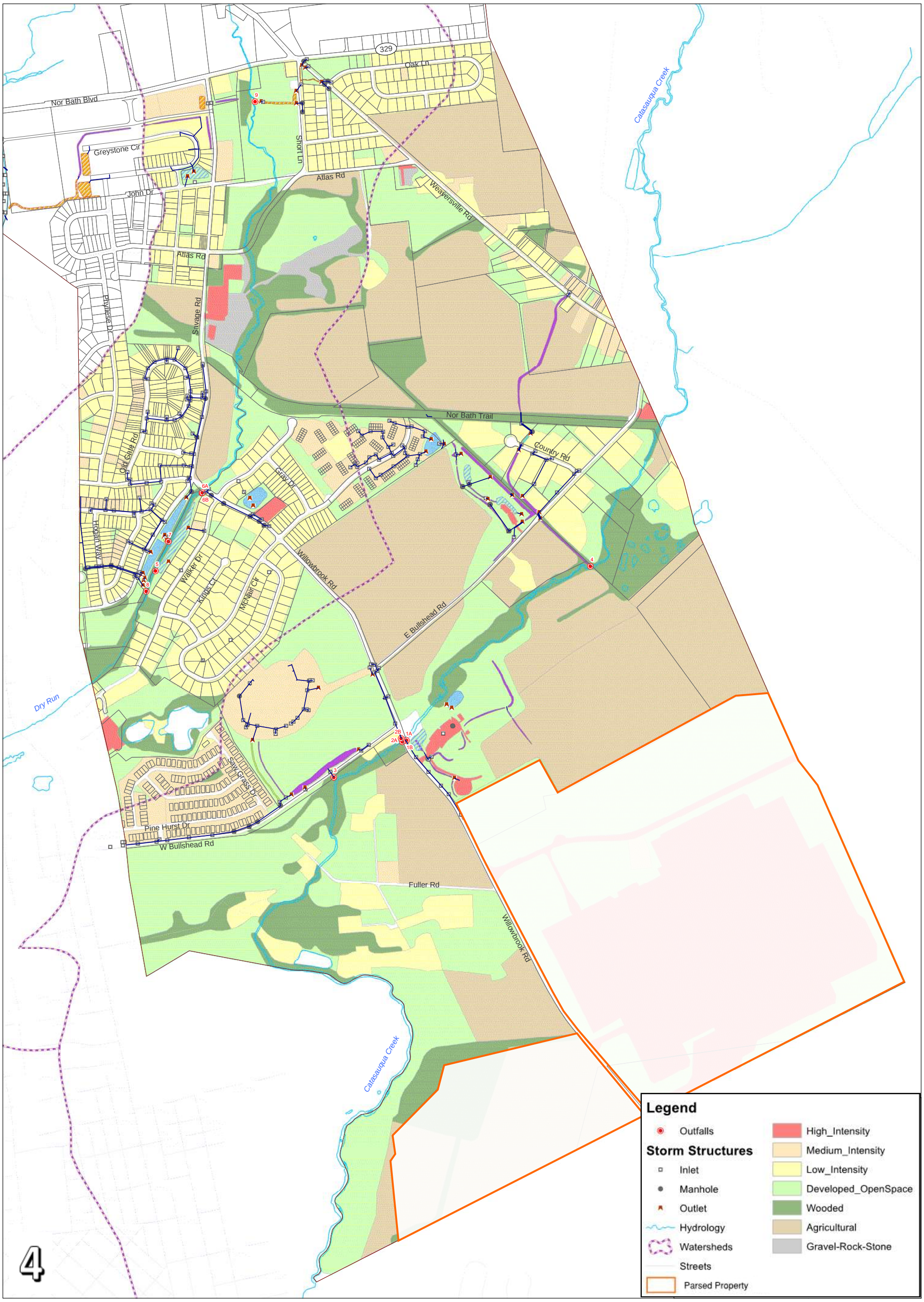

LAND USE & PARSED AREA MAP
DRY RUN & CATASAUQUA CREEK WATERSHED AREAS

ALLEN TOWNSHIP, NORTHAMPTON COUNTY, PA

BARRY ISETT & associates INC
MULTI-DISCIPLINE ENGINEERS AND CONSULTANTS

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C. POLLUTANTS OF CONCERN

The Township shall identify the pollutants of concern for each storm sewershed or the overall PRP planning area. DEP's MS4 Requirements Table identified Allen Township as having impaired stream waters for four (4) streams. The terms "sediment", "siltation" and "suspended solids" all refer to inorganic solids.

The table below shows each of the impaired waters receiving discharges from the Township, and the pollutant(s) that are of concern to that stream.

Table 1: DEP MS4 Requirements Table (last revised 3/5/18)

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)
Allen Township	PAI 132250	Yes	IP	Lehigh River	Appendix E – Organic Enrichment/ Low Dissolved Oxygen, Siltation, Suspended Solids
				Hokendauqua Creek	Appendix E – Siltation, Suspended Solids
				Dry Run	Appendix E – Siltation
				Catasauqua Creek	Appendix E - Siltation

The EPA defines sediment as '*the loose sand, clay, silt and other soil particles that settle at the bottom of a body of water. Sediment can come from soil erosion or from the decomposition of plant and animals. Wind, water and ice help carry these particles to rivers, lakes and streams*.' Sediment is a pollution of concern due to its degradation of water quality, which impacts sources of drinking water; increases water turbidity (cloudiness) causing impacts to aquatic habitat and fish health; and alters the depth and direction of drainage areas which can result in flooding issues.

The EPA notes that nitrogen pollution is *'one of America's most widespread, costly and challenging environmental problems, and is caused by excess nitrogen and phosphorous in the air and water'.* Although Nitrogen and Phosphorous are natural elements and support both animal and plant life, too much of either can impact our air quality, alter plant growth, decrease aquatic habitat and impact our food and drinking sources.

For all PRPs, the MS4 shall calculate the existing loading of the pollutant(s) of concern in pounds per year (lbs/yr). Allen Township utilized their mapping information to determine its existing contribution of sediment and Phosphorous being discharged into Lehigh River.

Allen Township is required to reduce the amount of sediment discharge by 10% for the Hokendauqua Creek, Dry Run and Catasauqua Creek watersheds.

Allen Township is required to reduce the amount of sediment discharge by 10% and Phosphorous by 5% for the Lehigh River watershed.

If the impairment is based on nutrients only or other surrogates for nutrients, which is often the direct result of human activity, such as fertilizers, pesticides, and soap detergents, then a minimum 5% reduction of Phosphorous is required. If the impairment is due to both sediment and nutrients, then both 10% reduction in sediment and 5% reduction in total Phosphorous must be addressed. PRP's may use a presumptive approach in which it is assumed that a 10% sediment reduction will also accomplish a 5% Phosphorous reduction. However, MS4s may not presume that a reduction in nutrients will accomplish a commensurate reduction in sediment.

The municipality shall select the Best Management Practices (BMPs) suited to reduce this pollution loading. The PRP shall demonstrate that the selected BMPs will achieve the minimum reductions required by DEP.

D. DETERMINE EXISTING LOADING FOR POLLUTANTS OF CONCERN

There are several possible methods to estimating the existing load, ranging from the simplistic to the complex. One method to estimate existing loading is the Simplified Method. This method determines the percent of impervious and pervious surface within the urbanized area of the storm sewershed and calculates the existing loading by multiplying those land areas (acres) by pollutant loading rates (lbs/acre/yr). This method does not take into consideration the different types of land uses within the storm sewershed.

Use of the simplified method is not required. Any methodology that uses the following factors based on sound science may be considered acceptable:

- calculates existing pollutant loading in terms of pounds per year, and
- evaluates BMP-based pollution reductions utilizing DEP's BMP Effectiveness Values contained in 3800-PM-BCW0100m, or
- evaluates BMP -based pollution reduction utilizing Chesapeake Bay Program expert panel reports, and
- uses average annual precipitation conditions, and
- considers both overland flow and stream erosion

The Engineer's office utilized the WikiWatershed online tool from the Stroud Water Research Center for impervious coverage rates for different land uses. Use of this GIS platform and the WikiWatershed were approved methods by PA DEP. Since different land uses have different impacts on impervious coverage, the WikiWatershed model was determined to give the Township more accurate pollution loading calculations. The following land cover categories and impervious rates were provided by the Model My Watershed: Site Storm Model function of the WikiWatershed program.

Table 2: Land Categories Used for Determining Pollutant Loads

LAND USE CATEGORY	% IMPERVIOUS COVERAGE
Rock/ Barren (Developed)	80 - 100
High Intensity	80 - 100
Medium Intensity	50 – 79
Agricultural	50 - 79
Low Intensity	20 - 49
Open Space (Developed)	0 – 19
Forested/ Wooded	0
Roads	100

Aerial photography was utilized through a GIS platform to outline the various land use boundaries within each of the drainage areas. The square footage of each land use was calculated by the GIS program and then compiled into a spreadsheet to get the total square footage of each land use.

After having each of the land uses calculated, the Township then needed to apply the pollution loading rate to each land use to find the MS4's total contribution to the watershed. The pollution loading rate was taken from Attachment B in DEP's PRP Instruction manual – Developed Land Loading Rates for PA Counties.

The attached tables show the calculation method and breakdown of land uses for determining the existing contribution of pollutants to each impaired sewershed. MS4's may claim "credit" for structural BMPs installed and implemented prior to development of this PRP to reduce the Township's existing loading estimates.

MS4s may not claim credit for street sweeping or other non-structural BMPs implemented in the past in order to meet its reduction requirement. Instead, the MS4 may claim pollutant reduction credit in the form of reducing the existing loading being discharged by the MS4 into the stream. In order for the structural BMPs to be credited, the stromwater BMP must have been continually operated and maintained.

Table 3A – Lehigh River Existing Pollutant Loads
No credits taken for existing BMPs

Table 3B – Hokendauqua Creek Existing Pollutant Loads
No credits taken for existing BMPs

Table 3C – Dry Run Existing Pollutant Loads

Credits for Existing BMPs being maintained by Owner:

a) Savage Road Upper Basin (MS4 Map ID# B-02A)
b) Savage Road Lower Basin (MS4 Map ID# B-02B)

Table 3D – Catasauqua Creek Existing Pollutant Loads

Credits for Existing BMPs being maintained by Owner:

a) Willow Ridge Basin (MS4 Map ID# A-24)
b) Wayne A. Grube Memorial Park on Willowbrook Road Swales (MS4 Map ID# A-06, A-07, A-08, A-09, A-10, A-11, A-12)
c) Wayne A. Grube Memorial Park Swales (MS4 Map ID# A-16, A-17)

Table 4 provides a summary of the required pollution reductions based on the existing loads of sediment and Phosphorous. The pollutant load is shown in pounds per year.

Table 4: Allen Township Required Pollution Reductions

WATERSHEDS			
Allen Township	Existing Load	Minimum Reduction	Required Reduction
LEHIGH RIVER			
Total Sediment	51,547.21 lb/yr	10 %	5,154.72 lb/yr
Total Phosphorous	74.42 lb/yr	5%	3.72 lb/yr
HOKENDAUQUA CREEK			
Total Sediment	475,012.22 lb/yr	10 %	47,501.22 lb/yr
DRY RUN			
Total Sediment	406,658.48 lb/yr	10 %	40,665.85 lb/yr
CATASAUQUA CREEK			
Total Sediment	1,001,117.95 lb/yr	10 %	100,111.80 lb/yr

Whatever tool or approach that is used to estimate existing loading from the PRP planning area must also be used to estimate proposed loading to the planned BMPs. Providing consistent methodologies avoids errors in percent pollutant removal calculations that would result if different methods were used.

E. SELECT BMPS TO ACHIEVE THE MINIMUM REQUIRED REDUCTIONS IN POLLUTANT LOADING

Once the Township identified the amount of pollution load required to be reduced for each watershed area, the Township could then identify areas within the municipality to be studied for installing BMP improvements. The proposed implementation of BMPs or land use changes must be within the storm sewershed that will result in meeting the minimum required reductions. For example, this means the municipality can not install a wetland in the Catasauqua Creek drainage area and use those pollution reduction amounts to satisfy reductions needed in the Hokendauqua Creek area.

These BMPs shall be implemented within five (5) years of DEP's approval date for coverage under the PAI-13 Individual Permit. The BMPs may be located on public or private property. If the applicant is aware of BMPs that will be installed by others, either in cooperation with the applicant or otherwise, and it will be located within the sewershed that will result in net pollutant loading reductions, then the applicant may propose those BMPs in this PRP.

As part of the Township's annual cleaning and maintenance practices for streets, sweeping has been used to remove sediment, debris and other potential sources of pollution affecting the streams. This practice is well suited for urban environments with little land available for the installation of structural controls. However, historic street sweeping practices with broom equipment have been a seasonal task and should not be considered in calculating PRP reduction credits. The method and frequency of street sweeping required to count for PRP credit requires a single street being swept at least 25 times a year by a vacuum sweeper. The cost of renting a machine, with the added labor and hauling costs, is not practical for the mere 9% sediment reduction allotted by DEP. Seasonal street sweeping activities with brush equipment may remain a housekeeping task (MCM#6) as part of the Township's annual MS4 reporting, but it is not included as a BMP option in this report.

In calculating future pollutant loading, the Township must be cognizant of planned changes to land uses or BMPs. For example, if a tract of land (<1 acre) currently in pasture will be converted within the next few years to residential land use, and there are no ordinances in place to control the rate, volume or quality of stormwater draining from the tract, the potential net increase in pollutant loading must be factored into the future loading estimates. This means that BMPs must be implemented on the tract or elsewhere within the storm sewershed to compensate for this change.

During the five (5) year permit, the MS4 can take credit for BMPs that are under 1 acre and are not being used to meet regulatory requirements, such as a Chapter 102 NPDES permit for construction activities. However in cases where there is a Chapter 102 NPDES permit, the MS4 may take credit for stormwater BMPs that go above and beyond the minimum requirements. For example, a land development project was required to install a stormwater BMP as part of its Chapter 102 NPDES permit requirement. The BMP was designed and installed to exceed the minimum requirements of the permit. The MS4 may elect to take credit for the additional pollution reduction provided by that BMP. It is the responsibility of the MS4 to demonstrate that

the BMP exceeds its regulatory requirements. The MS4 may take credit for only those additional reductions that result from exceeding the regulatory requirements.

Allen Township did not take any credits for BMPs that exceeded the minimum NPDES requirements.

STUDY AREAS

Township staff and the Engineer's office developed a list of priority areas for initial evaluation. These areas were reviewed against the inventory list of installed BMPs in the Township. The goal was to identify and assess a BMP's potential for retrofit improvements and/or finding opportunities for the municipality to address areas with existing concerns.

LEHIGH RIVER

BMP OPTION 1 – EISENHOWER DRIVE RAIN GARDEN

Located on undeveloped property and privately owned, the lot is located at the 'T' intersection of Eisenhower Drive and West 32nd Street. The property sits at the edge of the urban area, and is technically outside the Township's MS4 boundary, however a proposed rain garden located here would receive and treat stormwater from within the MS4 boundary.

The rain garden would receive 636,719 SF (14.61 ac) of run off from the residential lots along Eisenhower Drive, Kennedy Drive and West 32nd Street. A curb inlet at the street intersection would be re-directed to discharge to the proposed rain garden. Initial web soil survey information notes the area to have Berks-Weikert soils, which are typically well-drained and suitable for infiltration back to groundwater. An overflow pipe would be installed to allow stormwater to discharge during heavy, prolonged rain events, or when the garden reaches its holding capacity.

The rain garden shall be planted with deep rooted grasses suitable to the area, along with other native plantings, to encourage groundwater infiltration and filtering of sediment and nutrients from the stormwater run off. The plantings provide aarea for sediment to settle out from the water, selective plants uptake the phosphorous and nitrogen as part of their biological processes, and soils can help to adhere the nutrients and sediment so it doesn't get directly discharged to the streams. Use of rain garden is desirable in this location due to the surrounding residential development where lawns are typically managed with chemical fertilizers (containing both N and K) and well drained soils.

Photo (above): Undeveloped lot for proposed rain garden.
Location Map (below): The proposed rain garden location, with drainage area hatched.

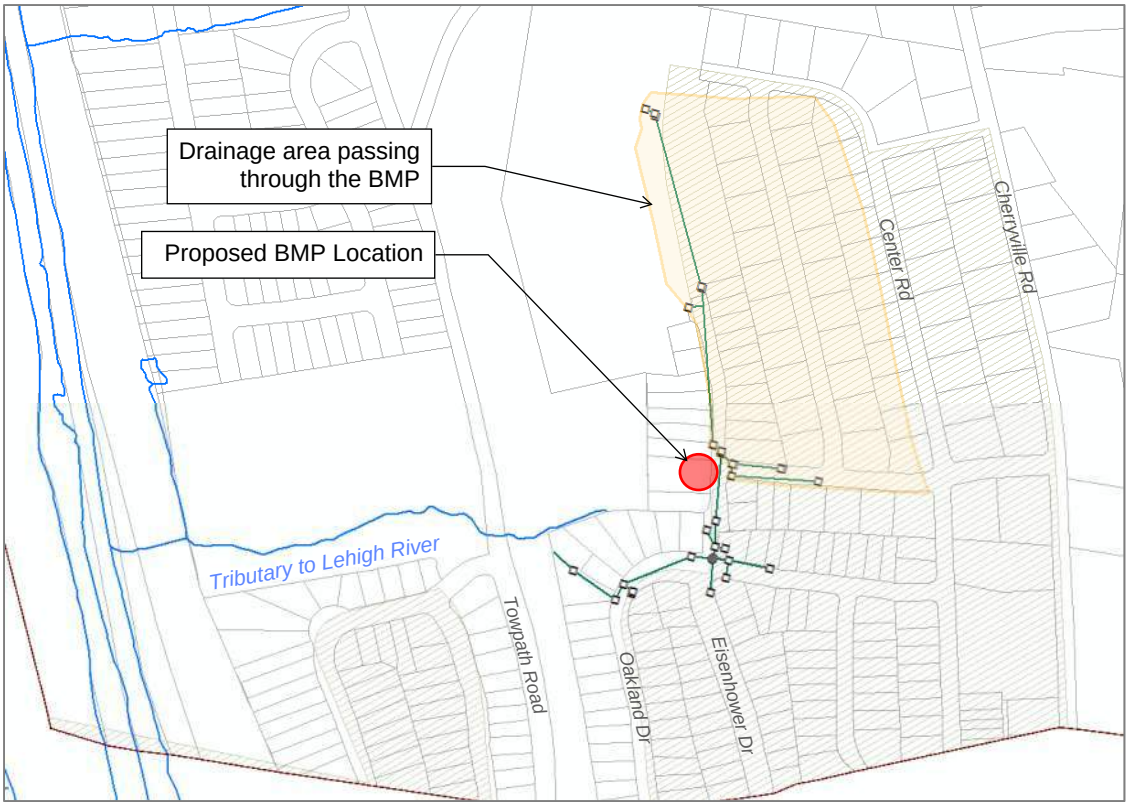


Table 5: Lehigh River Watershed - BMP Option 1 – Rain Garden at Eisenhower Drive

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)	PHOS. LOADING (LB/AC) [3]	LOAD (LBS)
DEVELOPED, OPEN SPACE	155,056.00	3.56	0.19	IMPERVIOUS	0.68	1839.00	1243.76	2.28	1.54
				PERVIOUS	2.88	264.96	763.95	0.84	2.42
DEVELOPED, LOW INTENSITY	357,216.00	8.20	0.49	IMPERVIOUS	4.02	1839.00	7389.60	2.28	9.16
				PERVIOUS	4.18	264.96	1108.14	0.84	3.51
DEVELOPED, MEDIUM INTENSITY	23,077.00	0.53	0.79	IMPERVIOUS	0.42	1839.00	769.66	2.28	0.95
				PERVIOUS	0.11	264.96	29.48	0.84	0.09
STREETS/ ROADS	101,370.00	2.33	1.00	IMPERVIOUS	2.33	1839.00	4279.60	2.28	5.31
TOTAL LOADS				SEDIMENT			15,584.19	PHOS.	22.99
BMP EFFECTIVENESS							80%		75%
TOTAL PROPOSED LOAD REDUCTION							12,467.35		17.24

Sources:

1 - Land Use Categories taken from Wiki Watershed Online Tool - National Land Cover Database

2 - Existing Loading Rates, PA DEP Attachment B Form [3800-PM-BCW0100k] " Developed Land Loading Rates for PA Counties" All Other Counties (Sediment) 1839.00 lbs/ac/yr Impervious; 264.96 lb/ac/yr Pervious

3 - Existing Loading Rates, PA DEP Attachment B Form [3800-PM-BCW0100k] " Developed Land Loading Rates for PA Counties" All Other Counties (Phosphorous) 2.28 lbs/ac/yr Impervious; 0.84 lb/ac/yr Pervious

With the selection of this BMP, the sediment and Phosphorous reduction requirement would be met for the Lehigh River drainage area.

BMP OPTION 2 – TOW PATH ROAD RAIN GARDEN

Located on undeveloped, sloping and privately owned property on TowPath Road, the proposed BMP would be 430 feet West of option #1, and 100 feet lower in elevation. This location is also outside the urbanized area of the Township's MS4 boundary. Due to the added distance outside the UA, and additional surface run off from surrounding land uses passing through this BMP location, the Engineer's office was required to expand the drainage area and increase the pollution reduction requirement to include the additional area outside the MS4 boundary.

Selection of this BMP option would increase the MS4 boundary by 372,483.03 square feet (8.55 ac). This additional UA would also increase the existing Lehigh River pollution loads by 5,5898 pounds of sediment and 10.23 pounds of Phosphorous. If the Township selects option #2 as the rain garden installation choice, the required 10% sediment reduction would then adjust to 5,713.71 pounds, and the required 5% Phosphorous reduction would adjust to 4.23 pounds.

The rain garden would receive 1,353,309 SF (31.06 ac) of run off from the same residential lots along Eisenhower Drive, Kennedy Drive and West 32nd Street in option #1, plus Oakland Drive and a sloped wooded area behind the properties. The storm sewer system discharges behind the Oakland Drive properties into the sloped wooded area. A drainage swale then carries the runoff underneath Tow Path Road through an HDPE pipe, continuing down a vegetated swale until it combines with the Lehigh River canal.

There is concern for the existing road culvert pipe to become clogged with leaf debris and displaced soils from the hillside. The proposed BMP location would require some excavation to remove piles of dumped debris and soils at the culvert. Thinning the tree canopy with some selective clearing, and providing a larger and deeper pooling area will offer longer retention times for sediment to settle out.

The same planting benefits for sediment and nutrient removals mentioned in option #1 would apply to this location as well.

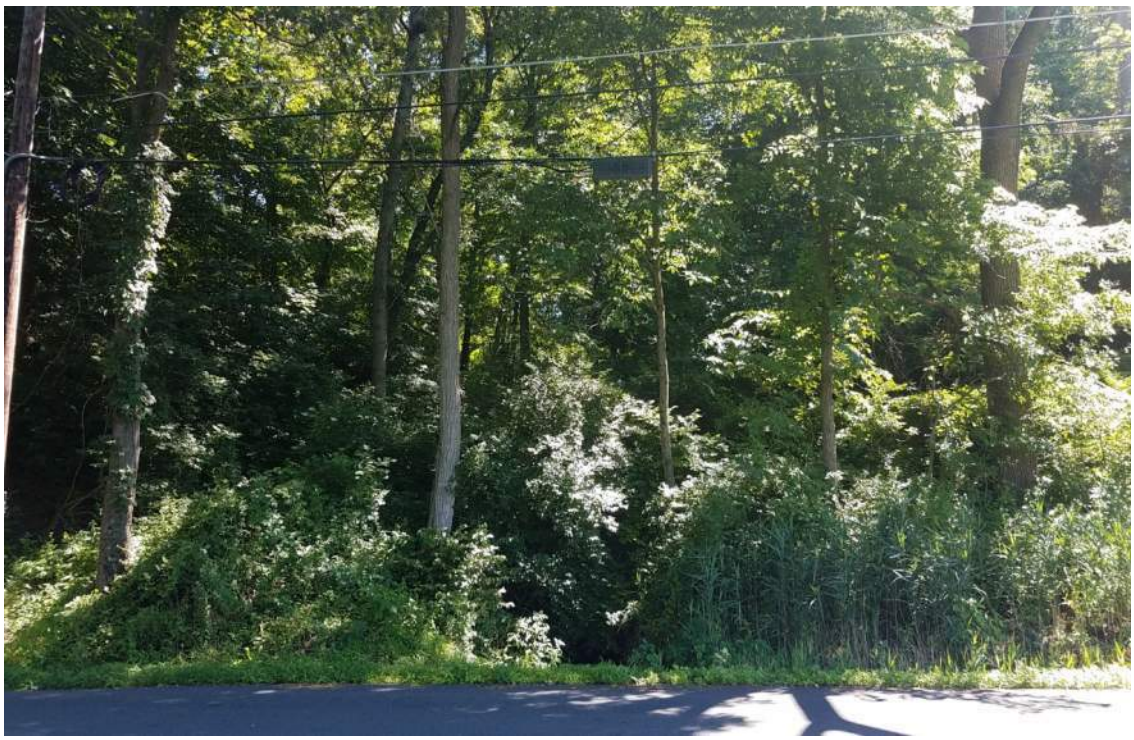


Photo (above): View east to Tow Path Road from Jeffrey Lane.
Location Map (below): The proposed rain garden location, with drainage area hatched.

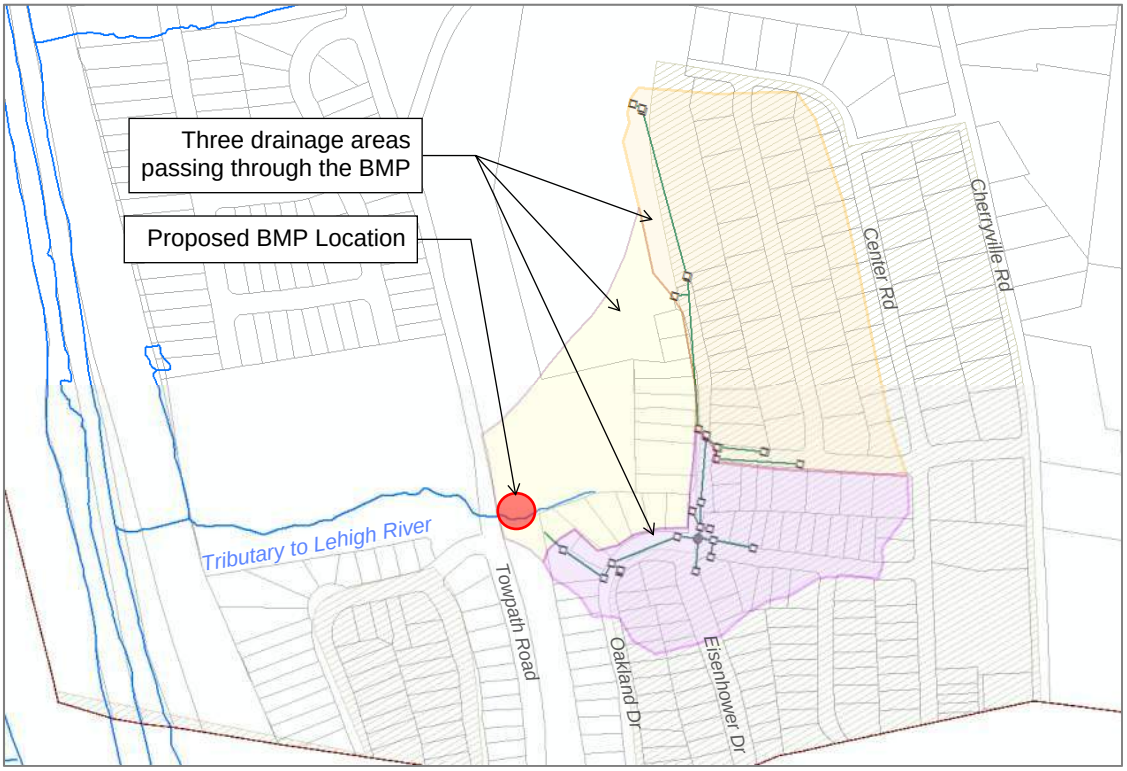


Table 6: Lehigh River Watershed - BMP Option 2 – Rain Garden at Tow Path Road

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)	PHOS. LOADING (LB/AC) [3]	LOAD (LBS)
WOODED	202,283.23	4.64	0.00	IMPERVIOUS	0.00	1839.00	-	2.28	-
				PERVIOUS	4.64	264.96	1230.42	0.84	3.90
DEVELOPED, OPEN SPACE	222,902.38	5.12	0.19	IMPERVIOUS	0.97	1839.00	1787.98	2.28	2.22
				PERVIOUS	4.14	264.96	1098.23	0.84	3.48
DEVELOPED, LOW INTENSITY	658,061.74	15.11	0.49	IMPERVIOUS	7.40	1839.00	13,613.09	2.28	16.88
				PERVIOUS	7.70	264.96	2041.41	0.84	6.47
DEVELOPED, MEDIUM INTENSITY	138,422.85	3.18	0.79	IMPERVIOUS	2.51	1839.00	4616.67	2.28	5.72
				PERVIOUS	0.67	264.96	176.82	0.84	0.56
STREETS/ ROADS	131,638.83	3.02	1.00	IMPERVIOUS	3.02	1839.00	5557.48	2.28	6.89
TOTAL LOADS				SEDIMENT			30,122.08	PHOS.	46.12
BMP EFFECTIVENESS							80%		75%
TOTAL PROPOSED LOAD REDUCTION							24,097.66		34.59

Sources:

1 - Land Use Categories taken from Wiki Watershed Online Tool - National Land Cover Database
2 - Existing Loading Rates, PA DEP Attachment B Form [3800-PM-BCW0100k] " Developed Land Loading Rates for PA Counties" All Other Counties (Sediment) 1839.00 lbs/ac/yr Impervious; 264.96 lb/ac/yr Pervious
3 - Existing Loading Rates, PA DEP Attachment B Form [3800-PM-BCW0100k] " Developed Land Loading Rates for PA Counties" All Other Counties (Phosphorous) 2.28 lbs/ac/yr Impervious; 0.84 lb/ac/yr Pervious

With the selection of this BMP, the sediment and Phosphorous reduction requirement would be met for the Lehigh River drainage area.

HOKENDAUQUA CREEK

BMP OPTION 1 – HORWITH DRIVE BIOSWALE

Located on the east side of Horwith Drive, along the agricultural fields of the Stone Ridge Subdivision, the topography drains the agricultural fields to the west towards Horwith Drive. An existing channel carries run off from the fields, and collects additional discharges from the east side of Horwith Drive via storm sewer pipes crossing under the road. The storm pipes crossing under Horwith Drive are from Brick Kiln Court and its surrounding land uses. The swale takes the run off south along Horwith Drive until it combines with Hokendauqua Creek in Northampton Borough.

Within the last 5 years, the existing drainage swale was partially filled in and a concrete sidewalk installed along Horwith Drive. Rather than remove the recent improvements for pedestrian circulation, the proposed bioswale BMP would be located between the sidewalk and the agricultural field, as a buffer. The Township anticipates the agricultural fields along Nor Bath Blvd (SR 0.329) to be developed within the next 5 years by Stone Ridge Meadow Commercial development. The proposed bioswale BMP could provide an alternate drainage point for the proposed development, if found to be applicable.

The bioswale would receive 1,015,261 (23.3 ac) of storm run off from the agricultural field, new access drive roadway, and open lawn areas. Initial web soil survey information notes the area to have Duffield silt loam, which are typically well-drained and suitable for infiltration.

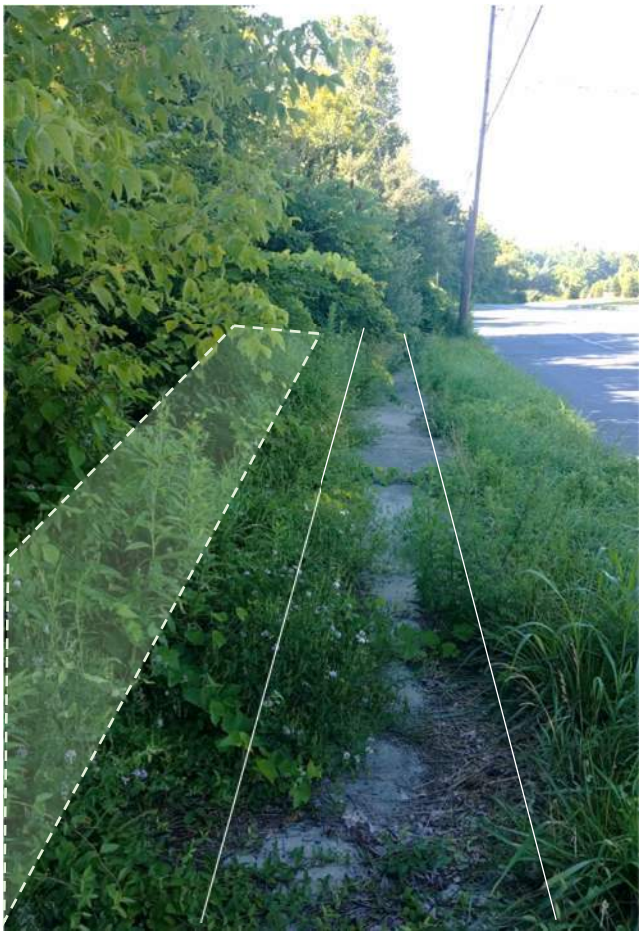


Photo (left): View looking south along the Horwith Drive sidewalk. Proposed BMP would push back the vegetation and clear the pedestrian walkway for better accessibility and sight clearance.

Photo (right): View looking north along the Horwith Drive sidewalk.

Location Map (below): The proposed bioswale location, with drainage area hatched.

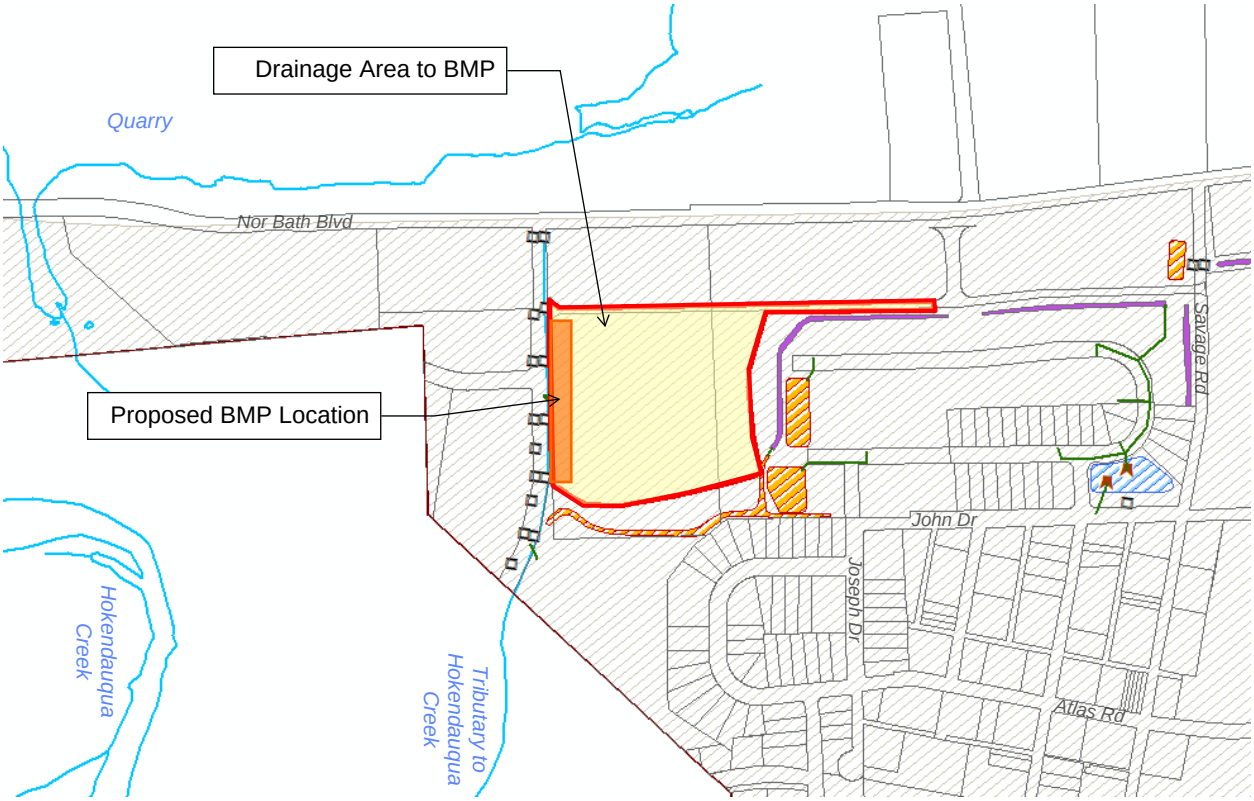


Table 7: Hokendauqua Creek - BMP Option 1 – Bioswale at Horwith Drive

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	37,098.97	0.85	0.19	IMPERVIOUS	0.16	1839.00	297.58
				PERVIOUS	0.69	264.96	182.78
AGRICULTURAL	399,434.22	9.17	0.79	IMPERVIOUS	7.24	1839.00	13321.90
				PERVIOUS	1.93	264.96	510.22
STREETS/ ROADS	37,411.50	0.86	1.00	IMPERVIOUS	0.86	1839.00	1579.42
TOTAL LOADS				SEDIMENT			15,891.91
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							12,713.53

With the selection of this stormwater BMP and location, the required sediment reduction would be partially met. Another BMP would need to be installed in addition to the bioswale at Horwith Drive.

BMP OPTION 2 – TWIN BROOK ROAD BIORETENTION

Located in the northeastern section of the Township, the Whispering Hollows mobile home village began construction in the 1970s and provides lots for over 100 homes. The property is located north of Old Carriage Road and west of Twin Brook Road. The internal streets utilize concrete gutter curbing, which carry storm run off to six (6) inlets for the entire development. These slightly depressed gutters provide a defined flow line along the curb, directly to the inlets. Topography of the site and storm drains direct flows towards Country Club Road North. From here the storm sewer travels north and daylights to private property .

This area was reviewed for potential improvements due to the age of the Village and lack of stormwater BMPs within the development. Water quality measures were not required at the time of its planning, and with the amount of impervious surface, placement of a stormwater BMP at the sewer's discharge point can have a significant impact on reducing sediment from the unfiltered runoff. Initial web soil survey information notes the drainage area north of Whispering Hollow Village to have Brinkerton-Comly silt loams and Berks-Weikert complex soils, which are poor to moderately drained. The Engineer's office recommends soil samples to confirm the soil composition at the proposed BMP location.

Photo (above): View east along Country Club Road North. Storm sewer discharges left of the fence.

Location Map (below): The proposed bioretention location, with drainage area hatched.

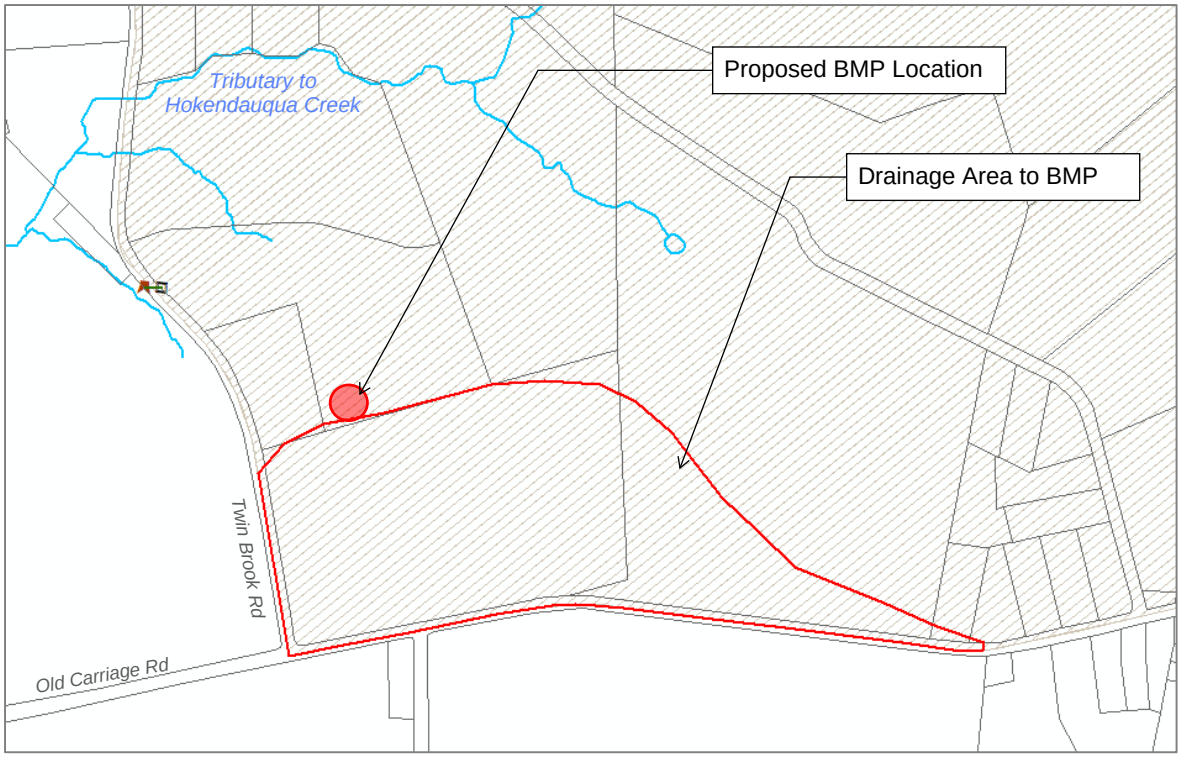


Table 8: Hokendauqua Creek - BMP Option 2 – Bioretention at Twin Brook Road

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	126,603.30	2.91	0.19	IMPERVIOUS	0.55	1839.00	1015.53
				PERVIOUS	2.35	264.96	623.77
AGRICULTURAL	379,809.90	8.72	0.79	IMPERVIOUS	6.89	1839.00	12667.39
				PERVIOUS	1.83	264.96	485.15
DEVELOPED, MEDIUM INTENSITY	569,714.85	13.08	0.79	IMPERVIOUS	10.33	1839.00	19001.09
				PERVIOUS	2.75	264.96	727.73
DEVELOPED, HIGH INTENSITY	63,301.65	1.45	1.00	IMPERVIOUS	1.45	1839.00	2672.45
				PERVIOUS	0.0	264.96	-
STREETS/ ROADS	126,603.30	2.91	1.00	IMPERVIOUS	2.91	1839.00	5344.89
TOTAL LOADS				SEDIMENT			42538.00
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							34,030.40

With the selection of this stormwater BMP and location, the required sediment reduction would be partially met. Another BMP would need to be installed in addition to the bioretention area.

BMP OPTION 3 – STORM INLET FILTER BAGS

Depending upon the stormwater BMP installations chosen by Allen Township, the Engineer reviewed the option of using inlet filter bags. These are bag inserts that get permanently installed in existing street inlets to collect sediment and prevent that debris from entering the storm system. The bags can only be used on streets for inlets with drainage areas under 0.5 acre. Inlet filter bags require continued maintenance to ensure the filter material does not get clogged from the captured sediment.

Photo (Left): Image of Filtrexx inlet filter bag

Due to the limited MS4 area located within the Hokendauqua Creek drainage, lack of existing stormwater BMPs for credits and limited MS4 area available for new installations, use of inlet filter bags may be necessary to reach the required sediment reductions for this Watershed.

The organic litter and sediment collected in the filter bags must be collected, dried and weighed throughout the year in order to receive PRP load reduction. With the required maintenance tasks, the Engineer does not recommend use of filter bags on any PennDOT road unless its deemed necessary. PennDOT has their own MS4 NPDES permit with DEP and must perform maintenance tasks on their roads. If needed, the Engineer recommends a maintenance agreement be signed between the Township and PennDOT for the installation of the filters in their roadway, and assign clear maintenance duties to each of the parites.

The Township may take up to 50% sediment reduction credit by using the filter bags (max 23,750 lb/yr reduction for Hokendauqua Creek). For analysis in this report, the filter bag basis of design used was a 2'x4' PennDOT approved model (62PENNMHDFX) from Filtrexx. Table 9 shows the best case scenario where 1 inlet bag filters the maximum 0.5 acres of 100% impervious road surface. For planning purposes this correlates to each bag being able to filter 735 lbs of sediment a year, however this is best case scenario. Inlet bags will likely filter less than 0.5 acres and may not collect 700 lbs, therefore placement of the bags for their optimum load reduction impact is important.

Table 9: Hokendauqua Creek - BMP Option 3 – Strom inlet filter bags

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD TOOL IMPERVIOUS (%) [1]	IMPERV AREA (AC)	LOADING RATE (LB/AC) [2]	PROPOSED LOAD (LBS)
ROADS	21,780	0.5	1.00	0.5	1839.00	919.50
TOTAL LOADS				SEDIMENT		919.50
BMP EFFECTIVENESS						80%
SEDIMENT REDUCTION PER BAG (MAX)						735.60

DRY RUN CREEK

BMP OPTION 1 – WALKER DRIVE BASIN IMPROVEMENTS

The existing basin is situated to the eastern side of Dry Run and located to the rear of the residential properties on Walker Drive. The basin provides a large drainage area for the surrounding single family, detached homes built during 2004 and 2005. The basin receives run off from two 36 inch diameter storm pipes, and the basin is being maintained as a mowed lawn with pocket areas of vegetation. A stone gabion wall provides separation between the basin and the wooded embankment of Dry Run. The Township has been mowing the basin for residents, however the Township would like to review alternatives for turning this basin into a naturalized area, similar to the changes the Township initiated at two basins on Savage Road.

By converting the dry detention basin into a naturalized basin with areas of extended holding time of the stormwater using shallow depressions and installing a mix of plantings to assist with groundwater recharge, sediment deposition, and nutrient uptake, the Township can utilize an existing BMP while providing a significant reduction in pollutant loads at the edge of Dry Creek. In addition to water quality benefits, the reduced frequency of mowing required by Allen Township staff allows re-allocation of those resources to other areas of the Township. Initial web soil survey information notes the basin to be of Holly silt loam the closer the basin is to Dry Run, and more Urban land-Udorthents complex closer to Walker Drive. As expected, the Holly silt loam closer to Dry Run are poorly drained as they are typically saturated by creek flow. The higher elevation soils being Urban land-Udorthents complex are more moderately drained.

Photo (above): View west through the dry detention basin. Discharge to Dry Creek at west end of basin

Location Map (below): The proposed dry detention basin retrofit, with drainage area hatched.

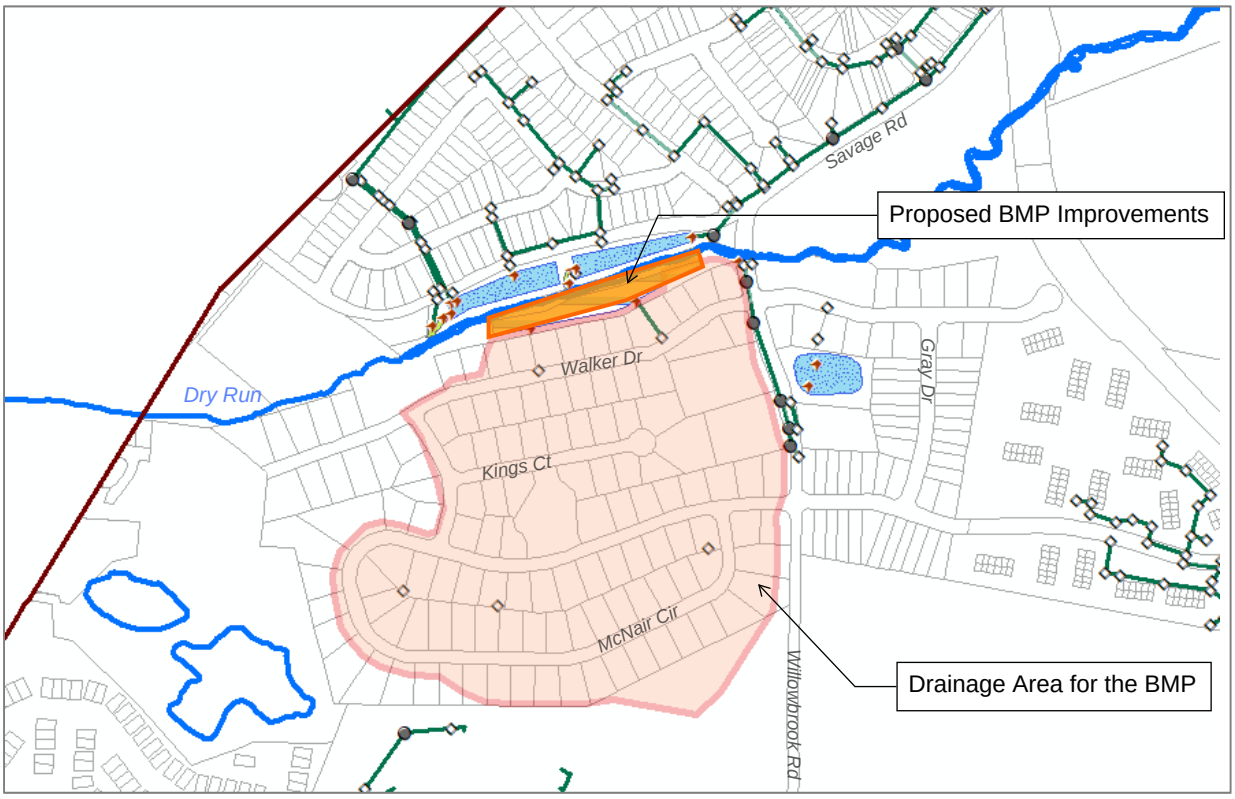


Table 10: Dry Run Creek - BMP Option 1 – Walker Drive Basin Improvements

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	198,242	4.55	0.19	IMPERVIOUS	0.86	1839.00	1590.17
				PERVIOUS	3.69	264.96	976.73
DEVELOPED, LOW INTENSITY	1,545,770	35.49	0.79	IMPERVIOUS	17.39	1839.00	31,976.79
				PERVIOUS	18.10	264.96	4,795.21
DEVELOPED, MEDIUM INTENSITY	40,374	0.93	0.79	IMPERVIOUS	0.73	1839.00	1346.55
				PERVIOUS	0.19	264.96	51.57
STREETS/ ROADS	266,649	6.12	1.00	IMPERVIOUS	6.12	1839.00	11257.29
TOTAL LOADS				SEDIMENT			51994.30
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							41,595.44

With the selection of this BMP, the sediment reduction requirement would be met for the Dry Run Creek drainage area.

BMP OPTION 2 – WILLOW RIDGE DEVELOPMENT BASIN IMPROVEMENTS

The existing basin is located on Willowbrook Road, adjacent to the Marth's Disposals property and installed as part of the Willow Ridge Development in 2005. For over a decade, the basin has remained functional but has received minimal maintenance. The BMP was designed with two stormwater inflow points at the east end, nearest the basin's riser and outflow pipe. Typically stormwater pools at the east end. The intention is to detain the water long enough so it has time to infiltrate back into the ground. The basin also has a outflow pipe elevation that allows the basin's water to discharge should the pooling reach a certain elevation.

As with the previous discussion about stormwater BMPs installed between 2002 and 2006, the focus was on managing the volume of stormwater, and less about the water quality of the stormwater being discharged from the BMPs. This existing basin would be a suitable location for basin improvements, such as deep rooted grasses to assist in the infiltration of water back into the soils and groundwater sources, woody vegetation to provide more diverse habitat for birds, and small mammals, additional plantings to filter out sediment while also processing nitrogen and phosphorous pollution from the stormwater as part of the plant's life cycle.

Due to the unknown maintenance history and discharges into the basin over the past decade, the Engineer's office recommends soil samples from the basin to determine if additional soil amendments are needed to address pH levels, soil salinity (salts), presence of metals, organic content and typical soil assessment data. Soil test kits are available through the Northampton County PSU Extension Office, 14 Gracedale Ave, Gracedale Complex, Greystone Building, Nazareth, PA 18064.

Photo (above): View of the detention basin. Discharge to Dry Creek at west end of basin.

Location Map (below): The proposed dry detention basin retrofit, with drainage area hatched.

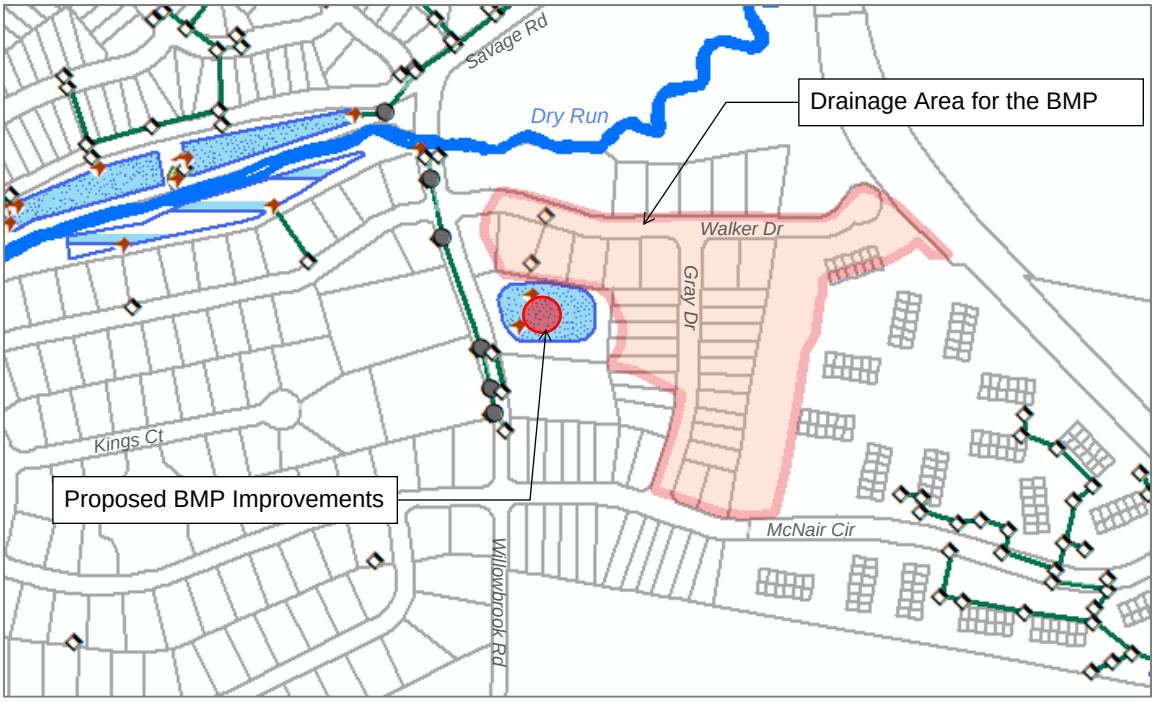


Table 11: Dry Run Creek - BMP Option 2 – Willow Ridge Development Basin Improvements

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	87,377	2.01	0.19	IMPERVIOUS	0.38	1839.00	700.88
				PERVIOUS	1.62	264.96	430.50
DEVELOPED, LOW INTENSITY	254,874	5.85	0.79	IMPERVIOUS	2.87	1839.00	5272.49
				PERVIOUS	2.98	264.96	790.66
DEVELOPED, MEDIUM INTENSITY	28,404	0.65	0.79	IMPERVIOUS	0.52	1839.00	947.33
				PERVIOUS	0.14	264.96	36.28
STREETS/ ROADS	83,558	1.92	1.00	IMPERVIOUS	1.92	1839.00	3527.62
TOTAL LOADS				SEDIMENT			11,705.76
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							9,364.61

With the selection of this stormwater BMP and location, the required sediment reduction would be partially met. Other BMPs would need to be installed in addition to the basin improvements.

BMP OPTION 3 – HOWERTOWN PARK RAIN GARDEN AT ATLAS ROAD

Allen Township Public Works Department identified a low lying area showing erosion cut west of the intersection of Short Lane and Atlas Road. Approximately 175 feet to the west of this drainage concern a retention berm is planned by PennDOT as part of the road improvements to Route 329 (Nor Bath Blvd). Erosion Control plans submitted by PennDOT show the retention berm to be permanently seeded with one of three possible standard seeding mixes, which predominantly use birdsfoot trefoil, reed canary grass, or Kentucky Bluegrass intended for regular mowings.

The proposed rain garden along Atlas Road can repair the drainage concerns near the intersection while providing more native, deep rooted plantings within the retention area. A mix of native grasses and herbaceous perennials will be more suited to tolerate fluctuating soil moisture levels throughout the year. Initial web soil survey information shows the southeast side of Howertown Park to have Comly site loam along Dry Run, and Clarksburg silt loam along Short Lane. Both of these classifications are C Group soils with somewhat poor drainage. The rain gardens will focus on filtering out of sediment and nutrients, likely including an riser to drain the areas when soils are saturated.

Photo (above): View of the retention berm for landscaping retrofit.

Location Map (below): The proposed rain garden improvement area, with drainage area hatched.

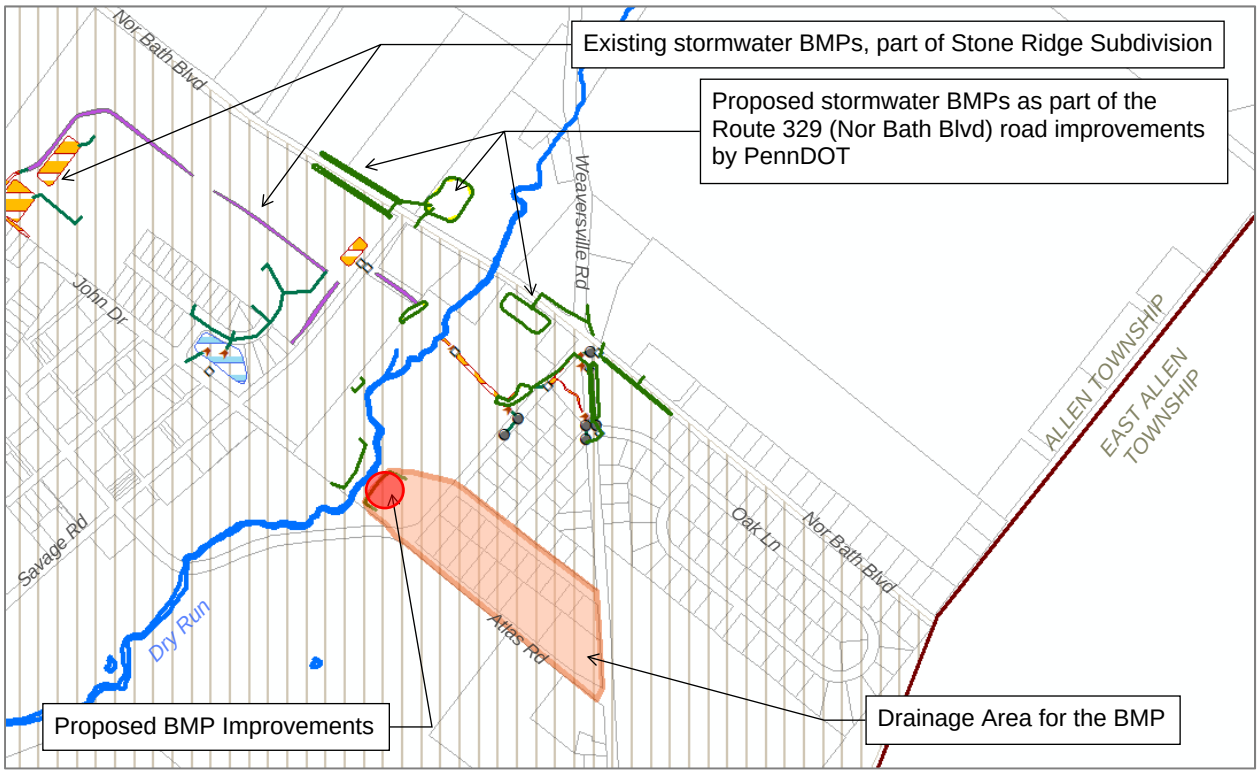


Table 12: Dry Run Creek - BMP Option 3 – Howertown Park Rain Garden at Atlas Road

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	105,678.40	2.43	0.19	IMPERVIOUS	0.46	1839.00	847.68
				PERVIOUS	1.97	264.96	520.67
DEVELOPED, LOW INTENSITY	227,801.65	5.23	0.79	IMPERVIOUS	2.56	1839.00	4712.45
				PERVIOUS	1.67	264.96	706.67
DEVELOPED, MEDIUM INTENSITY	33,706.50	0.77	0.79	IMPERVIOUS	0.61	1839.00	1124.18
				PERVIOUS	0.16	264.96	43.06
STREETS/ ROADS	72,506.02	1.66	1.00	IMPERVIOUS	1.66	1839.00	3061.03
TOTAL LOADS				SEDIMENT			11,015.74
BMP EFFECTIVENESS							55%
TOTAL PROPOSED LOAD REDUCTION							6,058.65

BMP OPTION 4 – HOWERTOWN PARK RAIN GARDEN AT ROUTE 329 (NOR BATH BLVD)

Staying at Howertown Park and reviewing PennDOT's proposed widening improvements, the northern section of the park will be regraded with roadside swales and stormwater basins. Stormwater BMPs and within the right of way should be the maintenance responsibility of PennDOT. BMPs installed to the north side of State Route 329 (Nor Bath Blvd) are outside the Township's MS4 boundary. Therefore, the Township reviewed the proposed 'vegetated swale' within Howertown Park at Short Lane. The Township is responsible for the long term maintenance and repairs of this BMP.

As with the proposed rain garden above, PennDOT proposes to seed the BMP with their standard mixes, which predominantly use birdsfoot trefoil, reed canary grass, or Kentucky Bluegrass intended for regular mowings. Due to location of the swale and intended volume of stormwater to be conveyed, the Engineer recommends retrofitting the seeding and plantings in this BMP to focus on water quality. The Township may elect to continue the planting bed further downstream, through the existing swale (B-05) that carries the run off to Dry Run at outfall ID#9.

Photo (above): View of the vegetated swale for landscaping retrofit.

Location Map (below): The proposed swale improvement area, with drainage area hatched.

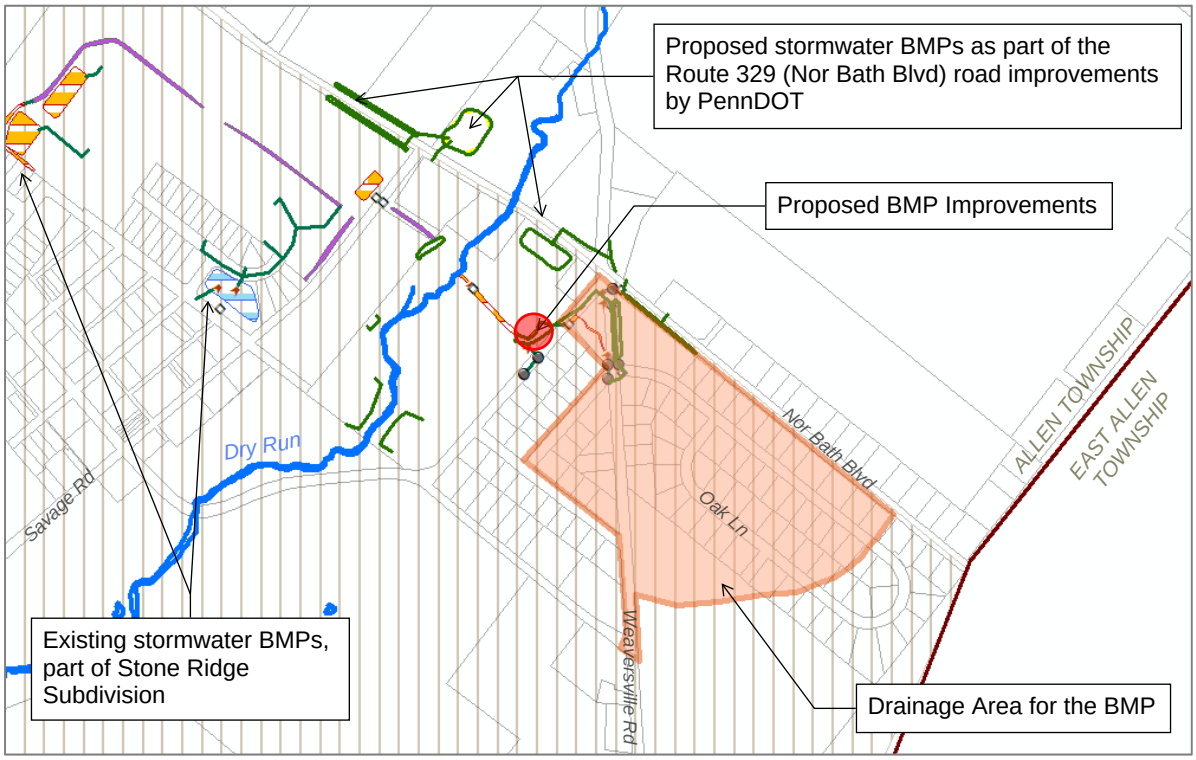


Table 13: Dry Run Creek - BMP Option 3 – Howertown Park Rain Garden at Route 329 (Nor Bath Blvd)

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	147,757.52	3.39	0.19	IMPERVIOUS	0.64	1839.00	1185.21
				PERVIOUS	2.75	264.96	727.99
DEVELOPED, LOW INTENSITY	739,024.27	16.97	0.79	IMPERVIOUS	8.31	1839.00	15,287.93
				PERVIOUS	8.65	264.96	2,292.56
DEVELOPED, MEDIUM INTENSITY	10,140.21	0.23	0.79	IMPERVIOUS	0.18	1839.00	338.20
				PERVIOUS	0.05	264.96	12.95
AGRICULTURAL	146,021.12	3.35	0.79	IMPERVIOUS	2.65	1839.00	4,870.09
				PERVIOUS	0.70	264.96	186.52
STREETS/ ROADS	178,605.75	4.10	1.00	IMPERVIOUS	4.10	1839.00	7,540.31
TOTAL LOADS				SEDIMENT			32,441.77
BMP EFFECTIVENESS							55%
TOTAL PROPOSED LOAD REDUCTION							17,842.97

BMP OPTION 5 – STORM INLET FILTER BAGS

Depending upon the stormwater BMP installations chosen by Allen Township, the Engineer reviewed the option of using inlet filter bags, same Filtrexx bags as described in the above Hokendauqua Creek BMP Option #3.

The Township may take up to 50% sediment reduction credit by using the filter bags (max 20,335 lb/yr reduction). The maximum allowed inlet bags in the Dry Run Creek drainage area would be 27 inlet bags. For analysis in this report, the filter bag basis of design used was a 2'x4' PennDOT approved model (62PENNMHDFX) from Filtrexx.

DRY RUN CREEK

As noted earlier in Section B 'Mapping', the MS4 may elect to parse areas from its pollution load calculations due to the areas already being covered by an NPDES permit for stormwater controls. Allen Township chose to parse three properties, all located within the Catasauqua Creek sewershed.

FedEx Hub property located on Willowbrook Road started construction in the Summer of 2016, and is still under construction at the time of this Pollution Reduction Plan report. Anticipated occupancy with the first phase is slated for August 2018. The set of recorded plans with the Northampton County Deeds office includes Post Construction Stormwater Management (PCSM) plans which include an Operation and Maintenance (O&M) Plan. The recorded plans have provisions that the '*owner shall be responsible for the proper construction, operation and maintenance of all post construction stormwater management (PCSWM) BMPs identified in the approved plan'*. The agreement continues with detailed notes on frequency of inspections and maintenance tasks. In the agreement, Allen Township has the right to enter the property to inspect the stormwater facilities at any time and can request corrective measures by the landowner, if necessary. Due to the recorded PCSM plans and O&M Agreement by the landowner, the Township identified this property as being appropriate for parsing.

Rockefeller Lehigh Industrial Development – Lot 4 is also located off Willowbrook Road on Radar Drive, abutting the FedEx property. The industrial development is currently under review by the Township, Northampton County Conservation District (NCCD), and Northeast District Office of DEP. Although the applicant has not received its approved NPDES permit by the time of this report, the industrial lot is anticipated to be developed within the next 5 years, and is being required to provide PCSM plans with an O&M agreement for on-going maintenance, repairs and inspection. The Township identified this property as being appropriate for parsing.

In addition to lot 4 on the eastern side of Willowbrook Road, Rockefeller Lehigh Industrial Development is proposing an industrial warehouse development on the western side, Lot 5. As with the other property, lot 5 is currently under Township, County and DEP agency review. The owner is required to obtain an NPDES permit, which will include another O&M agreement for on-going maintenance, repairs and inspections. Lot 5 was added to the list of parsed properties from the PRP.

The three parsed properties along Willowbrook Road totaled 371 acres and were not being included in the Township's planning area. Allen Township may not propose new BMPs or take credit reductions for stormwater controls located on these properties.

BMP OPTION 1 – CATASAUQUA HIGH SCHOOL BIOSWALE

The High School entrance drive on West Bullshead Drive has two grass swales (A-02, A-03) along either side of the driveway which conveys runoff to a third grass swale along West Bullshead Drive (A-01). Stormwater from this swale is then piped under the roadway through a 36 inch corrugated metal pipe and discharged to Catasauqua Creek at outfall ID#3.

The swales on school property collect run off from a mix of impervious surfaces, such as the large parking lots, sidewalks and the building's roof area. The swales also collect run off from pervious areas, such as surface flow across the open lawns and athletic fields. Surface run off from the roof and paved surfaces will have an increased temperature due to the asphalt and macadam retaining heat for longer periods of time than lawn. The majority of the swales are out in the open, devoid of significant tree cover or large plantings for shading. This can impact the temperature of stormwater runoff.

Another water quality impact the school property may have is with the surrounding athletic fields. Typical maintenance of the fields requires routine mowing and use of fertilizers to repair and maintain the turf from heavy sports use. The sediment and chemical fertilizers get washed into the swales after heavy storms, and eventually discharge to Catasauqua Creek.

Converting the grass lined swale (A-01) to a bioswale would include amending the soils to provide additional retention areas, and areas for plants to assist filtering out the sediment and processing the extra nitrogen and phosphorous found in lawn fertilizers. Initial web soil survey information identifies the Catasauqua High School field area as Urban land-Udorthents complex This soil is typically moderately drained and suited for infiltration and retention BMPs.

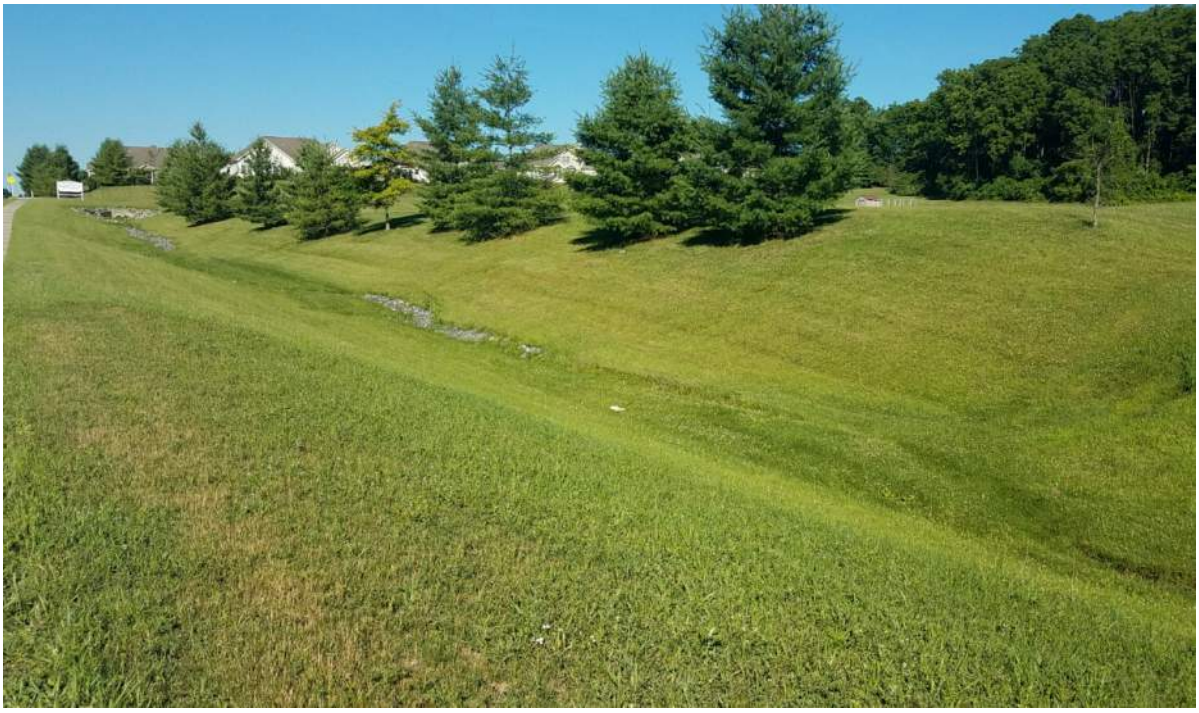


Photo (above): View of the proposed bioswale along East Bullshead Road.

Location Map (below): The proposed bioswale BMP, with 3 drainage areas hatched.

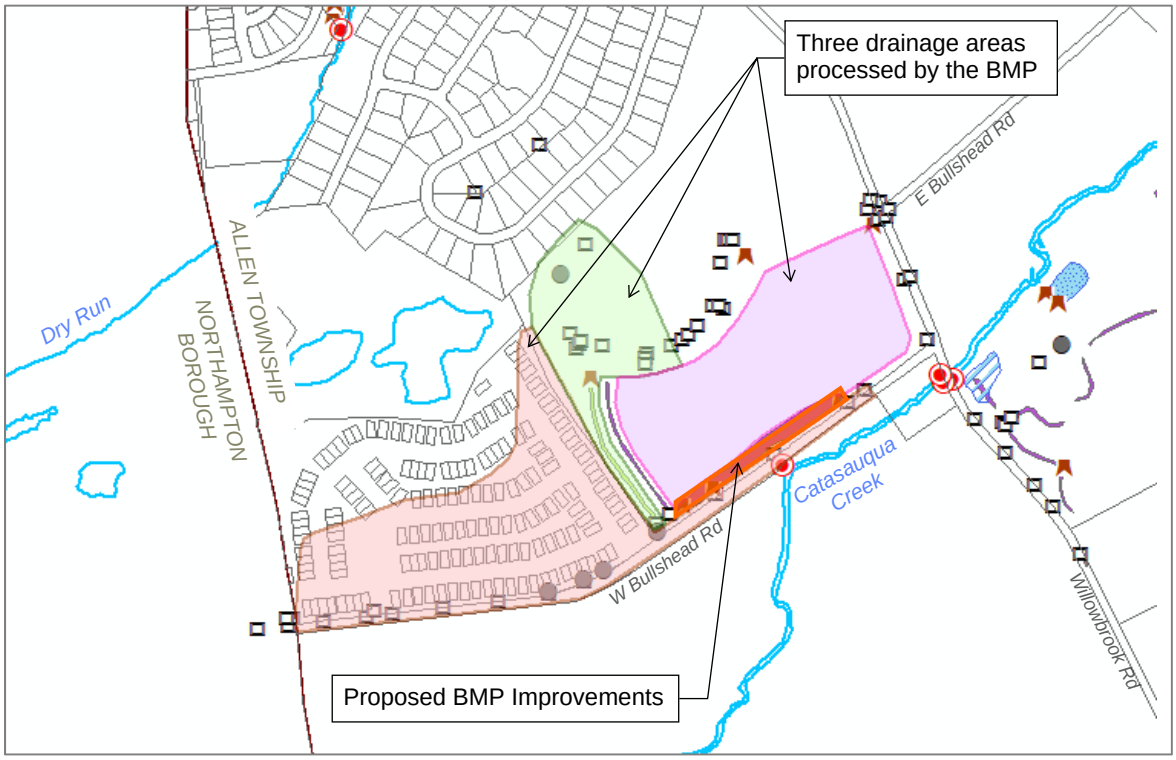


Table 14: Catasauqua Creek - BMP Option 1 – Catasauqua High School Bioswale

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
WOODED	7,240.79	0.17	0.00	IMPERVIOUS	0.00	1839.00	-
				PERVIOUS	0.17	264.96	44.04
DEVELOPED, OPEN SPACE	910,271.13	20.90	0.19	IMPERVIOUS	3.97	1839.00	7301.60
				PERVIOUS	16.93	264.96	4484.85
DEVELOPED, MEDIUM INTENSITY	1,063,354.85	24.41	0.79	IMPERVIOUS	19.28	1839.00	35,464.93
				PERVIOUS	5.13	264.96	1358.28
STREETS/ ROADS	270,143.34	6.20	1.00	IMPERVIOUS	6.20	1839.00	11,404.81
TOTAL LOADS				SEDIMENT			60,058.53
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							48,046.82

With the selection of this stormwater BMP and location, the required sediment reduction would be 48% satisfied. Other BMPs would need to be installed in addition to the High School bioswale.

BMP OPTION 2 – WAYNE A, GRUBE MEMORIAL PARK RAIN GARDEN (E BULLSHEAD ROAD)

The park is owned by Northampton County and provides areas where visitors can enjoy both passive and active recreation. The entire 200 acre park is situated on both sides of Catasauqua Creek, with access points off Willowbrook Road and East Bullshead Road. This proposed BMP of a rain garden is to be located at the East Bullshead park location.

The park has a series of grass swales and infiltration areas, which as shown on the Township's MS4 map. Allen Township used two of the grass swale (A-16 and A-17) and their subsequent drainage areas towards existing BMP credit, which means the MS4 can not make any improvements to the swales for proposed load reductions. The proposed rain garden BMP focuses on grass lined swale A-18 and the two concrete headwalls that discharge to the swale at Bullshead Road.

A rain garden is proposed as this stormwater junction point to treat the run off before it continues to the quad culvert at the end of BMP A-20. The intent is to provide additional delay and infiltration time on the County property, which may lessen the initial volume of runoff reaching the quad culvert. The proposed BMP load reduction is using the efficiency rate of 80% for sediment reduction as the design may include an underdrain. Should the soil test indicate that an underdrain is not required, then the efficiency rate may increase to 90% sediment reduction, resulting in an additional 3,480 lbs/yr load reduction.

Photo (above): View of the proposed bioretention/rain garden area to filter discharges from 2 headwalls.

Location Map (below): The proposed bioswale BMP, with 2 drainage areas hatched.

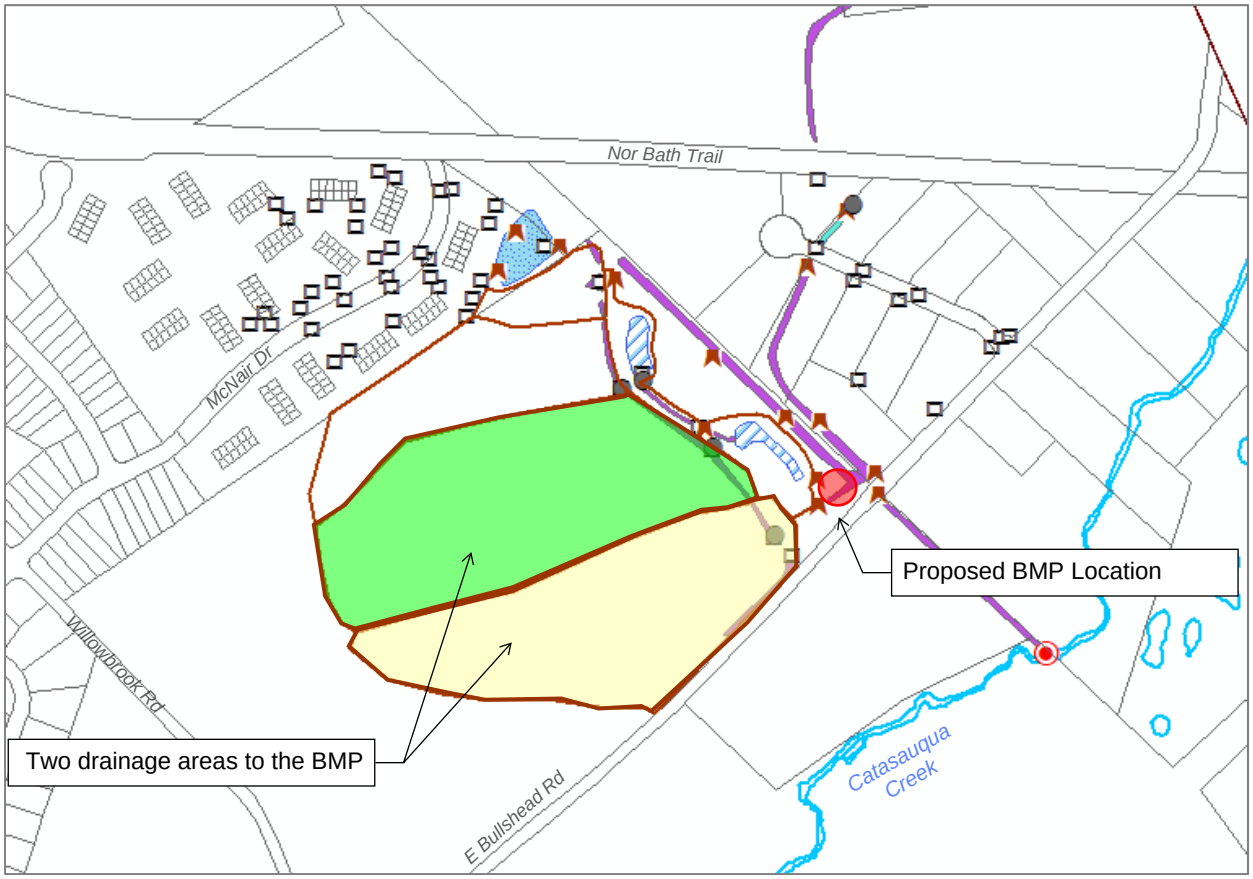


Table 15: Catasauqua Creek - BMP Option 2 – Wayne A Grube Park Rain Garden (E Bullshead Road)

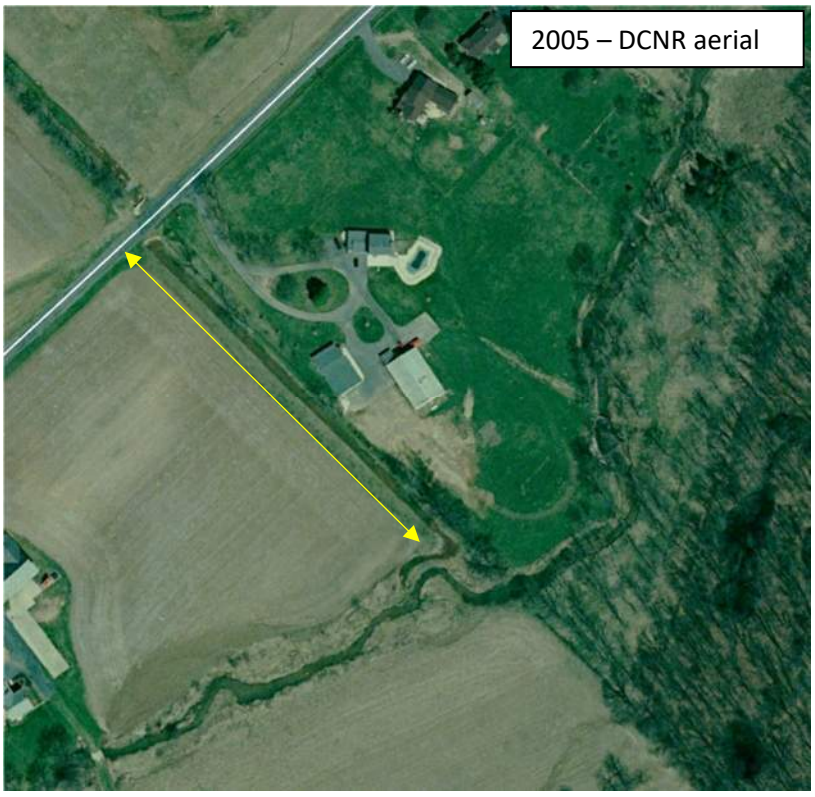
LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
DEVELOPED, OPEN SPACE	212,681.19	4.88	0.19	IMPERVIOUS	0.93	1839.00	1,705.99
				PERVIOUS	3.95	264.96	1,047.87
DEVELOPED, LOW INTENSITY	7,477.81	0.17	0.49	IMPERVIOUS	0.08	1839.00	154.07
				PERVIOUS	0.09	264.96	23.10
AGRICULTURE	920,168.60	21.12	0.79	IMPERVIOUS	16.69	1839.00	30,689.40
				PERVIOUS	4.44	264.96	1,175.38
TOTAL LOADS				SEDIMENT			34,795.81
BMP EFFECTIVENESS							80%
TOTAL PROPOSED LOAD REDUCTION							27,836.65

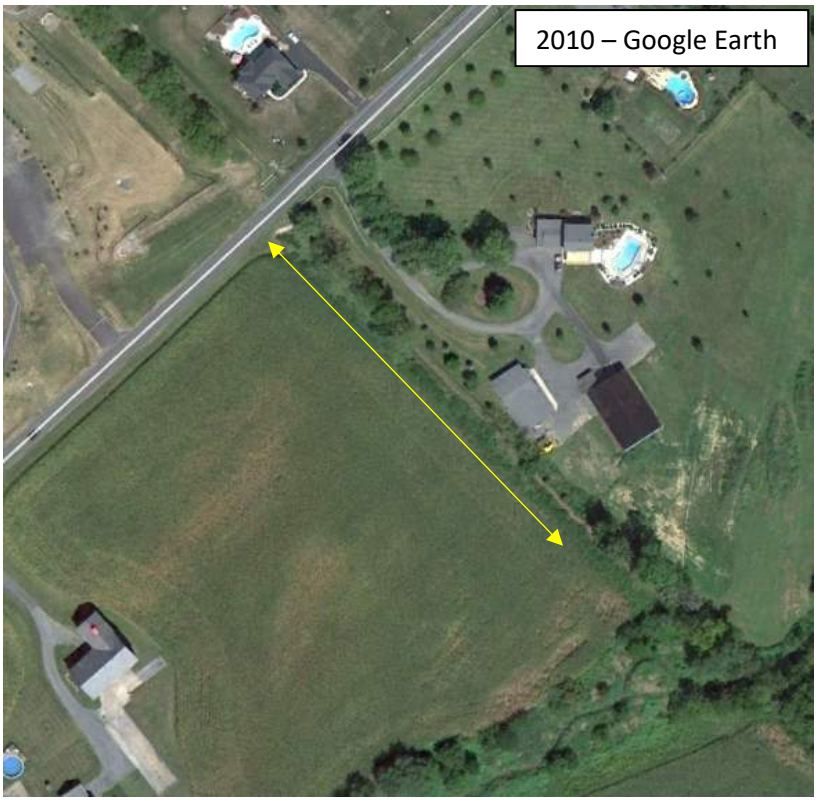
BMP OPTION 3 – DRAINAGE CHANNEL TO OUTFALL ID#4, E BULLSHEAD ROAD

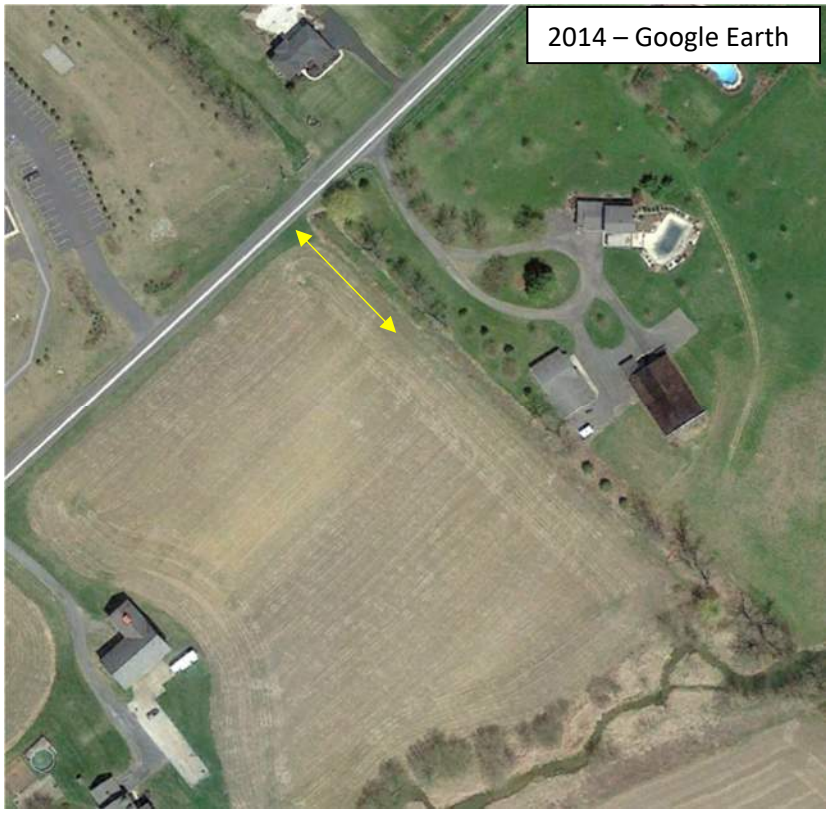
After the stormwater passes through the quad culvert on E Bullshead Road, it flows to an area that had a drainage channel, running 700 feet south to Catasauqua Creek. However field investigations found the drainage channel/swale to be partially filled in. Historical aerial photographs from the area show the channel's change in shape and length. With the development of Wayne A Grube Park and the development of housing units on Country Road both being upstream, and surface run off from the adjacent agricultural field, the sediment appears to have accumulated over time through various sources.

The Township may elect to restore the drainage channel to reach Catasauqua Creek. This would require excavation and removal of the accumulated soils. The channel can be developed into another open, vegetated channel or a channel with additional filtering features. The filtering practices would be to temporarily store the storm run off and pass it through a filter bed. The filter beds would be designed to be above ground and/or around the perimeter. The filtering material would be a combination of sand with organics.

Filtering practices are recognized by DEP as being more efficient at removing sediment, however due to their higher functioning, they also require annual inspections to ensure proper functioning and repairs are being made. So there would be an added maintenance cost to the Township.




2010 – Google Earth


2014 – Google Earth

Location Map (below): The proposed restoration of drainage swale with 3 drainage areas.

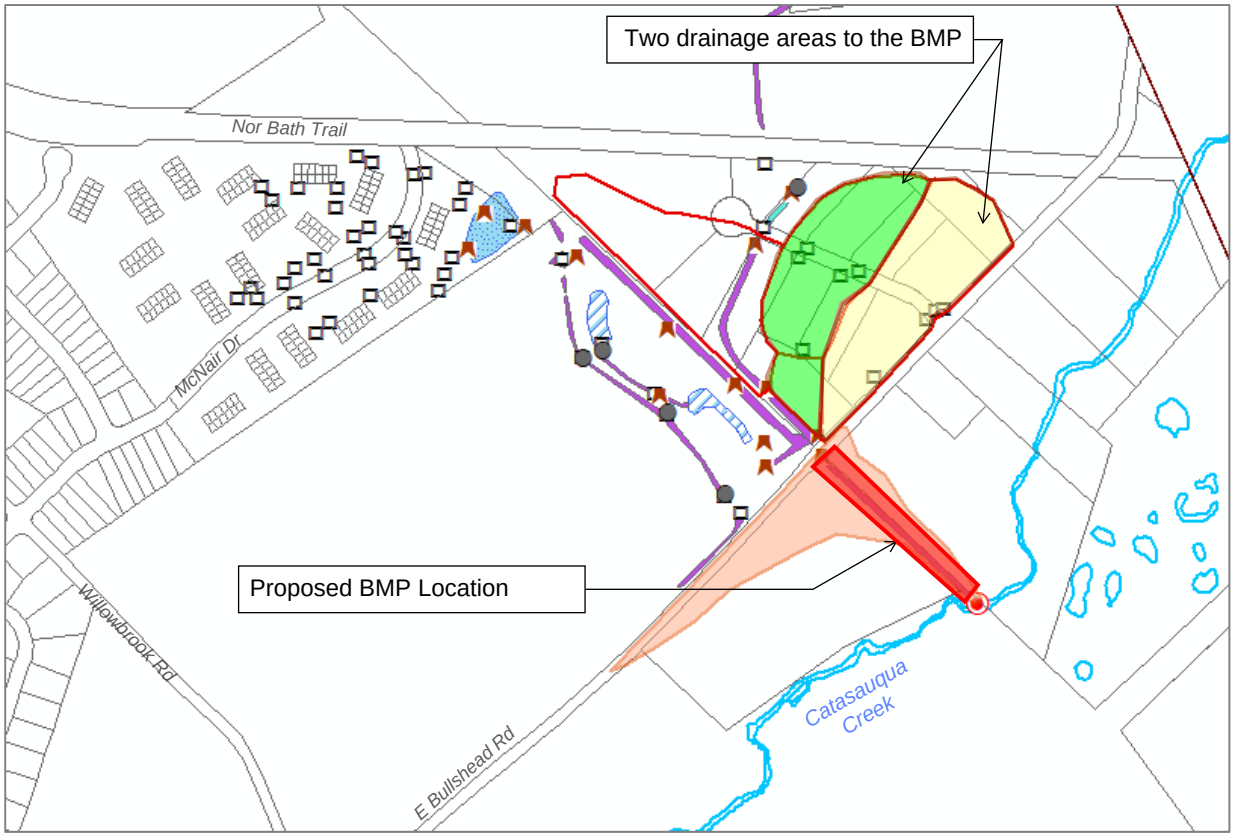


Table 16: Catasauqua Creek - BMP Option 3 – DRAINGE CHANNEL TO OUTFALL ID#4 (E Bullshead Road)

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
WOODED	36,475.80	0.84	0.00	IMPERVIOUS	0.00	1839.00	-
				PERVIOUS	0.84	264.96	221.87
DEVELOPED, OPEN SPACE	5,991.21	0.14	0.19	IMPERVIOUS	0.03	1839.00	48.06
				PERVIOUS	0.11	264.96	29.52
DEVELOPED, LOW INTENSITY	37,705.84	0.87	0.49	IMPERVIOUS	0.42	1839.00	780.01
				PERVIOUS	0.44	264.96	116.97
AGRICULTURE	122,464.96	2.81	0.79	IMPERVIOUS	2.22	1839.00	4084.44
				PERVIOUS		1839.00	156.43
STREETS/ROADWAY	14,110.84	0.32	1.00	IMPERVIOUS	0.32	264.96	595.73

TOTAL LOADS	SEDIMENT	AGRICULTURAL FIELD	6033.02
	SEDIMENT	UPSTREAM AREA #7&8	3319.54
	SEDIMENT	UPSTREAM AREA #9	5161.00
			14,513.56
BMP EFFECTIVENESS			50%
TOTAL PROPOSED LOAD REDUCTION	OPEN VEGETATED CHANNEL		7,256.78
	OR		
BMP EFFECTIVENESS			80%
TOTAL PROPOSED LOAD REDUCTION	CHANNEL WITH FILTERING PRACTICES		11,610.85

BMP OPTION 4 – SEIPLE PROPERTY BIORETENTION AT NOR BATH TRAIL

The Township and its residents enjoy the municipality's rural character, with rolling hills and expanses of agricultural fields. Efforts are being made to preserve the community's agricultural areas. With Pennsylvania DEP citing agriculture as *'a main contributor of nitrogen, phosphorous and sediment'* to streams, rivers and lakes, the Catasauqua Creek drainage area was reviewed for potential BMP locations. Preferred locations were agricultural land uses near the stream or impacting a drainage area to the stream. The purpose is to support the agricultural community, while presenting options for better erosion control and stormwater control measures, where feasible.

There is an existing drainage channel approximately 1275 linear feet in length cutting through the agricultural fields between Weaversville Road and the Nor Bath Trail. The Seiple property abuts the trail corridor and contains the drainage point where field run off travels under the Nor Bath Trail. The water daylights on the south side of the trail, passes through the Country Road development and ultimately combines with the creek at outfall ID #4.

A bioretention area is proposed where the stormwater collects and pools before passing underneath the trail. The existing drainage channel between the cultivated fields is at least 25 feet in width. The bioretention area can be adjusted linearly to reduce impacts to the crop fields. This location was chosen as the sediment and nutrient run off from the fields could be filtered on-site. Initial web soil survey information noted the proposed bioretention area to have Clarksburg silt loam soil, which is moderately well drained but still considered a C soil group. Due to the historic use of farming, the Engineer's office recommends soil samples to confirm the soil composition and identify any soil amendments that may be required to obtain the desired BMP efficiency.

The proposed BMP would be located on private property, requiring discussions between the property owner and the Township. If the BMP is approved for installation, easement agreements and a maintenance agreement would be required to establish long term responsibilities and maintenance tasks by the parties.

Location Map (below): The proposed rain garden at Nor Bath Trail, drainage area shaded.

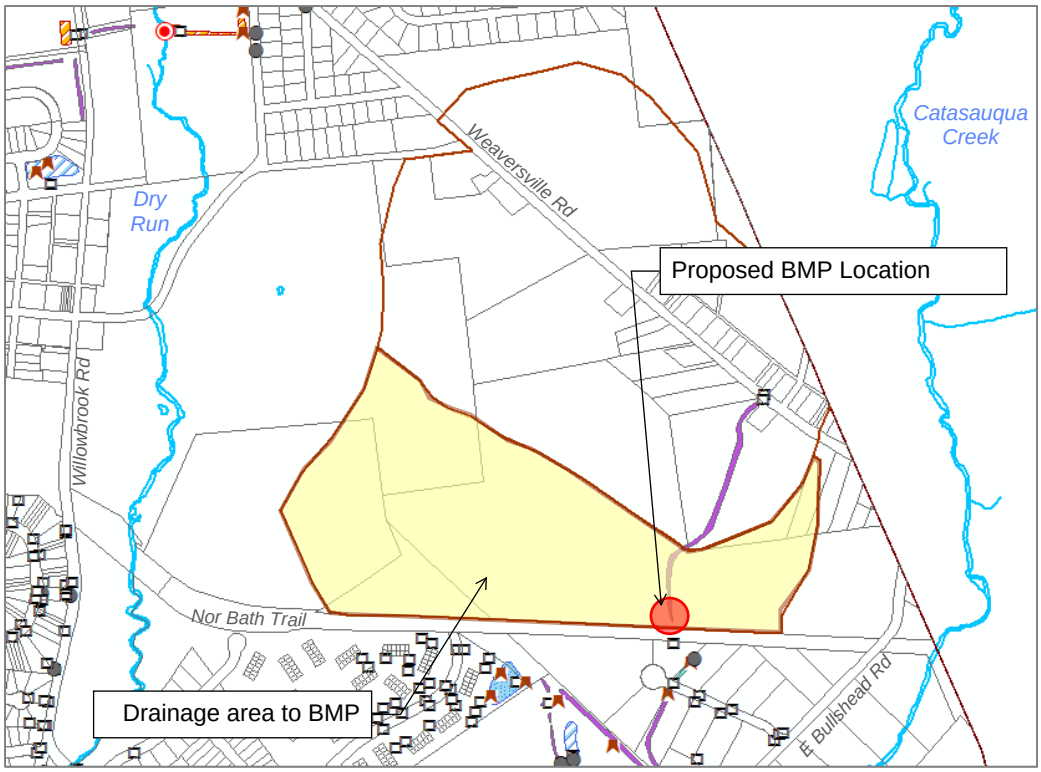


Table 17: Catasauqua Creek - BMP Option 4 – SEIPLE PROPERTY BIORETENTION AT NOR BATH TRAIL

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
WOODED	346,448.45	7.95	0.00	IMPERVIOUS	0.00	1839.00	-
				PERVIOUS	7.95	264.96	2107.32
DEVELOPED, OPEN SPACE	40,768.61	0.94	0.19	IMPERVIOUS	0.18	1839.00	327.02
				PERVIOUS	0.76	264.96	200.86
DEVELOPED, LOW INTENSITY	46,915.68	1.08	0.49	IMPERVIOUS	0.53	1839.00	970.53
				PERVIOUS	0.55	264.96	145.54
AGRICULTURE	2,052.640.65	47.12	0.79	IMPERVIOUS	37.23	1839.00	68,459.52
				PERVIOUS	9.90	264.96	2,621.95
TOTAL LOADS				SEDIMENT			74,832.75
BMP EFFECTIVENESS							55%
TOTAL PROPOSED LOAD REDUCTION							41,158.01

BMP OPTION 5 – FULLER PROPERTY RIPARIAN BUFFER

Continuing the Township's review of agricultural and farm type land uses, the Engineer reviewed opportunities to repair gaps in stream riparian buffers. Pennsylvania DEP supports the use of forest buffers along waterways as these buffers provide a transition between the land and the water. Riparian buffers typically utilize a mix of trees sizes with shrubs and meadow grasses. The plantings are successful in filtering out sediments and pollutants from the adjacent farm fields, open lawns and roadways before they reach the creek. Many times the stream buffer gets broken as land development, farming or infrastructure work cut down the trees and advance up to the streambank's edge.

The Fuller property, west of Willowbrook Road, has a section of Catasauqua Creek pass through it's western side. Near the intersection of Fuller Drive and Krall Lane, there is a segment of stream without a riparian buffer on either side of its banks. This gap in buffer runs approximately 400 linear feet. The area surrounding the streambank does not appear do have any urban infrastructure restricting placement of buffers. Currently the stream's edge and embankment is vegetated with un-mowed grasses.

Pennsylvania DEP directs the buffer to be no less than 35 feet on each side of the stream, measured from the top of the streambank, not the edge of water. Typically the wider the buffer and more diversely planted, the more water quality and habitat benefits the buffer will provide.

The proposed BMP would be located on private property, requiring discussions between the property owner and the Township. If the BMP is approved for installation, easement agreements and a maintenance agreement would be required to establish long term responsibilities and maintenance tasks by the parties.

Photo (right): View of Catasauqua Creek at Fuller Drive with buffer gap.

Location Map (below): The stream buffer, with drainage areas hatched.

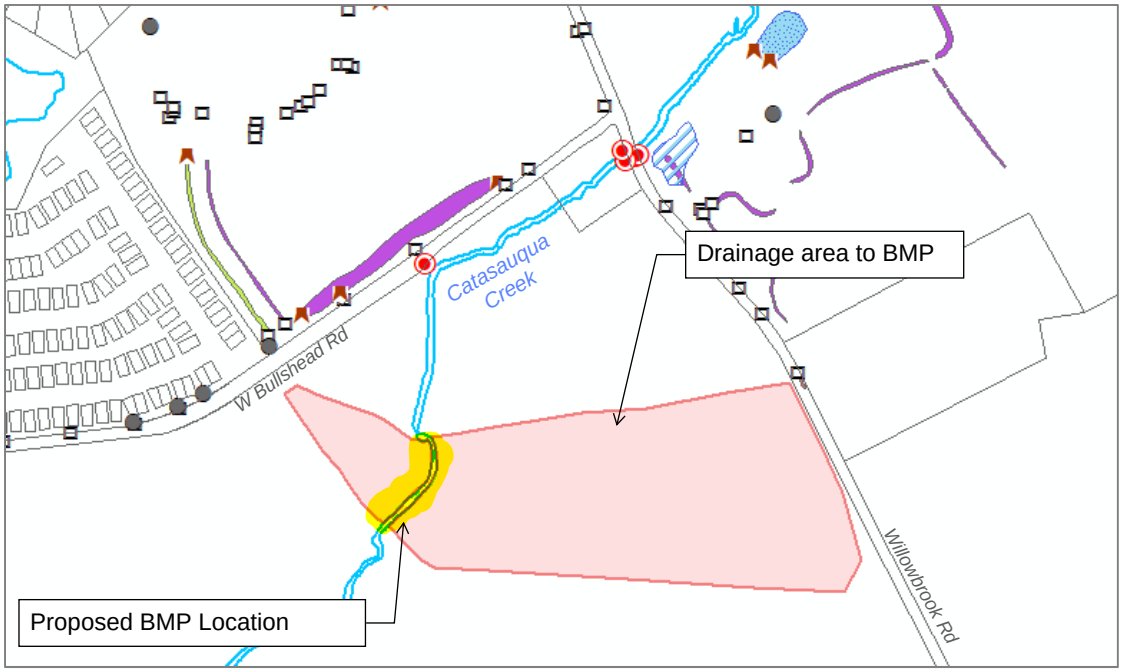


Table 18: Catasauqua Creek - BMP Option 5 – FULLER PROPERTY RIPARIAN BUFFER

LAND USE CATEGORY [1]	AREA (SF)	ACRES (AC)	STROUD IMPERV (%) [1]	TYPE	AREA (AC)	SEDIMENT LOADING (LB/AC) [2]	LOAD (LBS)
WOODED	20,622	0.47	0.00	IMPERVIOUS	0.00	1839.00	-
				PERVIOUS	0.47	264.96	124.44
DEVELOPED, OPEN SPACE	375,324	8.62	0.19	IMPERVIOUS	1.64	1839.00	3010.61
				PERVIOUS	6.98	264.96	1849.20
DEVELOPED, LOW INTENSITY	27,938	0.64	0.79	IMPERVIOUS	0.31	1839.00	577.94
				PERVIOUS	0.33	264.96	86.67
AGRICULTRUAL	537,363	12.34	0.79	IMPERVIOUS	9.75	1839.00	17,922.09
				PERVIOUS	2.59	264.96	686.40
DEVELOPED, MEDIUM INTENSITY	50,898	1.17	0.79	IMPERVIOUS	0.92	1839.00	1697.55
				PERVIOUS	0.25	264.96	65.01
STREETS/ROADS			1.00	IMPERVIOUS		1839.00	
TOTAL LOADS				SEDIMENT			27,998.34
BMP EFFECTIVENESS							50%
TOTAL PROPOSED LOAD REDUCTION							13,999.17

BMP OPTION 6 – STORM INLET FILTER BAGS

Depending upon the stormwater BMP installations chosen by Allen Township, the Engineer reviewed the option of using inlet filter bags, same Filtrexx bags as described in the above Hokendauqua Creek BMP Option #3.

The Township may take up to 50% sediment reduction credit by using the filter bags (max 50,055 lb/yr reduction). The maximum allowed inlet bags in the Catasauqua Creek drainage area would be 67 inlet bags. For analysis in this report, the filter bag basis of design used was a 2'x4' PennDOT approved model (62PENNMHDFX) from Filtrexx.

Table 19: Summary of Proposed BMPs

LEHIGH RIVER – REQUIRED REDUCTIONS						
SEDIMENT		5,154.72 lb/yr				
PHOSPHOROUS		3.72 lb/yr				
LEHIGH RIVER – PROPOSED BMP SUMMARY						
BMP	BMP PROPOSED		BMP Effectiveness Value	Sediment Reduction	BMP Effectiveness Value	Phosphorous Reduction
#1	RAIN GARDEN AT EISENHOWER DRIVE		80%	12,467	75%	17.24
#2	RAIN GARDEN AT TOW PATH ROAD		80%	24,097	75%	34.59

HOKENDAUQUA CREEK – REQUIRED REDUCTIONS			
SEDIMENT		47,501.22 lb/yr	
LEHIGH RIVER – PROPOSED BMP SUMMARY			
BMP	BMP PROPOSED	BMP Effectiveness Value	Sediment Reduction (lbs/yr)
#1	HORWITH DRIVE BIOSWALE	80%	25,620
#2	TWIN BROOK ROAD RAIN GARDEN	80%	34,030
#3	INLET FILTER BAGS (32)	80%	23,750 (maximum allowed)

DRY RUN – REQUIRED REDUCTIONS			
SEDIMENT		40,665.85 lb/yr	
LEHIGH RIVER – PROPOSED BMP SUMMARY			
BMP	BMP PROPOSED	BMP Effectiveness Value	Sediment Reduction (lbs/yr)
#1	WALKER DRIVE BASIN IMPROVEMENTS	80%	41,595
#2	WILLOW RIDGE BASIN IMPROVEMENTS	80%	9,364
#3	HOWERTOWN PARK RAIN GARDEN (ATLAS RD)	55%	6,058
#4	HOWERTOWN PARK RAIN GARDEN (RT 329)	55%	17,842
#5	INLET FILTER BAGS (27)	80%	20,335 (maximum allowed)

CATASAUQUA CREEK – REQUIRED REDUCTIONS			
SEDIMENT		100,111.80 lb/yr	
LEHIGH RIVER – PROPOSED BMP SUMMARY			
BMP	BMP PROPOSED	BMP Effectiveness Value	Sediment Reduction (lbs/yr)
#1	CATASAUQUA HIGH SCHOOL BIOSWALE	80%	48,046
#2	WAYNE A GRUBE MEMORIAL PARK RAIN GARDEN	80%	27,836
#3A	DRAINAGE CHANNEL TO OUTFALL ID#4	50%	7,256
#3B	DRAINAGE CHANNEL TO OUTFALL ID#4 WITH FILTERS	80%	11,610
#4	SEIPLE PROPERTY BIORETENTION	55%	41,158
#5	FULLER PROPERTY STREAM BUFFER	50%	13,999
#6	INLET FILTER BAGS	80%	50,055 (maximum allowed)

F. IDENTIFY FUNDING MECHANISMS

Once the Township has identified the types of BMPs being proposed, then the municipality will identify the types of funding sources available to install these projects during the five (5) year permit. DEP shall review the feasibility and implementation of the Township's PRP prior to DEP approving PAI-13 NPDES permit coverage. DEP does not expect that guaranteed sources be identified in the PRP, but expects that applicants propose their preferred funding options with alternatives in the event the preferred options do not materialize.

In identifying funding sources and potential community partnerships for the proposed BMP projects, the Township reviewed its list of target audiences in their MS4 Stormwater Management Program - groups that the MS4 has been working with during its previous permit who have a general understanding and interest in the protection of watershed resources.

Allen Township shall use the following five years of the PAI-13 Individual Permit to determine the best funding source for each proposed BMP project, and continue reviewing new opportunities as other partnerships and funding sources become available.

The following tables are a summary of potential funding sources.

Table 20: Summary of Funding Sources for Lehigh River BMPs

Source/ Group	Type
DEP – Growing Greener Grant	Conservation & Environmental Projects focused on water quality, requires 15% match
PENN VEST – Green Initiatives	Funding Source – encourage innovative green solutions for water quality management, including projects to reduce sediment and nutrient contamination
Lehigh River Stocking Association	Monitoring & Educational Outreach Source – Work with the local River association in achieving goals outlined in their Mission Statement; work with LRSA to prepare and distribute educational information on local efforts to reduce water pollution
Private Property Owner and Allen Township	Planning & Maintenance Resource – Preparation of a stormwater management agreement between the property owner and the Township
Lehigh Valley Greenways Conservation Landscape (D&L National Heritage Corridor)	Funding Source – Mini Grant for restoring stream buffers and best management practices, requires 1:1 match
Allen Township	Budget funds

Table 21: Summary of Funding Sources for Hokendauqua Creek BMPs

	Type
PENNDOT – TAP Grant Transportation Alternatives Program	Funding Source – Eligible projects include improvements to pedestrian and bicycle facilities, promoting safety and mobility, environmental mitigation and stormwater improvements (Focus: Horwith Drive Improvements)
PENN VEST – Green Initiatives	Funding Source – encourage innovative green solutions for water quality management, including projects to reduce sediment and nutrient contamination
Lehigh Valley Mater Watershed Steward Program Volunteers	Labor Source – Volunteers to assist with the installation of plantings
Business/Company Sponsorships (Example: The Brick Yard located on Horwith Drive)	Fundraising Source – opportunity for local businesses and organizations to donate funding or materials to be used in the project.
Boy Scouts and Girl Scout Troops	Labor Source – Volunteers to assist with the installation of plantings and educational signage
Allen Township	Budget funds

Table 22: Summary of Funding Sources for Dry Run BMPs

	Type
PENNDOT – TAP Grant Transportation Alternatives Program	Funding Source – Eligible projects include improvements to pedestrian and bicycle facilities, promoting safety and mobility, environmental mitigation and stormwater improvements (Focus: Howertown Park Improvements)
PENN VEST – Green Initiatives	Funding Source – encourage innovative green solutions for water quality management, including projects to reduce sediment and nutrient contamination
Chamber Foundation MSLV	Founding Source – Maximum Grant $2000, for the visual improvements to traditional neighborhoods, including landscaping
Private Property Owner and Allen Township	Planning & Maintenance Resource – Preparation of a stormwater management agreement and easement between the property owner and the Township
Lehigh Valley Mater Watershed Steward Program Volunteers	Labor Source – Volunteers to assist with the installation of plantings
Northampton County Conservation District Resource Tech Committee	Funding Source & Planning – work with the County's Watershed Specialist to discuss retro fit projects that include improvements to stormwater management, grant amounts typically around $2000 which can be used towards planning and design
Wildlands Conservancy	Planning & Educational Outreach Source – Assist with the identification of invasive and volunteer plantings; recommendations for rain garden and bioretention area plantings; educational resource for workshops and programming
Boy Scouts and Girl Scout Troops	Labor Source – Volunteers to assist with the installation of plantings and educational components, such as signage or bird boxes for Swallows
Business/Company Sponsorships	Fundraising Source – opportunity for local businesses and organizations to donate towards plantings for the park
Allen Township	Budget funds

Table 23: Summary of Funding Sources Catasauqua Creek BMPs

	Type
PENN VEST – Green Initiatives	Funding Source – encourage innovative green solutions for water quality management, including projects to reduce sediment and nutrient contamination
PENNDOT – Stormwater Management Grant	Funding & Planning Source – Stream channel stabilization projects eligible, in addition to mitigating hazards in flood prone areas
Chamber Foundation MSLV	Founding Source – Maximum Grant $2000, for the visual improvements to traditional neighborhoods, including landscaping
Property Owner and Allen Township Northampton County Catasauqua School District & Private property owners	Planning & Maintenance Resource – Preparation of a stormwater management agreement and easement for the property owner and the Township
Lehigh Valley Mater Watershed Steward Program Volunteers	Volunteers to assist with the removal of accumulated sediment, debris removal and re-vegetation of the channel
Watershed Coalition of the Lehigh Valley	Planning & Educational Outreach Source – Work with the coalition in developing volunteer opportunities for rain garden and bioswale plantings; utilize watershed staff for educational handouts and materials on the various benefits of the projects
Boy Scouts and Girl Scout Troops	Labor Source – Volunteers to assist with the installation of plantings, educational signage and nesting boxes for bird habitat
Reconnect with the Bertsch-Hokendauqua-Catasauqua Watershed Association	The group was last active in 2012, Allen Township can reach out to the organization to offer new opportunities for members to get involved (Public Outreach & Education)
Allen Township	Budget funds

Every project requires some level of assessment and design. Depending on the complexity and location of the project, a stream and/or channel design may contain any of the following components:

- Geomorphic Assessments and Stream Classification
- Site Surveys
- Hydrologic and Hydraulic Modeling
- Sediment Transport Assessment and Modeling
- Conceptual through final design development, including plans and specifications
- Environmental Permit development and coordination

As the permittee develops estimates on the amount of funding needed for a project, the costs are typically impacted by a variety of factors, many of which can be identified during the initial planning level. Factors that can impact a project include:

- Stream Size – larger streams require greater quantities of earthwork, stone and other materials, ad more stream flow maintenance.
- Urban Watersheds – typically have more constraints to construction access, require outfall repairs, and often involve pedestrian considerations such as foot bridges and/or trails. Larger planting materials are often required for a more mature landscape than in rural areas.
- Relocation of Utilities – The presence of utilities that have to be relocated adds an additional level of construction cost to any given project
- Easement agreements – Easement agreements on private property can delay construction activities. Access easements are often required across private property during construction, and maintenance easements for long term sustainability.
- Weather – Harder to anticipate and plan for during a project, excessive rainfall or snowfall can delay projects and add costs to construction.

G. IDENTIFY RESPONSIBLE PARTIES FOR OPERATION AND MAINTENANCE (O&M) OF BMPS

Once implemented, the BMPs must be maintained in order to continue producing the expected pollutant reductions. Applicants must identify anticipated maintenance tasks for the BMPs, including:

- The party(ies) responsible for ongoing O&M;
- The activities involved with O&M the BMP; and
- The frequency at which O&M activities will occur

MS4 permittees will need to identify actual O&M activities in Annual MS4 Status Reports submitted under their Individual Permit.

All stormwater BMPs installed under this PRP are subject to the Allen Township stormwater management ordinances. If the BMP is located on private land, the landowner must convey an easement to Allen Township to allow for access and periodic inspections and maintenance, as needed. Operation and maintenance activities conducted by the Township shall be listed in its annual report to DEP.

Table 24: Responsible Parties for Operation and Maintenance of BMPs

BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Rain Garden (Eisenhower Dr) (Tow Path Rd) (Twin Brook Rd) (Wayne Grube Park)	Allen Township	Visually inspect the area for signs of erosion; Clear accumulation of debris at pipe openings and discharge points	As Needed following construction
Rain Garden (Eisenhower Dr) (Tow Path Rd) (Twin Brook Rd) (Wayne Grube Park)	Allen Township & Community Volunteers (Garden Clubs)	Initial watering program to get plantings established	As Needed following construction
		Prune and weed garden to maintain appearance; Remove trash and debris	Monthly
Rain Garden (Eisenhower Dr) (Tow Path Rd) (Twin Brook Rd) (Wayne Grube Park)	Allen Township & Engineer	Inspect each BMP location using PCSM form and provide summary report of BMPs for MS4 annual report to DEP	Annual
Rain Garden (Eisenhower Dr) (Tow Path Rd) (Twin Brook Rd) (Wayne Grube Park)	Watershed Coalition of the Lehigh Valley Lehigh Valley Mater Watershed Stewards	Organize educational event/ demonstration event on how the rain gardens work	Goal is to have this be a planned event coordinated with Allen Township every other year to target different audience groups Minimum: 1 event at each rain garden during the 5 year permit
BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Bioswale Area (Catasauqua H.S.) (Horwith Drive)	Allen Township	Visually inspect the area for signs of erosion; Clear accumulation of debris around inlet areas	As Needed following construction
Bioswale Area (Catasauqua H.S.) (Horwith Drive)	Allen Township, Catasauqua High School, Property Owners	Initial watering program to get plantings established	First 18 months – supplemental watering schedule After 18 months – As Needed
Bioswale Area (Catasauqua H.S.) (Horwith Drive)	Allen Township, Catasauqua High School, Property Owners	Prune and weed swale to maintain appearance; Remove trash and debris	Monthly Township – responsible for the more intensive BMP pruning/ cleaning

			during Spring and Fall. Township to provide assistance to owners rest of the year by collecting trash, debris and cuttings assembled by the property owners.
Bioswale Area (Catasauqua H.S.) (Horwith Drive)	Allen Township & Engineer	Illicit Discharge Inspections	Annually
Bioswale Area (Catasauqua H.S.)	Catasauqua High School Lehigh Valley Mater Watershed Stewards	Organize educational event or outdoor class on how the bioswale works Organize a clean up day to remove trash and debris from the swale.	Annual – Clean up event Every 2 Years – outdoor class/ educational event at the swale

BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Vegetated Filter Strip	Allen Township	Vegetation Inspection Inspect for signs of erosion concerns along the embankments and areas of pooling water that need corrective actions	Months 1-18: Once a month After 18 months: Annually and after every major storm event with rainfall greater than 1”
Vegetated Filter Strip	Allen Township & Engineer	Illicit Discharge Inspections	Annually
Vegetated Filter Strip	Property Owner	Vegetation Inspection	Quarterly: owner to inspect vegetation, replace dead or damaged plant material, repair displaced mulch and soil areas
		Debris Removal	As Needed – keep inlet grates and overflow areas clear of debris to maintain flows
		Annual Task form To submit with MS4 report	Annually: Owner shall provide Allen Township with copy of completed inspections sheets and tasks during the year

BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Vegetated Filter Strip Vegetated Open Channel	Allen Township	Vegetation Inspection Inspect and correct erosion concerns Identify and correct areas of pooling water	Months 1-18: Once a month After 18 months: Annually and after every major storm event with rainfall greater than 1”
Vegetated Filter Strip Vegetated Open Channel	Allen Township & Engineer	Illicit Discharge Inspections	Annually
Vegetated Filter Strip Vegetated Open Channel	Allen Township	Sediment removal from channel	5 years or As Needed – when accumulation is 3” or greater
Vegetated Filter Strip Vegetated Open Channel	Property Owner	Vegetation Inspection	Quarterly: owner to inspect vegetation, replace dead or damaged plant material, repair displaced mulch and soil areas
		Debris Removal	As Needed – keep inlet grates and overflow areas clear of debris to maintain flows
		Annual Task form To submit with MS4 report	Annually: Owner shall provide Allen Township with copy of completed inspections sheets and tasks during the year
BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Basin Improvements (Walker Dr) (Willow Ridge)	Allen Township	Visually inspect the area for signs of erosion; clear accumulation of debris at pipe openings and discharge points	As Needed Following Construction
		Inspect inflow area for sediment accumulation; Test planting bed pH, adjust soil as needed to maintain functions	Annually test
		Replace dying vegetation	Annually
		Replace mulch (where appropriate)	Every 2-3 years

Basin Improvements (Walker Dr) (Willow Ridge)	Adjacent property owners	Initial vegetation monitoring and watering program to get plantings established	First 18 months – monitoring program to be in conjunction with the Township
		Report illicit discharges or dumping activities to the Township	As Needed
BMP Option	Parties Responsible for O&M	O&M Activities	Frequency of Activities
Inlet Filters	Allen Township	When removing the filter bag to dispose of the collected sediment, the following steps must be taken to get PRP credit: 1) Remove refuse, debris and floatables from the bag (bottles, trash, cigarettes, wrappers, etc.) They do not count towards materials collected. 2) Measure the weight of solid/organic material collected (lbs.) 3) Sum the total weight of material collected for an annual period. 4) Convert the annual wet weight captured into annual dry weight (lbs)	First 12 months - inspect inlet filters monthly to determine rate of sediment accumulation for that particular roadway. Based on their accumulation rates, Township shall prepare a schedule when street inlet bags need to be cleared Annually – Township to prepare a summary sheet showing the totaled captured weight of sediment for each watershed.

H. GENERAL INFORMATION

Volunteer Community Garden Clubs Sponsoring the Maintenance of a Stormwater BMP

The proposed BMP improvements to Howertown Park, Wayne A Grube Park, and the Catasauqua High School are in recreational use areas, near residential developments. Their locations provide an opportunity to work with homeowners and park users to assist in the long term maintenance of these best management practices in their neighborhoods. The proposed stormwater BMPs improvements can be used as demonstration areas, where desirable plants and designs can be viewed by visitors. Since poorly maintained planting areas can discourage residents from replicating the design in their own neighborhoods, the use of community garden clubs would provide the occasional, yet necessary, maintenance support to have the planting beds looking and functioning at their best. The most typical maintenance tasks would be weeding and removing trash. Allen Township can provide annual training sessions to the garden clubs through the Northampton County Watershed Program or through the use of a Lehigh Valley Master Watershed Steward on how to identify different vegetation for removal.

Increased community participation with the stormwater BMPs can provide various newsletter articles and social media posts about the on-going work of the volunteers. Educational hand outs and materials can be made available for public download from the Township's homepage, whereas educational signage at the BMP locations can include a QR Code enabling walkers to use their cell phones to download educational information on that particular stormwater BMP.

It is encouraged to have Allen Township work with the local Wastershed Steward to develop an Operations and Procedural Guideline Manual for use by volunteer Garden Clubs. The manual shall provide guidelines for the work, such as: construction of the planting beds, list of encouraged native plantings, non-approved plantings, typical maintenance tasks, frequency of the work and safety information. The manual is to be used by the garden clubs as a resource throughout the Township.

Photo: Example of interactive educational signage using QR codes

Stormwater Fee

The Township has seen the recent actions taken by other Pennsylvania municipalities to implement a stormwater fee to provide a long term sustainable funding source to cover the increasing costs for storm sewer maintenance and programming tasks required by the NPDES MS4 permit. The fee may be based on the area of impervious surface associated with each tax parcel, or a flat fee rate. Properties that are exempt from school tax or property taxes would not be exempt from the stormwater fee, thus providing an opportunity for additional funding sources. The fee could also be offset by the individual property owner through the installation of on-site BMPs that would reduce their rate and volume, and improve water quality of stormwater running off from their property.

As with many other Pennsylvania municipalities, the Township needs more information on this topic. Additional information is needed on how other municipalities in Pennsylvania have implemented their ordinance. Some municipalities work with a separate Stormwater Authority to administer the fee program, while other communities look to establishing a joint municipal partnership to manage the entire watershed area in order to share resources.

PRP Implementation and Final Report

Under the NPDES Individual Permit, the permittee must achieve the required pollutant load reductions within five (5) years following DEP's approval of coverage, and must submit a report demonstrating compliance with the minimum pollutant load reductions as an attachment to the first Annual MS4 Status Report that is due following completion of the 5th year of coverage.

This summary will review the work completed by the municipality and how the required pollution load reduction was satisfied. Report submission dates shall be verified once Allen Township receives its approved coverage dates, which is listed on the NPDES Individual permit.

Allen Township shall submit the PRP in accordance with the above requirements. This plan shall be dynamic and changing as unforeseen projects may be added as new opportunities arise during the next five years.

PA DEP MUNICIPAL MS4 REQUIREMENT TABLE

MS4 Name	NPDES ID	Individual Permit Required?	Reason	Impaired Downstream Waters or Applicable TMDL Name	Requirement(s)	Other Cause(s) of Impairment
Northampton County						
ALLEN TWP	PAI132250	Yes	IP	Lehigh River	Appendix A-Metals (5), Appendix E-Organic Enrichment/Low D.O., Siltation, Suspended Solids (5)	
				Hokendauqua Creek	Appendix E-Siltation, Suspended Solids (5)	
				Dry Run	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Catasauqua Creek	Appendix E-Siltation (5)	
BANGOR BORO	PAG132249	No		Unnamed Tributaries to Martins Creek	Appendix E-Siltation (5)	Flow Alterations, Other Habitat Alterations (4c)
BATH BORO	PAI132215	Yes	SP, IP	East Branch Monocacy Creek	Appendix E-Siltation (5)	
				Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
BETHLEHEM CITY	PAI132210	Yes	SP, IP	Unnamed Tributaries to Lehigh Coal And Navigation Canal	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Unnamed Tributaries to East Branch Saucon Creek		Other Habitat Alterations, Water/Flow Variability (4c)
				Saucon Creek	Appendix E-Siltation (5)	
				Nancy Run	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Lehigh River	Appendix C-PCB (5), Appendix E-Organic Enrichment/Low D.O., Siltation, Suspended Solids (5)	
				East Branch Saucon Creek	Appendix E-Siltation (5)	
BETHLEHEM TWP	PAI132214	Yes	SP, IP	Nancy Run	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Lehigh River	Appendix C-PCB (5), Appendix E-Organic Enrichment/Low D.O., Siltation, Suspended Solids (5)	
				Delaware River		Mercury (5)
BUSHKILL TWP	PAI132219	Yes	SP, IP	East Branch Monocacy Creek	Appendix E-Siltation (5)	
				Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Bushkill Creek	Appendix B-Pathogens (5)	
				Shoeneck Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
CHAPMAN BORO	PAI132257*	Yes	SP, W-I	Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
EAST ALLEN TWP	PAI132212	Yes	SP, IP	Catasauqua Creek	Appendix E-Siltation (5)	
				East Branch Monocacy Creek	Appendix E-Siltation (5)	
				Unnamed Tributaries to Shoeneck Creek	Appendix E-Siltation (5)	Water/Flow Variability (4c)
				Monocacy Creek	Appendix E-Siltation (5)	Other Habitat Alterations (4c)
				Lehigh River	Appendix E-Organic Enrichment/Low D.O., Siltation, Suspended Solids (5)	

CATASAUQUA CREEK MAP
OUTFALLS AND EXISTING BMPS

&

DRY RUN CREEK MAP
OUTFALLS AND EXISTING BMPS

CATASAUQUA CREEK
OUTFALL LOCATIONS & EXISTING BMPS

BMP - SWALE

BMP - INFILTRATION BASIN

X03 BMP - ID

OUTFALL - ID

CATASAUQUA CREEK
OUTFALL LOCATIONS & EXISTING BMPS

BMP - SWALE

BMP - INFILTRATION BASIN

X03 BMP - ID

OUTFALL - ID

Outfall ID-4 located at end of swale A19 at Creek edge

DRY RUN CREEK
OUTFALL LOCATIONS & EXISTING BMPS

BMP - SWALE

BMP - INFILTRATION BASIN

X03 BMP - ID

OUTFALL - ID

DRY RUN CREEK
OUTFALL LOCATIONS & EXISTING BMPS

BMP - SWALE

BMP - INFILTRATION BASIN

X03 BMP - ID

OUTFALL - ID

EXISTING LOAD CALCULATIONS
AND
REDUCTIONS FOR EXISTING BMPS

ALLEN TOWNSHIP, Northampton County PA

Lehigh River Watershed

Using Wiki Watershed - Stroud Watershed Tool Modeling - EXISTING

					EXISTING LOAD SEDIMENT			PHOSPHOROUS	
LAND USE CATEGORY [1]	TOTAL AREA (SF)	CONVERSION TO ACRES (AC)	STROUD IMPERV. (%)	TYPE	AREA (AC)	LOADING RATE (LB/AC) [2]	EXISTING LOAD (LBS)	LOADING RATE (LB/AC) [4]	EXISTING LOAD (LBS)
DEVELOPED, WOODED	-	-	0.00	IMPERVIOUS	0.00	1839.00	0.00	2.28	0.00
				PERVIOUS	0.00	264.96	0.00	0.84	0.00
DEVELOPED, OPEN SPACE	268,720.54	6.17	0.19	IMPERVIOUS	1.17	1839.00	2155.50	2.28	2.67
				PERVIOUS	5.00	264.96	1323.97	0.84	4.20
DEVELOPED, LOW INTENSITY	1,233,013.89	28.31	0.49	IMPERVIOUS	13.87	1839.00	25506.91	2.28	31.62
				PERVIOUS	14.44	264.96	3824.99	0.84	12.13
DEVELOPED, MEDIUM INTENSITY	232,882.94	5.35	0.79	IMPERVIOUS	4.22	1839.00	7767.10	2.28	9.63
				PERVIOUS	1.12	264.96	297.47	0.84	0.94
DEVELOPED, HIGH INTENSITY	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00	2.28	0.00
				PERVIOUS	0.00	264.96	0	0.84	0.00
REMAINING STREETS/ROADWAYS	252,767.94	5.80	1.00	IMPERVIOUS	5.80	1839.00	10671.26	2.28	13.23
					TOTALS:		**51547.21**	PHOSPHOROUS	**74.42**

ALLEN TOWNSHIP, Northampton County PA

Hokendauqua Watershed

Existing Land Use - Pollutant Load

LAND USE CATEGORY [1]	TOTAL AREA (SF)	CONVERSION TO ACRES (AC)	STROUD IMPERV. (%)	EXISTING LOAD TYPE	AREA (AC)	LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
DEVELOPED, WOODED	4,027,242.52	92.45	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS	92.45	264.96	24496.29
DEVELOPED, OPEN SPACE	3,693,401.75	84.79	0.19	IMPERVIOUS	16.11	1839.00	29626.07
				PERVIOUS	68.68	264.96	18197.18
DEVELOPED, LOW INTENSITY	4,030,423.44	92.53	0.49	IMPERVIOUS	45.34	1839.00	83375.92
				PERVIOUS	47.19	264.96	12502.97
DEVELOPED, MEDIUM INTENSITY	1,089,272.63	25.01	0.79	IMPERVIOUS	19.75	1839.00	36329.34
				PERVIOUS	5.25	264.96	1391.39
DEVELOPED, HIGH INTENSITY	663,878.30	15.24	1.00	IMPERVIOUS	15.24	1839.00	28027.37
				PERVIOUS	0.00	264.96	0
DEVELOPED, AGRICULTURAL	4,919,897.86	112.95	0.79	IMPERVIOUS	89.23	1839.00	164088.08
				PERVIOUS	23.72	264.96	6284.457961
DEVELOPED, STONE/GRAVEL	565,911.03	12.99	1.00	IMPERVIOUS	12.99	1839.00	23891.42
				PERVIOUS	0.00	264.96	0
STREETS/ROADWAYS	1,108,582.88	25.45	1.00	IMPERVIOUS	25.45	1839.00	46801.74

TOTALS: SEDIMENT **475012.22**

ALLEN TOWNSHIP, Northampton County PA

Dry Run Creek Watershed

Existing Land Use - Pollutant Load

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD IMPERV. (%)	EXISTING LOAD TYPE	EXISTING LOAD AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
DEVELOPED, WOODED	1,755,435.80	40.30	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS	40.30	264.96	10677.69
DEVELOPED, OPEN SPACE	4,067,029.63	93.37	0.19	IMPERVIOUS	17.74	1839.00	32623.07
				PERVIOUS	75.63	264.96	20038.02
DEVELOPED, LOW INTENSITY	6,930,665.24	159.11	0.49	IMPERVIOUS	77.96	1839.00	143372.17
				PERVIOUS	81.14	264.96	21499.95
DEVELOPED, MEDIUM INTENSITY	1,261,309.46	28.96	0.79	IMPERVIOUS	22.87	1839.00	42067.10
				PERVIOUS	6.08	264.96	1611.14
DEVELOPED, HIGH INTENSITY	226,737.49	5.21	1.00	IMPERVIOUS	5.21	1839.00	9572.32
				PERVIOUS	0.00	264.96	0.00
AGRICULTURAL	2,183,016.61	50.12	0.79	IMPERVIOUS	39.59	1839.00	72807.81
				PERVIOUS	10.52	264.96	2788.49
BARREN/ ROCK/ GRAVEL	427,184.26	9.81	1.00	IMPERVIOUS	9.81	1839.00	18034.71
				PERVIOUS	0.00	264.96	0
STREETS/ROADWAYS	1,900,773.34	43.64	1.00	IMPERVIOUS	43.64	1839.00	80246.15

TOTALS: SEDIMENT **455338.62**

Existing BMP Credits			
Savage Road Basin A		39,409.73	Sediment (lbs/yr)
Savage Road Basin B		9,270.41	Sediment (lbs/yr)
	Existing Load	455338.62	Sediment (lbs/yr)
	Credits	48,680.14	Sediment (lbs/yr)
	Revised Ex. Load	406658.48	Sediment (lbs/yr)

Dry Creek Run — Savage Road Basin A (B02 - Upper)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
DEVELOPED, WOODED	120,255.84	2.76	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS	2.76	264.96	731.47
DEVELOPED, OPEN SPACE	190,535.91	4.37	0.19	IMPERVIOUS	0.83	1839.00	1528.36
				PERVIOUS	3.54	264.96	938.76
DEVELOPED, LOW INTENSITY	1,050,086.56	24.11	0.49	IMPERVIOUS	11.81	1839.00	21722.76
				PERVIOUS	12.29	264.96	3257.52
DEVELOPED, MEDIUM INTENSITY	108,762.73	2.50	0.79	IMPERVIOUS	1.97	1839.00	3627.45
				PERVIOUS	0.52	264.96	138.93
DEVELOPED, HIGH INTENSITY		-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
REMAINING STREETS/ROADWAYS	1,110,299.59	25.49	1.00	IMPERVIOUS	25.49	1839.00	46874.22
					TOTALS:	SEDIMENT	**78819.47**
B SOILS	Effectiveness Value for Rain Garden (A/B soils):					50%	39409.73

Dry Creek Run — Savage Road Basin B (B02 - Lower)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
DEVELOPED, OPEN SPACE	47,847.57	1.10	0.19	IMPERVIOUS	0.21	1839.00	383.80
				PERVIOUS	0.89	264.96	235.74
DEVELOPED, LOW INTENSITY	446,414.96	10.25	0.49	IMPERVIOUS	5.02	1839.00	9234.83
				PERVIOUS	5.23	264.96	1384.85
DEVELOPED, MEDIUM INTENSITY	51,139.40	1.17	0.79	IMPERVIOUS	0.93	1839.00	1705.60
				PERVIOUS	0.25	264.96	65.32
DEVELOPED, HIGH INTENSITY		-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
REMAINING STREETS/ROADWAYS	131,004.16	3.01	1.00	IMPERVIOUS	3.01	1839.00	5530.69
					TOTALS:	SEDIMENT	**18540.82**
B SOILS	Effectiveness Value for Rain Garden (A/B soils):					50%	9270.41

ALLEN TOWNSHIP, Northampton County PA

Catasuqua Creek Watershed

Existing Land Use - Pollutant Load

				EXISTING LOAD			SEDIMENT
LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD IMPERV. (%)	TYPE	AREA (AC)	LOADING RATE (LB/AC) [2]	EXISTING LOAD (LBS)
DEVELOPED, WOODED	3,153,892.53	72.40	0.00	IMPERVIOUS	72.40	1839.00	133149.87
				PERVIOUS	0.00	264.96	0.00
DEVELOPED, OPEN SPACE	10,178,754.57	233.67	0.19	IMPERVIOUS	44.40	1839.00	81647.35
				PERVIOUS	189.27	264.96	50150.13
DEVELOPED, LOW INTENSITY	3,158,315.69	72.50	0.49	IMPERVIOUS	35.53	1839.00	65334.94
				PERVIOUS	36.98	264.96	9797.57
DEVELOPED, MEDIUM INTENSITY	2,281,613.04	52.38	0.79	IMPERVIOUS	41.38	1839.00	76096.19
				PERVIOUS	11.00	264.96	2914.43
DEVELOPED, HIGH INTENSITY	36,024.28	0.83	1.00	IMPERVIOUS	0.83	1839.00	1520.86
				PERVIOUS	0.00	264.96	0.00
AGRICULTURAL	14,235,734.39	326.81	0.79	IMPERVIOUS	326.81	1839.00	600998.98
				PERVIOUS	0.00	264.96	0.00
GRAVEL/ STONE	22,033.66	0.51	1.00	IMPERVIOUS	0.51	1839.00	930.21
				PERVIOUS	0.00	264.96	0.00
STREETS/ROADWAYS	688,345.56	15.80	1.00	IMPERVIOUS	15.80	1839.00	29060.32
PARSED PROPERTY (FED EX + LOT 4)	12,444,061.59	285.68					
ROCKEFELLER LOT 5	3,716,672.43	85.32					

TOTALS: SEDIMENT **1,051,600.85**

Existing BMP Credits			
Willow Ridge Basin		10,410.35	Sediment (lbs/yr)
Wayne A Grube Park (Willowbrook Rd)		30,038.59	Sediment (lbs/yr)
Wayne A Grube Park (E Bullshead Rd)		7,458.47	Sediment (lbs/yr)
Country Road Swale		2,575.49	Sediment (lbs/yr)
	Existing Load	1,051,600.85	Sediment (lbs/yr)
	Credits	50,482.90	Sediment (lbs/yr)
	Revised Ex Load	1,001,117.95	Sediment (lbs/yr)

Catasauqua Creek Drainage Area

Willow Ridge Detention Basin (A24)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
DEVELOPED, ROCK/BARREN	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, WOODED	-	-	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	114,085.96	2.62	0.19	IMPERVIOUS	0.50	1839.00	915.12
				PERVIOUS	2.12	264.96	562.09
DEVELOPED, LOW INTENSITY	29,986.82	0.69	0.49	IMPERVIOUS	0.34	1839.00	620.33
				PERVIOUS	0.35	264.96	93.02
DEVELOPED, MEDIUM INTENSITY	388,142.28	8.91	0.79	IMPERVIOUS	7.04	1839.00	12945.29
				PERVIOUS	1.87	264.96	495.80
DEVELOPED, HIGH INTENSITY		-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
REMAINING STREETS/ROADWAYS	40,716.01	0.93	1.00	IMPERVIOUS	0.93	1839.00	1718.93
					TOTALS:	SEDIMENT	**17350.59**
B SOILS	Effectiveness Value for Rain Garden (A/B soils):					60%	10410.35

Wayne Grube Memorial Park - Drainage Area #6 (Filtered by A-15)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	50,115.27	1.15	0.19	IMPERVIOUS	0.22	1839.00	401.99
				PERVIOUS	0.93	264.96	246.92
DEVELOPED, HIGH INTENSITY	15,038.38	0.35	1.00	IMPERVIOUS	0.35	1839.00	634.88
				PERVIOUS		264.96	
REMAINING STREETS/ROADWAYS	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
					TOTALS:	SEDIMENT	**1283.79**
HAS MIX OF B AND C SOIL GROUPS	Effectiveness Value			Existing Dry Detention Basin gives =		60%	770.28

(W Bullshead Road)

Wayne Grube Memorial Park - Drainage Area #4 (Filtered by Swale A16)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	38,574.98	0.89	1.00	IMPERVIOUS	0.89	1839.00	1628.54
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	24,339.93	0.56	0.19	IMPERVIOUS	0.11	1839.00	195.24
				PERVIOUS	0.45	264.96	119.92
DEVELOPED, LOW INTENSITY	-	-	0.49	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS	0.00	264.96	0.00
DEVELOPED, MEDIUM INTENSITY	4,299.52	0.10	0.79	IMPERVIOUS	0.08	1839.00	143.40
				PERVIOUS	0.02	264.96	5.49
DEVELOPED, HIGH INTENSITY	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
					TOTALS:	SEDIMENT	**2092.59**
GROUP C SOILS	Effectiveness Value			Existing Veg Open Channel		50%	1046.30

(W Bullshead Road)

Wayne Grube Memorial Park - Drainage Area #3 & #5 (Filtered by Swale A17)

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	248,277.45	5.70	1.00	IMPERVIOUS	5.70	1839.00	10481.69
				PERVIOUS		264.96	
DEVELOPED, WOODED	-	-	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	61,946.82	1.42	0.19	IMPERVIOUS	0.27	1839.00	496.90
				PERVIOUS	1.15	264.96	305.21
					TOTALS:	SEDIMENT	**11283.79**
GROUP C SOILS	Effectiveness Value			Existing Veg Open Channel		50%	5641.90

Country Road Development - Swale A21

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, WOODED	-	-	0.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	76,672.30	1.76	0.19	IMPERVIOUS	0.33	1839.00	615.02
				PERVIOUS	1.43	264.96	377.76
DEVELOPED, LOW INTENSITY	134,345.65	3.08	0.49	IMPERVIOUS	1.51	1839.00	2779.16
				PERVIOUS		264.96	
REMAINING STREETS/ROADWAYS	32,664.93	0.75	1.00	IMPERVIOUS	0.75	1839.00	1379.04
					TOTALS:	SEDIMENT	**5150.97**
GROUP C SOILS	Effectiveness Value			Existing Veg Open Channel		50%	2575.49

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A06

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	62,473.02	1.43	0.19	IMPERVIOUS	0.27	1839.00	501.12
				PERVIOUS	1.16	264.96	307.80
DEVELOPED, HIGH INTENSITY	37,074.93	0.85	1.00	IMPERVIOUS	0.85	1839.00	1565.22
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**2374.13**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	1661.89

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A07

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	109,056.56	2.50	0.19	IMPERVIOUS	0.48	1839.00	874.78
				PERVIOUS	2.03	264.96	537.32
DEVELOPED, HIGH INTENSITY	9,127.79	0.21	1.00	IMPERVIOUS	0.21	1839.00	385.35
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**1797.45**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	1258.21

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A09

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	95,905.24	2.20	0.19	IMPERVIOUS	0.42	1839.00	769.29
				PERVIOUS	1.78	264.96	472.52
DEVELOPED, HIGH INTENSITY	2,722.57	0.06	1.00	IMPERVIOUS	0.06	1839.00	114.94
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**1356.75**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	949.72

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A10

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	166,656.40	3.83	1.00	IMPERVIOUS	3.83	1839.00	7035.84
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	114,631.22	2.63	0.19	IMPERVIOUS	0.50	1839.00	919.50
				PERVIOUS	2.13	264.96	564.78
DEVELOPED, HIGH INTENSITY	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**8520.12**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	5964.08

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A11

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	266,029.02	6.11	1.00	IMPERVIOUS	6.11	1839.00	11231.11
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	13,037.16	0.30	0.19	IMPERVIOUS	0.06	1839.00	104.58
				PERVIOUS	0.24	264.96	64.23
DEVELOPED, HIGH INTENSITY	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**11399.92**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	7979.95

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Swale A16

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	337,209.40	7.74	1.00	IMPERVIOUS	7.74	1839.00	14236.18
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	81,659.55	1.87	0.19	IMPERVIOUS	0.36	1839.00	655.02
				PERVIOUS	1.52	264.96	402.33
DEVELOPED, HIGH INTENSITY	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**15293.53**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		70%	10705.47

(Willowbrook Road)

Wayne Grube Memorial Park #2 - Infiltration Basin A13

LAND USE CATEGORY [1]	AREA (SF)	CONVERSION TO ACRES (AC)	STROUD TOOL IMPERVIOUS (%)	PROPOSED TYPE	PROPOSED AREA (AC)	SEDIMENT LOADING RATE (LB/AC) [2]	SEDIMENT EXISTING LOAD (LBS)
AGRICULTURAL	-	-	1.00	IMPERVIOUS	0.00	1839.00	0.00
				PERVIOUS		264.96	
DEVELOPED, OPEN SPACE	25,577.17	0.59	0.19	IMPERVIOUS	0.11	1839.00	205.16
				PERVIOUS	0.48	264.96	126.02
DEVELOPED, HIGH INTENSITY	64,128.01	1.47	1.00	IMPERVIOUS	1.47	1839.00	2707.33
				PERVIOUS		264.96	
					TOTALS:	SEDIMENT	**3038.51**
GROUP B SOILS	Effectiveness Value			Existing Veg Open Channel		50%	1519.26

PA DEP
DEVELOPED LOADING RATES FOR COUNTIES

ATTACHMENT B

DEVELOPED LAND LOADING RATES FOR PA COUNTIES[1,2,3]

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
Adams	impervious developed	10,373.2	33.43	2.1	1,398.77
	pervious developed	44,028.6	22.99	0.8	207.67
Bedford	impervious developed	9,815.2	19.42	1.9	2,034.34
	pervious developed	19,425	17.97	0.68	301.22
Berks	impervious developed	1,292.4	36.81	2.26	1,925.79
	pervious developed	5,178.8	34.02	0.98	264.29
Blair	impervious developed	3,587.9	20.88	1.73	1,813.55
	pervious developed	9,177.5	18.9	0.62	267.34
Bradford	impervious developed	10,423	14.82	2.37	1,880.87
	pervious developed	23,709.7	13.05	0.85	272.25
Cambria	impervious developed	3,237.9	20.91	2.9	2,155.29
	pervious developed	8,455.4	19.86	1.12	325.3
Cameron	impervious developed	1,743.2	18.46	2.98	2,574.49
	pervious developed	1,334.5	19.41	1.21	379.36
Carbon	impervious developed	25.1	28.61	3.97	2,177.04
	pervious developed	54.2	30.37	2.04	323.36
Centre	impervious developed	7,828.2	19.21	2.32	1,771.63
	pervious developed	15,037.1	18.52	0.61	215.84
Chester	impervious developed	1,838.4	21.15	1.46	1,504.78
	pervious developed	10,439.8	14.09	0.36	185.12
Clearfield	impervious developed	9,638.5	17.54	2.78	1,902.9
	pervious developed	17,444.3	18.89	1.05	266.62
Clinton	impervious developed	7,238.5	18.02	2.80	1,856.91
	pervious developed	11,153.8	16.88	0.92	275.81
Columbia	impervious developed	7,343.1	21.21	3.08	1,929.18
	pervious developed	21,848.2	22.15	1.22	280.39
Cumberland	impervious developed	8,774.8	28.93	1.11	2,065.1
	pervious developed	26,908.6	23.29	0.34	306.95
Dauphin	impervious developed	3,482.4	28.59	1.07	1,999.14
	pervious developed	9,405.8	21.24	0.34	299.62
Elks	impervious developed	1,317.7	18.91	2.91	1,556.93
	pervious developed	1,250.1	19.32	1.19	239.85
Franklin	impervious developed	13,832.3	31.6	2.72	1,944.85
	pervious developed	49,908.6	24.37	0.76	308.31
Fulton	impervious developed	3,712.9	22.28	2.41	1,586.75
	pervious developed	4,462.3	18.75	0.91	236.54
Huntington	impervious developed	7,321.9	18.58	1.63	1,647.53
	pervious developed	11,375.4	17.8	0.61	260.15
Indiana	impervious developed	589	19.29	2.79	1,621.25
	pervious developed	972	20.1	1.16	220.68
Jefferson	impervious developed	21.4	18.07	2.76	1,369.63
	pervious developed	20.4	19.96	1.24	198.60
Juniata	impervious developed	3,770.2	22.58	1.69	1,903.96
	pervious developed	8,928.3	17.84	0.55	260.68
Lackawana	impervious developed	2,969.7	19.89	2.84	1,305.05
	pervious developed	7,783.9	17.51	0.76	132.98
Lancaster	impervious developed	4,918.7	38.53	1.55	1,480.43
	pervious developed	21,649.7	22.24	0.36	190.93
Lebanon	impervious developed	1,192.1	40.58	1.85	1,948.53
	pervious developed	5,150	27.11	0.4	269.81
Luzerne	impervious developed	5,857	20.43	3	1,648.22
	pervious developed	13,482.9	19.46	0.98	221.19
Lycoming	impervious developed	10,031.7	16.48	2.57	1,989.64
	pervious developed	19,995.5	16	0.84	277.38

County	Category	Acres	TN lbs/acre/yr	TP lbs/acre/yr	TSS (Sediment) lbs/acre/yr
McKean	impervious developed	38.7	20.93	3.21	1,843.27
	pervious developed	5.3	22.58	1.45	249.26
Mifflin	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Montour	impervious developed	5,560.2	21.83	1.79	1,979.13
	pervious developed	16,405.5	21.13	0.71	296.07
Northumberland	impervious developed	8,687.3	25.73	1.54	2,197.08
	pervious developed	25,168.3	24.63	0.54	367.84
Perry	impervious developed	5,041.1	26.77	1.32	2,314.7
	pervious developed	9,977	23.94	0.51	343.16
Potter	impervious developed	2,936.3	16.95	2.75	1,728.34
	pervious developed	2,699.3	17.11	1.09	265.2
Schuylkill	impervious developed	5,638.7	30.49	1.56	1,921.08
	pervious developed	14,797.2	29.41	0.57	264.04
Snyder	impervious developed	4,934.2	28.6	1.11	2,068.16
	pervious developed	14,718.1	24.35	0.4	301.5
Somerset	impervious developed	1,013.6	25.13	2.79	1,845.7
	pervious developed	851.2	25.71	1.14	293.42
Sullivan	impervious developed	3,031.7	19.08	2.85	2,013.9
	pervious developed	3,943.4	21.55	1.31	301.58
Susquehanna	impervious developed	7,042.1	19.29	2.86	1,405.73
	pervious developed	14,749.7	20.77	1.21	203.85
Tioga	impervious developed	7,966.9	12.37	2.09	1,767.75
	pervious developed	18,090.3	12.22	0.76	261.94
Union	impervious developed	4,382.6	22.98	2.04	2,393.55
	pervious developed	14,065.3	20.88	0.69	343.81
Wayne	impervious developed	320.5	18.69	2.89	1,002.58
	pervious developed	509	21.14	1.31	158.48
Wyoming	impervious developed	3,634.4	16.03	2.53	2,022.32
	pervious developed	10,792.9	13.75	0.7	238.26
York	impervious developed	10,330.7	29.69	1.18	1,614.15
	pervious developed	40,374.8	18.73	0.29	220.4
All Other Counties	impervious developed	-	23.06	2.28	1,839
	pervious developed	-	20.72	0.84	264.96

Notes:

1 These land loading rate values may be used to derive existing pollutant loading estimates under DEP's simplified method for PRP development. MS4s may choose to develop estimates using other scientifically sound methods.

2 Acres and land loading rate values for named counties in the Chesapeake Bay watershed are derived from CAST. (The column for Acres represents acres within the Chesapeake Bay watershed). For MS4s located outside of the Chesapeake Bay watershed, the land loading rates for "All Other Counties" may be used to develop PRPs under Appendix E; these values are average values across the Chesapeake Bay watershed.

3 For land area outside of the urbanized area, undeveloped land loading rates may be used where appropriate. When using the simplified method, DEP recommends the following loading rates (for any county) for undeveloped land:

- TN – 10 lbs/acre/yr
- TP – 0.33 lbs/acre/yr
- TSS (Sediment) – 234.6 lbs/acre/yr

These values were derived by using the existing loads for each pollutant, according to the 2014 Chesapeake Bay Progress Run, and dividing by the number of acres for the unregulated stormwater subsector.

PA DEP BMP EFFECITIVENESS TABLE

pennsylvania
DEPARTMENT OF ENVIRONMENTAL PROTECTION

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES)
STORMWATER DISCHARGES FROM
SMALL MUNICIPAL SEPARATE STORM SEWER SYSTEMS
BMP EFFECTIVENESS VALUES

This table of BMP effectiveness values (i.e., pollutant removal efficiencies) is intended for use by MS4s that are developing and implementing Pollutant Reduction Plans and TMDL Plans to comply with NPDES permit requirements. The values used in this table generally consider pollutant reductions from both overland flow and reduced downstream erosion, and are based primarily on average values within the Chesapeake Assessment Scenario Tool (CAST) (www.casttool.org). Design considerations, operation and maintenance, and construction sequences should be as outlined in the Pennsylvania Stormwater BMP Manual, Chesapeake Bay Program guidance, or other technical sources. The Department of Environmental Protection (DEP) will update the information contained in this table as new information becomes available. Interested parties may submit information to DEP for consideration in updating this table to DEP's MS4 resource account, RA-EPPAMS4@pa.gov. Where an MS4 proposes a BMP not identified in this document or in Chesapeake Bay Program expert panel reports, other technical resources may be consulted for BMP effectiveness values. Note – TN = Total Nitrogen and TP = Total Phosphorus.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Wet Ponds and Wetlands	20%	45%	60%	A water impoundment structure that intercepts stormwater runoff then releases it to an open water system at a specified flow rate. These structures retain a permanent pool and usually have retention times sufficient to allow settlement of some portion of the intercepted sediments and attached nutrients/toxics. Until recently, these practices were designed specifically to meet water quantity, not water quality objectives. There is little or no vegetation living within the pooled area nor are outfalls directed through vegetated areas prior to open water release. Nitrogen reduction is minimal.
Dry Detention Basins and Hydrodynamic Structures	5%	10%	10%	Dry Detention Ponds are depressions or basins created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Hydrodynamic Structures are devices designed to improve quality of stormwater using features such as swirl concentrators, grit chambers, oil barriers, baffles, micropools, and absorbent pads that are designed to remove sediments, nutrients, metals, organic chemicals, or oil and grease from urban runoff.
Dry Extended Detention Basins	20%	20%	60%	Dry extended detention (ED) basins are depressions created by excavation or berm construction that temporarily store runoff and release it slowly via surface flow or groundwater infiltration following storms. Dry ED basins are designed to dry out between storm events, in contrast with wet ponds, which contain standing water permanently. As such, they are similar in construction and function to dry detention basins, except that the duration of detention of stormwater is designed to be longer, theoretically improving treatment effectiveness.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Infiltration Practices w/ Sand, Veg.	85%	85%	95%	A depression to form an infiltration basin where sediment is trapped and water infiltrates the soil. No underdrains are associated with infiltration basins and trenches, because by definition these systems provide complete infiltration. Design specifications require infiltration basins and trenches to be built in good soil, they are not constructed on poor soils, such as C and D soil types. Engineers are required to test the soil before approval to build is issued. To receive credit over the longer term, jurisdictions must conduct yearly inspections to determine if the basin or trench is still infiltrating runoff.
Filtering Practices	40%	60%	80%	Practices that capture and temporarily store runoff and pass it through a filter bed of either sand or an organic media. There are various sand filter designs, such as above ground, below ground, perimeter, etc. An organic media filter uses another medium besides sand to enhance pollutant removal for many compounds due to the increased cation exchange capacity achieved by increasing the organic matter. These systems require yearly inspection and maintenance to receive pollutant reduction credit.
Filter Strip Runoff Reduction	20%	54%	56%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.4 design ratio of filter strip length to impervious flow length is recommended for runoff reduction urban filter strips.
Filter Strip Stormwater Treatment	0%	0%	22%	Urban filter strips are stable areas with vegetated cover on flat or gently sloping land. Runoff entering the filter strip must be in the form of sheet-flow and must enter at a non-erosive rate for the site-specific soil conditions. A 0.2 design ratio of filter strip length to impervious flow length is recommended for stormwater treatment urban filter strips.
Bioretention – Raingarden (C/D soils w/ underdrain)	25%	45%	55%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in C or D soil.
Bioretention / Raingarden (A/B soils w/ underdrain)	70%	75%	80%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has an underdrain and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Bioretention / Raingarden (A/B soils w/o underdrain)	80%	85%	90%	An excavated pit backfilled with engineered media, topsoil, mulch, and vegetation. These are planting areas installed in shallow basins in which the storm water runoff is temporarily ponded and then treated by filtering through the bed components, and through biological and biochemical reactions within the soil matrix and around the root zones of the plants. This BMP has no underdrain and is in A or B soil.
Vegetated Open Channels (C/D Soils)	10%	10%	50%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in C or D soil.
Vegetated Open Channels (A/B Soils)	45%	45%	70%	Open channels are practices that convey stormwater runoff and provide treatment as the water is conveyed, includes bioswales. Runoff passes through either vegetation in the channel, subsoil matrix, and/or is infiltrated into the underlying soils. This BMP has no underdrain and is in A or B soil.
Bioswale	70%	75%	80%	With a bioswale, the load is reduced because, unlike other open channel designs, there is now treatment through the soil. A bioswale is designed to function as a bioretention area.
Permeable Pavement w/o Sand or Veg. (C/D Soils w/ underdrain)	10%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in C or D soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/ underdrain)	45%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/o Sand or Veg. (A/B Soils w/o underdrain)	75%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, no sand or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (A/B Soils w/ underdrain)	50%	50%	70%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in A or B soil.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Permeable Pavement w/ Sand or Veg. (A/B Soils w/o underdrain)	80%	80%	85%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has no underdrain, has sand and/or vegetation and is in A or B soil.
Permeable Pavement w/ Sand or Veg. (C/D Soils w/ underdrain)	20%	20%	55%	Pavement or pavers that reduce runoff volume and treat water quality through both infiltration and filtration mechanisms. Water filters through open voids in the pavement surface to a washed gravel subsurface storage reservoir, where it is then slowly infiltrated into the underlying soils or exits via an underdrain. This BMP has an underdrain, has sand and/or vegetation and is in C or D soil.
Stream Restoration	0.075 lbs/ft/yr	0.068 lbs/ft/yr	44.88 lbs/ft/yr	An annual mass nutrient and sediment reduction credit for qualifying stream restoration practices that prevent channel or bank erosion that otherwise would be delivered downstream from an actively enlarging or incising urban stream. Applies to 0 to 3rd order streams that are not tidally influenced. If one of the protocols is cited and pounds are reported, then the mass reduction is received for the protocol.
Forest Buffers	25%	50%	50%	An area of trees at least 35 feet wide on one side of a stream, usually accompanied by trees, shrubs and other vegetation that is adjacent to a body of water. The riparian area is managed to maintain the integrity of stream channels and shorelines, to reduce the impacts of upland sources of pollution by trapping, filtering, and converting sediments, nutrients, and other chemicals. (Note – the values represent pollutant load reductions from stormwater draining through buffers).
Tree Planting	10%	15%	20%	The BMP effectiveness values for tree planting are estimated by DEP. DEP estimates that 100 fully mature trees of mixed species (both deciduous and non-deciduous) provide pollutant load reductions for the equivalent of one acre (i.e., one mature tree = 0.01 acre). The BMP effectiveness values given are based on immature trees (seedlings or saplings); the effectiveness values are expected to increase as the trees mature. To determine the amount of pollutant load reduction that can credited for tree planting efforts: 1) multiply the number of trees planted by 0.01; 2) multiply the acreage determined in step 1 by the pollutant loading rate for the land prior to planting the trees (in lbs/acre/year); and 3) multiply the result of step 2 by the BMP effectiveness values given.
Street Sweeping	3%	3%	9%	Street sweeping must be conducted 25 times annually. Only count those streets that have been swept at least 25 times in a year. The acres associated with all streets that have been swept at least 25 times in a year would be eligible for pollutant reductions consistent with the given BMP effectiveness values.

BMP Name	BMP Effectiveness Values			BMP Description
	TN	TP	Sediment	
Storm Sewer System Solids Removal	0.0027 for sediment, 0.0111 for organic matter	0.0006 for sediment, 0.0012 for organic matter	1 – TN and TP concentrations	This BMP (also referred to as "Storm Drain Cleaning") involves the collection or capture and proper disposal of solid material within the storm system to prevent discharge to surface waters. Examples include catch basins, stormwater inlet filter bags, end of pipe or outlet solids removal systems and related practices. Credit is authorized for this BMP only when proper maintenance practices are observed (i.e., inspection and removal of solids as recommended by the system manufacturer or other available guidelines). The entity using this BMP for pollutant removal credits must demonstrate that they have developed and are implementing a standard operating procedure for tracking the material removed from the sewer system. Locating such BMPs should consider the potential for backups onto roadways or other areas that can produce safety hazards. To determine pollutant reductions for this BMP, these steps must be taken: 1) Measure the weight of solid/organic material collected (lbs). Sum the total weight of material collected for an annual period. Note – do not include refuse, debris and floatables in the determination of total mass collected. 2) Convert the annual wet weight captured into annual dry weight (lbs) by using site-specific measurements (i.e., dry a sample of the wet material to find its weight) or by using default factors of 0.7 (material that is predominantly wet sediment) or 0.2 (material that is predominantly wet organic matter, e.g., leaf litter). 3) Multiply the annual dry weight of material collected by default or site-specific pollutant concentration factors. The default concentrations are shown in the BMP Effectiveness Values columns. Alternatively, the material may be sampled (at least annually) to determine site-specific pollutant concentrations. DEP will allow up to 50% of total pollutant reduction requirements to be met through this BMP. The drainage area treated by this BMP may be no greater than 0.5 acre unless it can be demonstrated that the specific system proposed is capable of treating stormwater from larger drainage areas. For planning purposes, the sediment removal efficiency specified by the manufacturer may be assumed, but no higher than 80%.

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